Transportation Security Administration

Planning Guidelines and Design Standards for Checked Baggage Inspection Systems

Version 6.0

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Transportation Security Administration

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Walter Dickey
Program Manager, Electronic Baggage Screening Program (EBSP)
Transportation Security Administration (TSA)
Office of Acquisition Program Management (OAPM)

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DISCLAIMER

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The purpose of the document is to present TSA's requirements and documented best practices for implementing a high performance and cost-effective checked baggage inspection system (CBIS). This document captures TSA's requirements for a CBIS project from the beginning stages of design through commissioning of the system. Best practices are meant to highlight practices that have proven successful during implementation and which TSA recommends for the Project Sponsor's consideration during the design and construction of a CBIS.

DEFINITIONS AND IDENTIFICATION OF REQUIREMENTS, BEST PRACTICES AND SUPPORT INFORMATION

When used in the Planning Guidelines and Design Standards (PGDS) for Checked Baggage Inspection Systems, the terms Requirement, Best Practice/Guidance, and Support statements shall be defined as follows:

Requirement – a statement of required, mandatory practice. All requirement statements are presented in underlined text. The verb "shall" is used. The verbs "should" and "will" are not used in requirement statements.

Best Practice/Guidance – a statement of recommended, but not mandatory, practice. These statements are generated from lessons learned. These statements are geared to inform the reader of known effective practices that have proven successful during implementation. Best practice/guidance statements can be identified within the document by the use of the verb "should". The verbs "shall" and "will" are not used in best practice/guidance statements.

Support – an informational statement that does not convey any degree of mandate, recommendation, authorization, prohibition, or enforceable condition. The verbs "shall" and "should" are not used in Support statements. The verb "will" can sometimes be used in support statements when referencing things that are the government's responsibility.

VERSION HISTORY

Version	Date	Modifications
1.0	October 10, 2007	First published version
2.0	January 31, 2009	Update based on recommended follow-on studies and comments on Version 1.0
3.0	November 27, 2009	Update based on recommended follow-on studies and comments on Version 2.0
4.0	July 15, 2011	Update based on recommended follow-on studies and comments on Version 3.0
4.1	September 15, 2011	Update based on recommended follow-on studies and comments on Version 4.0
4.2	May 2, 2014	Update based on recommended follow-on studies and comments on Version 4.1
5.0	July 9, 2015	Update based on need for clear differentiation between requirements and best practices, follow-on studies and comments on Version 4.2
6.0	September 29, 2017	Update based on recommended follow-on studies and comments on Version 5.0

EXCEPTIONS

PGDS Applicability

Designs for new checked baggage inspection systems shall comply with the requirements set forth in this version of the PGDS. However, any project sponsor that has received formal confirmation from TSA of the receipt of the complete 30% Detailed Design Package for a CBIS project prior to the publication date of this version of the PGDS shall continue to be governed by the PGDS version in effect at the time of such confirmation. Furthermore, projects that have passed the 30% Detailed Design phase—including those systems currently under construction or in operation—with TSA approval shall be held to the design standards specified by that approval (either under the previous PGDS versions or prior standards in place before the publication of Version 1.0 of the PGDS).

For Operational Analysis Reports and CBIS that are being upgraded or changed, TSA reserves the right to evaluate the CBIS against the most current published PGDS version.

All CBIS will be tested to requirements as established in Appendix D of the latest version of the PGDS in effect at the time of testing. This will allow TSA to obtain the best set of test data to evaluate CBIS performance and to recommend fixes or improvements to the system.

Delayed Opening of CBIS

TSA reserves the right to require a project sponsor to resubmit the 30% Detailed Design Package under the requirements of the latest PGDS if the CBIS has not passed the Integrated Site Acceptance Test (ISAT), according to the PGDS version in effect at the time of the original 30% Detailed Design Package submittal, within two years of TSA approval of the original 30% Detailed Design Package.

Major Redesigns

Major redesign of an existing CBIS shall be required to adhere to the latest version of the PGDS at the time of the major redesign. The scope of a major redesign is to be discussed on a case-by-case basis between the project sponsor and TSA.

INDUSTRY COLLABORATION AND COMMENTS

TSA's contractor responsible for the maintenance of the PGDS has been collaborating with an industry working group that represents airlines, Baggage Handling System (BHS) designers, manufacturers, and consultants to finalize recommended changes to Version 5.0 of the PGDS that will address several key topics.

The working group will continue to meet on a quarterly basis to discuss additional changes and maintain the collaboration. These changes will be presented to TSA for incorporation into the next version of PGDS.

The public and industry are invited to submit comments to TSA at pgds@tsa.dhs.gov from the date of PGDS publication. Comments, as well as TSA proposed changes, will be shared with the industry working group prior to each quarterly exchange session and will be reviewed and discussed during the sessions. The quarterly sessions are expected to occur in July, October, January, and April each year. Any additional comments provided through the industry working group will also be considered during these sessions.

The TSA values all comments and input from industry stakeholders, but only those comments and input determined to enhance and improve the PGDS will be incorporated in the next release of the PGDS. An example of the standard form for comments is provided in Appendix A, Section A.13.

The comment form can be found at the following address:
https://www.fbo.gov/index?s=opportunity&mode=form&id=5f27246b608d3914c43bb0dd2d11ebd9&tab=core&_cview=1
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ACRONYMS AND ABBREVIATIONS

AACE	The Association for the Advancement of Cost Engineering International
ACWP	Actual Cost of Work Performed
ADA	Americans With Disabilities Act
ADPM	Average Day of the Peak Month
AL	Alarm Line
APIS	Advance Passenger Information System
AQM	Alternate Queuing Method
ASP	Advanced Surveillance Program
ATO	Airline Ticket Office
ATR	Automatic Tag Reader
BAC	Budget at Completion
BAM	Bag Allocation Methodology
BCWP	Budgeted Cost of Work Performed
BCWS	Budgeted Cost of Work Scheduled
BHS	Baggage Handling System
BHSC	Baggage Handling System Contractor
BIS	Baggage Inspection Station
BMA	Baggage Measurement Array
BOE	Basis of Estimate
bph	Bags per Hour
BPT	Baggage Process Timer
BRL	Baggage Reinsertion Line
BRP	Baggage Removal Position
BSD	Bag Status Display
BSIS	Baggage Screening Investment Study
BTT	Bag Travel Time
CBIS	Checked Baggage Inspection System
CBRA	Checked Baggage Resolution Area
CCI	Construction Cost Index
CCR	CBIS Change Request
CCTV	Closed Circuit Television
CI	Control Interface
CL	Clear Line
CM	Corrective Maintenance
CPI	Cost Performance Index
CSV	Comma-Separated Values
CT	Computerized Tomography
CWE	Current Working Estimate
DBU	Date of Beneficial Use
DHS	Department of Homeland Security
EAC	Estimate at Completion
EBSP	Electronic Baggage Screening Program
EDS	Explosives Detection System
EDS-CP	EDS Competitive Procurement
ESM	Enhanced Staffing Model
ETD	Explosives Trace Detection
EVM	Earned Value Management
FA	False Alarm
FAA	Federal Aviation Administration
FDRS	Field Data Reporting System
FIFO	First In First Out
FRM	Field Regional Manager
FSD	Federal Security Director
GFI	Government Furnished Information
HMI	Human Machine Interface
HSD	High Speed Diverter
HVAC	Heating, Ventilation, and Air Conditioning
IATA	International Air Transport Association
ICS	Individual Carrier System
ICS-CERT	Industrial Control Systems Cyber Emergency Response Team
ID	Identification (or Identifier)
ILDT	Integrated Local Design Team
IMAC	Installation, Move, Add and Change
IQ	Image Quality
IQT	Image Quality Test
IRD	Interface Requirements Document
ISAT	Integrated Site Acceptance Test
ISO	International Organization for Standardization
IT	Information Technology
IWG	Industry Working Group
LCC	Life-Cycle Cost
LCCA	Life-Cycle Cost Analysis

LEO	Law Enforcement Officer
MCP	Motor Control Panel
MCS	Master Control Station
MTCBF	Mean Time Between Critical Failures
NC	Non-Condensing
NEDS	Networked Explosive Detection Systems
NFPA	National Fire Protection Association
O&M	Operating and Maintenance
OAPM	Office of Acquisition Program Management
OEM	Original Equipment Manufacturer
OH	Over Height
OIT	Office of Information Technology
OL	Over Length
OOG	Out-of-Gauge
ORCA	Office of Requirements and Capabilities Analysis
OS	Oversize
OSARP	On-Screen Alarm Resolution Protocol
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
OSR	On-Screen Resolution
OSRA	On-Screen Resolution Area
OTA	Other Transaction Agreement
OTK	Operational Test Kit
OVT	OSR Viewing Time
OW	Over Width
PDF	Portable Document Format
PDPM	Peak Day Peak Month
PE	Photo Eye
PEC	Photoelectric Cell
PGDS	Planning Guidelines and Design Standards
PLC	Programmable Logic Controller
PM	Preventive Maintenance
PMIS	Performance Management Information System
PNR	Passenger Name Record
PVS	Primary Viewing Station
RBS	Risk Based Security
RFI	Request for Information
RFID	Radio Frequency Identification
RFV	Request for Variance
RL	Re-Insert Line
ROM	Rough Order-of-Magnitude
SAT	Site Acceptance Test
ScTP	Screened Twisted Pair
SF	Security Feed
SIDA	Security Identification Display Area
SOP	Standard Operating Procedures
SOS	System Optimization Support
SOW	Scope of Work
SS	Security Shunt
SSI	Sensitive Security Information
SSTP	Site Specific Test Plan
STIP	Security Technology Integrated Program
STZ	Security Tracking Zone
SV	Schedule Variance
SVS	Secondary Viewing Station
TAF	Terminal Area Forecast
TCU	Threat Containment Unit
TRC	Technical Review Committee
TRR	Test Readiness Review
TSA	Transportation Security Administration
TSM	Transportation Security Manager
TSO	Transportation Security Officer
UPS	Uninterruptible Power Supply
UTP	Unshielded Twisted Pair
VAC	Variance at Completion
VFD	Variable Frequency Drive
VSU	Vertical Sortation Unit
WBS	Work Breakdown Structure

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Delta Air Lines
JetBlue Airways
Northwest Airlines
Southwest Airlines
United Airlines

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TSA Occupational Safety, Health and Environment Division
TSA Office of Acquisition Program Management
TSA Office of Requirements and Capabilities Analysis
TSA Office of Security Operations

Baggage Handling System Designers/Consultants

AECOM
Alliant Technologies
Beumer Corporation
BNP Associates Inc.
Brock Solutions
CAGE Inc.
ECRS
Five Star Airport Alliance
Faith Group
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Gresham, Smith, & Partners
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Other Industry Contributors

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AvAirPros
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Sabel Systems
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PGDS Project Team

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TSA Office of Security Operations

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CHAPTER 1:

OVERVIEW

The purpose, applicability, and background of the Planning Guidelines and Design Standards for Checked Baggage Inspection Systems, prepared by the Transportation Security Administration of the U.S. Department of Homeland Security, are provided in this chapter.

The purpose of a BHS is sortation and conveyance of checked baggage from airport inputs to baggage makeup areas. The CBIS, as part of the BHS, begins when bags are diverted from the infeed mainline conveyor for inspection and ends when bags are merged back onto the outbound mainline conveyor.

1.1 Purpose

The main purpose of the PGDS is to provide specific guidance on ways to implement a CBIS that (1) are less costly from both capital and life-cycle perspectives and (2) have higher performance than the previous generation of installed baggage screening systems.

The PGDS also establishes design requirements clarifying the operational parameters that must be met. Additional best practice information is provided based on the lessons learned over the past decade of designing and installing these systems.

To expedite the nationwide installation of checked baggage screening systems in an equitable, sustainable, and cost-effective manner as required by legislation, the PGDS:

- Establishes common design requirements and metrics to which all screening system designs must adhere.
- Consolidates collective industry experience and insights relating to best practices for planning, designing, and implementing baggage screening systems.
- Disseminates the latest information on screening technologies, in-line screening concepts, and screening protocols.
- Standardizes the methodologies for planning, designing, and evaluating various system design alternatives.

The PGDS not only emphasizes best practices associated with screening system layouts, it also addresses other factors necessary to actively manage system costs and performance. The key objectives emphasized include the following:

- **Achieve the most cost efficient solution** – Achieving the lowest-cost solution requires two key changes from typical past practices: (1) considering a wide range of alternatives rather than relying on a preconceived notion regarding which system would be best suited for a particular airport (Chapter 4), and (2) assessing the 20-year life-cycle costs of different alternatives, so that the ongoing costs of operating and maintaining these systems are appropriately balanced with the upfront capital costs (Chapter 8).
- **Define design requirements and best practices** – Clearly delineating TSA's requirements for CBISs and presenting industry best practices have proven effective at making sure those requirements are met once the system is operational.
- **Understand the complexity of in-line screening systems and avoid the common pitfalls of first-generation designs** – Baggage screening systems are complex, especially those with high level of automation (see Appendix B). Many different technologies for

conveyance, tracking, and screening must all work together seamlessly to achieve an efficient and reliable CBIS. Lessons learned have been incorporated into this document as best practices and are intended to inform designers of effective elements of design which have proven successful during implementation.

- **Develop principles for appropriate sizing of CBISs, including methods for estimating demand and equipment requirements** – The approach used to estimate demand and equipment needs for the initial system has a major effect on project costs. Many different approaches have been used over the last several years, with widely varying results. An overly conservative approach to estimating demand and equipment needs can result in prematurely eliminating potentially less costly screening alternatives. Under-estimating demand and equipment needs can result in excessive occurrences of demand exceeding capacity and associated operational difficulties and security degradation. The PGDS provides TSA's approach for validating baggage screening demand and determining the equipment requirements for a given project.
- **Develop principles for providing equipment redundancy and establishing contingency operations** – Other important considerations for system sizing are Explosive Detection System (EDS) equipment redundancy (see Chapter 6) and contingency operations (see Chapter 11 and Appendix E). EDS equipment redundancy is designed into a system in an effort to attain the best operational availability from an EDS matrix. In addition, projects are required to create a project-specific contingency plan agreed upon by all key stakeholders, including local TSA, airport and airline personnel, that defines how the CBIS will operate when screening equipment is unavailable, demand exceeds capacity during extraordinary circumstances, or a catastrophic system failure occurs.
- **Develop principles for accommodating growth beyond initial system sizing** – Systems are designed to accommodate demand up to five years beyond the Date of Beneficial Use (DBU). Planning marginal additional upfront investments in conveyors or facilities can significantly reduce costs in the long term. For example, significant savings and less operational disruption could be achieved by providing needed expansion space up front rather than incrementally expanding a facility over time. The choice of how additional capacity is to be provided will depend on the constraints of the facility, forecast growth, degree of confidence about the forecast growth, overall capacity of the terminal, expected life of the terminal, and the initial system type. DBU+5 years will continue to be used as the design year for initial system sizing; however, the level of upfront investment to accommodate demand beyond DBU+5 years should be assessed using a 20-year life-cycle cost analysis (see Chapter 5 and Chapter 8).
- **Use an integrated and participatory approach to the planning and design process, as well as the implementation process, by involving all relevant stakeholders** – Stakeholder involvement is key to successful and cost-effective CBIS implementation. This involvement needs to occur at both the industry/federal government level and the local/airport level (see Chapter 2).
- **Upgrade the design review and approval process** – Utilizing lessons learned to improve the design review and approval process is important to support the objectives of cost management and increased quality for the screening systems.

The PGDS also addresses some aspects of the installation, testing, and commissioning of the CBIS (see Appendix D). Requirements related to the operation and maintenance of CBISs are not within the scope of the PGDS but some best practice information is included. Reimbursable and nonreimbursable expense information related to the Electronic Baggage Screening Program (EBSP) are also not in the PGDS but are available in a separate policy memo called Electronic Baggage Screening Program Policy – TSA Funding of Checked Baggage Inspection System Project Costs, which can be obtained from TSA website at:
https://www.fbo.gov/index?s=opportunity&mode=form&id=5f27246b608d3914c43bb0dd2d11ebd9&tab=core&_cview=1

1.2 Applicability

The PGDS was developed as an industry reference to develop cost-effective solutions and to convey TSA requirements for CBISs. The PGDS was developed for use by airport operators, airlines, CBIS planners and designers, EDS and BHS vendors, CBIS-related service providers and additional stakeholders involved in the planning, design, commissioning, operation, and maintenance of CBISs.

1.3 Background

PGDS Version 1.0, published on October 10, 2007, was prepared as part of the Baggage Screening Investment Study (BSIS) undertaken by TSA in 2006 in consultation with the aviation industry.

The BSIS was a direct response to the requirements included in the Intelligence Reform and Terrorism Prevention Act of 2004 (Section 4019d), and was intended to respond to directives in the 2005 DHS Appropriations Act Conference Report and recommendations contained in the March 15, 2005, Government Accountability Office report. The EBSP framework was developed as the basis for the BSIS. The EBSP is a DHS acquisition program, under which the Checked Baggage Technologies Division, within TSA's Office of Acquisition Program Management (OAPM) receives funding for the execution of checked baggage screening projects.

As described in the EBSP Strategic Planning Framework submitted to Congress in February 2006, the primary goals of the EBSP Strategic Plan are to:

1. Increase security through deploying EDS equipment to as many airports as practicable and implementing more labor-intensive explosives trace detection (ETD) screening protocols at those locations where ETD will continue to be used for primary screening.
2. Minimize EBSP life-cycle costs by deploying the best possible screening solutions at each airport, appropriately balancing capital investment and operating cost tradeoffs.
3. Minimize impacts to TSA and airport/airline operations through well-designed and well-placed EDS solutions.
4. Provide a flexible security infrastructure "platform" for accommodating growing airline traffic and other industry changes over the next 20 years and for addressing potential new threats.

During 2007 and 2008, many valuable industry comments on Version 1.0 of the PGDS were received from airport operators, airlines, designers, and planners, as well as from TSA. In addition, several follow-on studies were conducted to implement some of the next steps articulated in PGDS, Version 1.0 (Section 1.7). Since then, TSA has completed several rounds of review processes in which industry comments and follow-on PGDS studies were incorporated.

Since publication of the PGDS V5.0 in 2015, the industry and the TSA has made a consolidated effort to emphasize performance-based requirements in the PGDS and clearly identify and differentiate between requirements and best practices within the document. The TSA formed an internal stakeholder group from various offices, divisions and branches called the PGDS Technical Review Committee (TRC) to review and address internal and external stakeholder recommendations and govern the PGDS. Industry created the PGDS Industry Working Group (IWG) in an effort to create a forum for industry stakeholders to discuss relevant PGDS issues and collaborate with TSA. The result of the collaboration between these two groups and the updating, revision and review process is reflected in this version (V6.0) of the PGDS.

1.4 Organization

The subsequent chapters of this document are as follows:

- **Chapter 2, Roles, Responsibilities, and Project Phasing** – Roles and responsibilities of project stakeholders and descriptions of the various phases of the project, including deliverables to TSA and TSA responsibilities.
- **Chapter 3, Screening Process and CBIS Types** – Detailed descriptions of screening equipment and screening system concepts.
- **Chapter 4, Development and Evaluation of Alternatives** – Overview of the alternatives development and evaluation process, including matching zone type to security equipment and baggage screening system design, conducting a preliminary high-level assessment, and conducting a quantitative assessment based on a life-cycle cost analysis.
- **Chapter 5, Methodology to Determine Baggage Screening Demand** – Methodology and elements of demand forecasting.
- **Chapter 6, Methodology to Determine Baggage Screening Equipment Requirements** – Methodology for initially sizing CBISs.
- **Chapter 7, CBIS Design Principles** – TSA's requirements for checked baggage inspection systems; establishes all performance requirements that must be met prior to the commissioning of the system. Industry best practices are also included, as they serve as a guide for designers by presenting measures that have proven successful at achieving performance requirements established in this chapter.
- **Chapter 8, Life-Cycle Costs** – Detailed explanation on how to assess costs, establish the economic value of alternatives, and determine the most cost-effective alternatives. Also includes guidance on how to prepare a detailed cost estimate and a Basis of Estimate (BOE) document for a CBIS project. For allowable/allocable cost information please refer to the TSA Funding Policy document titled Electronic Baggage Screening Program Policy – TSA Funding of Checked Baggage Inspection System Project Costs, which can be found at http://www.tsa.gov/research-center/airport-checked-baggage-guidance-materialshttps://www.fbo.gov/index?s=opportunity&mode=form&id=5f27246b608d3914c43bb0dd2d11ebd9&tab=core&_cview=1.

- **Chapter 9, Checked Baggage Resolution Area Planning Standards** – Requirements for the design of Checked Baggage Resolution Areas (CBRAs).
- **Chapter 10, On-Screen Resolution Area Planning Standards** – Requirements for the design of On-Screen Resolution Areas (OSRAs).
- **Chapter 11, Contingency Planning** – Summary of the process for developing a contingency plan, principles of contingency design, and evaluation of contingency alternatives.
- **Chapter 12, Cybersecurity Requirements** – Requirements for CBIS network security.
- **Chapter 13, References** – Listing of all references cited in this document, as well as other resources.

This document also contains the following appendices:

- **Appendix A, Submittal Outlines, Form Templates, and Examples** – Report submittal outlines for CBIS for the Pre-Design and Schematic Design phases and form templates, CBIS reporting examples, the Controls Configuration Architectural Overview, and an outline for TSA training documentation required for operation of the CBIS.
- **Appendix B, Generic Examples of CBIS** – Generic examples of baggage screening systems, operational assumptions, and best practices, and detailed explanation regarding the planning and design of standardized mini in-line CBISs.
- **Appendix C, Basis of Design Report Case Study** – Oakland International Airport—Example of a Basis of Design Report showing how the PGDS should be followed to develop and select viable CBIS alternatives.
- **Appendix D, Commissioning and Evaluation Requirements** – Suite of tests that TSA has developed for the execution of the Testing and Commissioning Phase of a project. Guidelines for developing a Site Specific Test Plan (SSTP) used to test and commission the CBIS after installation.
- **Appendix E, Contingency Plan Examples** – Two examples of CBIS contingency plans. They serve as reference for the development of this document, which is required as part of the design deliverables covered in Chapter 2.
- **Appendix F, Risk Based Security Impacts for the Electronic Baggage Screening Program** – RBS Placeholder.

1.5 Next Steps

It is anticipated that future versions of the PGDS will include new and updated screening equipment specifications (Chapter 3) and cost assumptions for the life-cycle cost analysis (Chapter 8), details relating to the recapitalization and optimization of current CBISs, and the integration of concepts to promote RBS. Each future version will also address the industry's comments to the previous version of the PGDS. In addition, the following studies are planned to be conducted:

- Bag Spacing consistency at the EDS unit to gauge industry performance relative to spacing requirements of the PGDS.

1.6 Key Changes from PGDS v5 to PGDS v6

Section	Section Title	Changes
2.1.2.1	System Change Implementation and Test Data	Requirements moved from Appendix A into the body of the PGDS document.
2.2	Project Phasing	Revised deliverable requirements related to contingency plan (mini in-line), current working estimates and National Environmental Policy Act form
3.2	CBIS Types	Revised CBIS type nomenclature and added corresponding EDS Types
3.2.1	In-Line CBIS	Added footnote to EDS throughput table for Individual Carrier Systems (ICS)
3.2.1	In-Line CBIS	Removed EDS models that are not Qualified
3.2.2	Mini In-Line CBIS	Removed EDS models that are not Qualified
3.2.2	Mini In-Line CBIS	Language clarified to more accurately define a Mini In-Line CBIS
3.2.4.1	Standalone ETD Screening	Removed ETD models that are not Qualified
3.2.4	Other Baggage Conveying System Types	Clarified ICS nomenclature and impact on CBRA operations
3.2.4	Other Baggage Conveying System Types	Added an introduction to MITs
7.2.1.2	Tail-to-head Bag Spacing	Added clarification for spacing of ICS carriers
7.2.5.1.1	Pre-EDS Requirements	Added requirements and equations for calculating Upstream IATA and OOG (Relative) Tracking Accuracy
7.2.5.1.1	Pre-EDS Requirements	Established the BHS ID (Pseudo) as the primary tracking ID
7.2.5.1.2	Post-EDS Requirements	Clarified Valid and Invalid CBRA arrival requirements
7.2.6.1	Divert and Merge Requirements	Requirement and all associated references amended to state that alarm bags pass through and clear bags are diverted
7.2.6.1	Divert and Merge Requirements	Clarified ICS divert and merge requirements
7.2.6.2	Baggage Allocation Methodology	Requirement added for Round-Robin Baggage Allocation Methodology
7.2.7.2	Out-Of-Gauge Bag Requirements	Requirement which routes bags-without BMA information-to EDS lines rather than OOG line and added over-height protective device two queues upstream of each EDS
7.2.8	Fail-Safe Operation	Added requirements for fail-safe activations

Section	Section Title	Changes
7.2.10.1	Bag Jam Requirements	Language clarified to better define Bag Jam requirements during controlled testing and live operations.
7.2.12.4	ASP Video Surveillance	Added ASP best practices for CBIS video surveillance
7.2.13.2	Reporting Detail Requirements	Added language to clarify MIT CBRA report critical PE location
7.2.13.4	CBIS Reporting	Added new BHS ID Log Report requirement
7.3.2.7	BHS Reporting during Maintenance	Clarified BHS reporting requirements during maintenance or when conveyors are stopped
8.3	Cost Estimating	Moved requirements from Appendix F into the body of the PGDS document.
Chapter 9	Checked Baggage Resolution Area Planning Standards	Entire chapter reorganized to improve clarity
9.3.3	CBRA Layout and Equipment	Added requirements for a passive secondary CBIS dashboard display in the CBRA
9.5.6	Reinsert Line	Requirement added to create new BHS Tracking ID for reinserted bags
9.5.7	Serial Communication Requirements	Added serial communications requirements and removed BSD log-in requirements
9.6.1	CBRA BHS Displays	Updated BSD screens. Included an example for each of the BSD screens that will be used in CBRA
9.6.2	BSD Statuses	Added consolidated bag statuses
9.7.1	Bag Storage Capacity	Added example of CBRA accumulation calculation
9.7.13	CBRA Space Requirements	Added requirement to limit equipment in CBRA to only that directly required for operations
10.4.3	OSR Room Layout	Requirement added for duplicate CBRA dashboard display in the OSR
11.3.2	Out-of-Gauge Diverter – Bypass to CBRA	Added requirement that engaging the "limited operation" mode shall only occur with concurrence from local TSA
Chapter 12	Cybersecurity Requirements	Added new chapter for Cybersecurity Requirements
A.5	CBIS Operations Guide	Outdated guide in former Appendix E condensed into an outline and moved into Appendix A
A.9	CBIS Change Request	Added CCR/RFV process flow and revised forms
A.12	GFI Requests	Added GFI process information and request form
Entire document	Main document and appendices	Format updated to change from print-oriented functionality to electronic-oriented functionality; added accessibility features

CHAPTER 2:

ROLES, RESPONSIBILITIES, AND PROJECT PHASING

REQUIREMENTS TABLE

Section	Requirement
2.1.2 Integrated Local Design Team, Responsibilities	The ILDT shall assess all implications of an exemption from any requirements set forth in the PGDS due to local constraints and include full documentation supporting the request.
2.1.2 Integrated Local Design Team, Responsibilities	When any change to the CBIS is required during the Test Readiness Review, a change request shall be submitted to and approved by TSA's Site Integration (SI) contractor prior to implementation. The same CBIS Change Request (CCR) form and included information used for post-ISAT change requests, as defined in Appendix A, Section A.9, shall be used.
2.1.2 Integrated Local Design Team, Responsibilities	When any change to the CBIS is required post-TRN, between the Test Readiness Review and the completion of ISAT, a change request shall be submitted to and approved by TSA's Acceptance Testing contractor prior to implementation. The same CCR form and included information used for post-ISAT change requests, as defined in Appendix A, Section A.9, shall be used.
2.1.2 Integrated Local Design Team, Responsibilities	When any change to the CBIS is required post-ISAT, a change request shall be submitted to and approved by TSA System Optimization Support (SOS) Engineering prior to implementation. The process and requirements for post-ISAT change requests are described in the next section, and Section A.9 provides example changes and the CCR form that shall be used.
2.1.2.1 System Change Implementation and Test Data	A descriptive summary narrative of the procedures and protocols in place to implement, test, and document changes made to the CBIS post-ISAT. This shall include at a minimum the items listed in this section.
2.1.2.1.1 Change Request Proposal	Any changes made to the CBIS post-ISAT must be approved by the TSA prior to implementation. All requests for changes shall be submitted to TSA SOS engineering at OSTCBD@tsa.dhs.gov. A change request log detailing the proposed change(s) shall be included in the change request submittal.
2.1.2.1.2 Change Request Log	A log of each change made to the CBIS post-ISAT shall be maintained. This log shall be included in the change request submittal for TSA approval. The log shall include the data listed in Section 2.1.2.1.2 at a minimum.
2.1.2.1.3 TSA Approval	In response to the change request submittal, the TSA will provide direction on the request. The proposed change shall be implemented for testing and live operations if and only if approved by the TSA. The testing results shall be submitted to the TSA within five business days upon the completion of testing.
2.1.2.1.4 Testing Procedures	Testing procedures shall be developed and followed during any BHS testing on the CBIS post-ISAT. At a minimum, the procedures shall include the items listed in Section 2.1.2.1.4.
2.1.2.1.5 Test Results	Empirical data shall be recorded during testing. A summary of the data shall be provided explaining how the collected data met (or did not meet) the expected results.
2.1.3 Project Sponsor	If an ILDT is not formed, the Project Sponsor shall assume the responsibilities of the ILDT as defined in Section 2.1.2.

Section	Requirement
2.1.5 High Level Overview of Design Review Process Interactions between the Project Sponsor, ILDT, and TSA Headquarters	The Project Sponsor shall provide a written response to each TSA comment on the form and in the space provided.
2.1.6 Submittals Formatting	All Design submittals shall be made electronically, in print ready PDF format, and shall include the following: • The title of the Design shall be located on the front page and in the footer section, and shall state the applicable PGDS version at the time. • Each Design package shall begin with a table of contents. • All chapters/submittals shall be indexed electronically within the file. • A Table of Contents listing headings and page numbers shall be included in the front of each chapter/submittal. • Each chapter shall be identified with an electronic PDF bookmark.
2.2 Project Phasing	All projects shall follow the phasing listed in Section 2.2.
2.2 Project Phasing	During the entirety of the design phase, All formulas and calculations for figures shall be submitted. All PGDS or other TSA-provided rates and numbers shall be used in all submittals unless a RFV is submitted to and approved by TSA. All rates and numbers supplied shall be accompanied by all the supporting numbers and calculations, as detailed in Chapter 5 and Chapter 6.
2.2.1.2 Pre-Design Phase, Deliverables	The Pre-Design package shall include the deliverables described below: • Alternatives Analysis Report. This report documents the assumptions and methodology used to derive the design-year baggage screening demand, the process used to develop alternatives, a description of all alternatives considered, and a list of the preliminary set of alternatives to be carried forward for analysis on a life cycle cost basis. • Preliminary contingency plan (mini in-line only at this phase)

Section	Requirement
2.2.2.2 Schematic Design Phase, Deliverables	The Schematic Design package shall include the Basis of Design Report, which adds the following elements to the Alternatives Analysis Report described in the Pre-Design phase: • Detailed Program Requirements, including planning and modeling assumptions and results, a conceptual system overview, and a system evaluation of the preferred alternative (see Chapter 4 for further information on the selection of the preferred alternative). Planners shall make specific reference to TSA-specified CBIS design performance requirements and current commissioning requirements outlined in Chapter 7 and Appendix D. Planners shall also make specific reference to the equipment that TSA has identified to perform the screening function • Indication of preferred EDS equipment make and model • High-level flow-based modeling assumptions and results • Preliminary Concept Plans for the existing BHS, as well as the planned configuration of the in-line CBIS • Contingency plan (mini in-line only at this phase) • Phasing and Constructability Technical Memoranda documenting project-specific issues for each discipline, including CBIS design and architectural, structural, mechanical, plumbing, electrical, and communications considerations • ROM estimate of probable construction and operating and maintenance (O&M) costs based on the Basis of Design Report documentation • Stakeholder Notification Documentation • Preliminary Project Schedule • A compatibility assessment between environmental conditions that will exist in designed CBIS and environmental requirements of EDS units • Written response to each TSA comment from the design review of the form and in the space provided
2.2.2.2 Schematic Design Phase, Deliverables	The approved Basis of Design Report shall be the basis upon which subsequent design is developed.

Section	Requirement
2.2.3.1.2 30% Design, Deliverables	The 30% design package shall include the following documents, which shall be delivered both in the native format (Word, Excel, AutoCAD, etc.) and as a PDF file (hard copies are not required): • Updated Basis of Design Report • Preliminary Plans for all disciplines • Cross Sections • Concept of Operations • Baggage and data flow charts • Table of contents for CBIS • Screening Equipment Installation Guidelines • Outline of Reporting Capabilities • National Environmental Policy Act form • Stakeholder Notification Documentation • 30% Current Working Estimate and LCCA • Preliminary phasing plan and schedule • Conveyor manifest • A list of EDS equipment, by make, model, and serial number that will be decommissioned after the proposed in-line system is operational. • Written response to each TSA comment from the design review of the form and in the space provided. [See Deliverables list in 2.2.3.1.2 for all details surrounding these required deliverables]
2.2.3.2.2 70% Design, Deliverables	The 70% design package shall include the following documents: • Updated Basis of Design Report • 70% design drawings for all disciplines • Cross Sections showing the vertical dimensions of the CBIS • Refinements to the Description of Operations • Preliminary Contingency Plan • 70% specifications including detailed requirements for the Baggage Inspection Stations • Draft Site-Specific Configuration Management Plan • Stakeholder Notification Documentation, including responses to comments concerning OSR and CBRA areas for TSA review. • 70% Current Working Estimate and updated LCCA • Refined phasing plan and schedule • Conveyor manifest • Updated list of EDS equipment, by make, model, and serial number, which will be decommissioned after the proposed in-line system is operational. • Written response to each TSA comment from the design review of the form and in the space provided. [See Deliverables list in Section 2.2.3.2.2 for all details surrounding these required deliverables]

Section	Requirement
2.2.3.3.2 100% Design, Deliverables	The 100% design package shall include the following documents: • Bid Documents • Final Basis of Design Report including a plan view PDF drawing of the entire system • Final Description of Operations including the final discussion of how the system is intended to work. Any differences between proposed CBRA operations and current version of Chapter 9 requirements shall be documented and submitted on an RFV. • Contingency Plans, including diagrammatic depictions of baggage screening contingencies, as well as other screening methods and mitigation measures. A consolidated document shall be provided to TSA describing the conditions that would trigger mitigation measures and protocols for operation plus a directory of all project stakeholders with direct responsibilities for operation of the CBIS • Project specifications • Final Site-Specific Configuration Management Plan • National Environmental Policy Act form confirmation • Stakeholder Notification Documentation • Final 100% current working estimate and LCCA • Final phasing plan and schedule • An updated list of EDS equipment, by make, model, and serial number that will be decommissioned after the proposed in-line system is operational. • Updated Conveyor Manifest • Written response to each TSA comment from the design review of the form and in the space provided. [See Deliverables list in 2.2.3.3.2 for all details surrounding these required deliverables]
2.2.3.4.1 Design-Build Projects, Deliverables	Sponsors of projects anticipated for completion through a design-build contract, regardless of the design percentage at which the design-build contract is expected to be awarded, shall provide all documentation outlined above for the 30% design, 70% design, and 100% design submittals.
2.2.3.4.1 Design-Build Projects, Deliverables	All documents shall be provided in accordance with a schedule coordinated by the Project Sponsor and TSA to ensure applicability of the intended system to the guidelines and standards presented herein.
2.2.3.4.1 Design-Build Projects, Deliverables	Additionally, shop drawings and 70% progress drawings shall be provided for CBIS being constructed through design-build contracts to demonstrate that the system being constructed conforms to the design reviewed and approved by TSA.
2.2.4.1 Construction Phase, Tasks	To ensure TSA's complete understanding and acceptance of the projected system performance, any changes or amendments to the approved 100% design including, but not limited to, contract document addenda or change requests and Requests for Information (RFIs) which affect the functionality of the CBIS shall be presented for approval to TSA.

Section	Requirement
2.2.4.1 Construction Phase, Tasks	Construction schedules shall include at a minimum key milestones for project completion such as: Design phases Construction bid solicitation Construction award Construction notice to proceed General construction prior to EDS delivery and post-EDS delivery BHS construction prior to EDS delivery and post-EDS delivery Substantial completion of facility modification EDS delivery Schedule for system integration services SSTP Checklist received and completed Pre-ISAT Test Readiness Review (TRR) Integrated Site Acceptance Testing (ISAT) (see Section 2.2.7) Live Bag Screening 30-day Run-in EDS decommission Completion of all required deficiency corrections Substantial completion Project closeout
2.2.4.1 Construction Phase, Tasks	The Project Sponsor shall submit an updated Construction Schedule to TSA stakeholders at a minimum of every 30 days after construction award.
2.2.4.1 Construction Phase, Tasks	Most projects conduct a weekly meeting to review project status and shall invite a TSA Deployment representative.
2.2.4.1 Construction Phase, Tasks	The Project Sponsor shall request an update of the availability of equipment and equipment upgrades.

Section	Requirement
2.2.4.1 Construction Phase, Tasks	At a minimum, the following ISAT durations <u>shall</u> be used as initial inputs to the construction schedule with the type of ISAT test being conducted (single-phase or multi-phase): Single-Phase ISAT: One business day for mobilization to site One business day per EDS spur line Three business days for system testing (1 business day each for System Mixed Bag, System Dieback, and System Throughput tests) One business day for outbrief and demobilization Multi-Phase ISATs, Each Phase (except for final phase): One business day for mobilization to site One business day per EDS spur line not tested in previous phase Two business days for system testing (System Mixed Bag and System Dieback) One business day for out brief and demobilization Final Phase: One business day for mobilization to site One business day per EDS spur line not tested in previous phase Three business days for system testing (System Mixed Bag, System Dieback and System Throughput) conducted across all EDS in final form One business day for out brief and demobilization
2.2.4.1 Construction Phase, Tasks	The Project Sponsor <u>shall</u> consult with TSA Deployment and TSA Acceptance Testing no later than 90 days prior to ISAT during the SSTP Site Survey, to refine projected Commissioning durations.
2.2.4.2 Construction Phase, Deliverables	The Construction Phase deliverables <u>shall</u> include the following documents: • Any changes or amendments to the approved 100% design including, but not limited to, contract document addenda or change requests and RFIs • Construction schedules • Courtesy copies of shop and installation drawings to ensure the original intent of the design as reviewed up to and including the 100% design review submittal process
2.2.4.4 Construction Phase, Meetings	Regular meetings <u>shall</u> be conducted with the Project Sponsor/ILDT and TSA to monitor system construction.

Section	Requirement
2.2.5.1 CBIS Use and Logistics Training	CBIS Use and Logistics training, distinct from maintenance training, shall be provided by the project sponsor to TSA for mechanical, electrical, and computer functions required to properly operate the staffed portions of the system including, but not be limited to: Any BHS provided equipment provided in the CBRA Bag induction and handling procedures Any BHS provided equipment provided in the On-Screen Resolution (OSR) room BHS control interface provided to conduct the Image Quality Test (IQT) procedures (see Appendix D) CBIS orientation and layout CBIS fail-safe procedures and layout (see Chapter 7) System safety Bag jam and fault clearing procedures
2.2.5.1 CBIS Use and Logistics Training	The BHSC shall provide training on how to access and download BHS reports as well as SSI training for any BHS reports classified as SSI; training must comply with government SSI guidelines.
2.2.5.1 CBIS Use and Logistics Training	All operators and individuals with access to either viewing or printing reports shall have completed SSI procedures training prior to operation.
2.2.5.1 CBIS Use and Logistics Training	The training sessions shall be conducted prior to the operational startup of the respective BHS.
2.2.5.1.1 CBIS Use and Logistics Training, Deliverables	Training materials and documentation to be presented shall be submitted to TSA for review 60 days prior to the first scheduled training session.
2.2.6.1 Testing and Commissioning Phase, Pre-commissioning Requirements	All IATA tags for all phases of BHS testing, Pre-ISAT, TRR, and ISAT shall be provided by the airport or airline tenant.
2.2.6.1 Testing and Commissioning Phase, Pre-commissioning Requirements	Pre-ISAT tests shall be conducted in accordance with the requirements set forth in Appendix D and detailed in the SSTP. Written documentation of the successful demonstration of the Pre-ISAT shall be provided by the Project Sponsor to TSA.

Section	Requirement
2.2.6.1 Testing and Commissioning Phase, Pre-commissioning Requirements	From the TRR forward, the Project Sponsor shall ensure that change management processes are stringently adhered to. Sections 2.1.2 and 2.1.3 detail the conditions under which variance and change requests shall be initiated. In addition to the process outlined in Appendix D, a benchmarked copy of the PLC program controlling CBIS components shall be submitted at the following points: Post-ISAT Post-Operational Run-In PLC code representing the CBIS under test shall be provided to TSA's Acceptance Testing Contractor at ISAT, and PLC code representing the post-operational run-in state shall be provided to TSA's Acceptance Testing Contractor during on-site observations for the run-in period or be submitted remotely upon successful completion of the run-in period if observations are not made. Passwords for any and all portions of "locked" PLC code shall be provided along with the code.
2.2.6.1 Testing and Commissioning Phase, Pre-commissioning Requirements	If the CBIS fails the TRR, subsequent testing shall be conducted at intervals of no less than 14 calendar days.
2.2.6.1 Testing and Commissioning Phase, Pre-commissioning Requirements	Multiple EDS and/or multiple changes to the in-feed, out-feed and/or OSR/CBRA subsystems – A combined pre-ISAT/TRR shall be conducted with the ISAT scheduled separately.
2.2.6.1 Testing and Commissioning Phase, Pre-commissioning Requirements	The ISAT (for in-line CBIS only) is conducted by TSA with logistical/labor support from the project sponsor. Logistical/labor support shall include but is not limited to the following: Operational EDS Network Printers to print EDS images Operational BHS network printers to print BHS reports Baggage handlers to assist in bag induction Tugs and carts to move test bags to test locations Fork lift support for TSA-owned Unit Load Devices that transport test bags Bag tags for test bags Secure storage space for test bags Security Identification Display Area (SIDA) badging support for TSA contractor test team SIDA escort support
2.2.6.1 Testing and Commissioning Phase, Pre-commissioning Requirements	If the CBIS fails the ISAT conducted by TSA, subsequent testing shall be conducted at intervals no less than 30 calendar days.

Section	Requirement
2.2.6.1 Testing and Commissioning Phase, Pre-commissioning Requirements	The Run-In Period shall consist of a 30-day period to collect meaningful operational data (BHS and EDS) to support a well-rounded test summary report that accurately depicts system performance characteristics. During the Run-In period, the Project Sponsor or its designee(s) shall submit weekly data reports in electronic format, preferably in Portable Document Format (PDF) or native Comma-Separated Values (CSV) file format to the TSA Acceptance Testing Contractor. These reports shall include all BHS reports required by PGDS Section 7.2.13 (CBIS Reporting) as well as select EDS reports.
2.2.6.1 Testing and Commissioning Phase, Pre-commissioning Requirements	Upon notification from TSA OAPM that a Post-ISAT Audit has been directed, the authority with jurisdiction at the airport (along with local TSA) shall submit to the TSA Acceptance Testing Contractor and/or the TSA Engineering Team, the immediate past 30 days of BHS and EDS reports in electronic format, preferably in native CSV or PDF format. These reports shall include all BHS reports required by PGDS Section 7.2.13 (CBIS Reporting) as well as select EDS Reports.
2.2.6.1 Testing and Commissioning Phase, Pre-commissioning Requirements	Any CBIS components not in final configuration, or any situation requiring phased commissioning (see also the ILDT and Project Sponsor Responsibility Sections 2.1.2 and 2.1.3 above), shall be submitted to TSA for approval using the Request for PGDS Variance Template found in Appendix A (Section A.10) prior to the start of TRR testing.
2.2.6.2 Testing and Commissioning Phase, Deliverables	The Testing and Commissioning Phase deliverables shall include the following: • Pre-ISAT documentation • ISAT documentation
2.2.7.1 Project Closeout Phase, Deliverables	The Project Closeout Phase deliverables shall include the following: • As-built CBIS documentation listed in Section 2.2.7.1 shall be submitted to TSA, in both CAD and PDF file format. • The PLC program shall be submitted to TSA in accordance with Section 2.2.7 above. • PLC and software disaster recovery procedures shall be submitted to TSA including software recovery application(s).
2.2.7.2.1 Control Configuration Architecture, Submittal Requirements	The submittal data described herein shall be submitted to the TSA as follows: 30-Day Post DBU Submission: Within 30 days following DBU, the initial submittal, as defined in Section 2.2.7, shall be made. Submission Procedure: Submission of all data shall be coordinated with the FSD or designee. All data shall be submitted via electronic files – paper copies will not be accepted.

Section	Requirement
2.2.7.2.2 Control Configuration Architecture, Summary	A descriptive summary narrative of the submittal shall be included in Microsoft Word and PDF format. This summary shall include, at a minimum, the following information: Airport name and area of the airport included in the submittal such as terminal, matrix, node, etc. Description of the included area including: Number and type of EDS units type and quantity of infeed conveyor systems such as ticket counter sub-systems, curbside sub-systems, mainlines, etc. type and quantity of outfeed conveyor systems such as mainlines to sort piers, make-up units, etc. Description of the conveyors / sub-systems and their controller equipment. At a minimum, the following information shall be provided: List of each PLC and the conveyors / sub-systems it controls List of each MCP and the conveyors / sub-systems it controls Contact information for: Airport director, engineering manager or other primary contact point responsible for this CBIS Airline(s) primary contact for this CBIS Operation and/or maintenance contractor (if applicable) primary point of contact Point of contact responsible for follow-up submittals
2.2.7.2.3 Control Configuration Architecture, Index	An index of the documents included in the submittal shall be included. This index shall be submitted in Microsoft Excel and PDF format. The index shall include, at a minimum, the title of each file, the file date and the electronic file name.
2.2.7.2.4 Control Configuration Architecture, Drawing	A control system architecture drawing shall be summated for each CBIS. This drawing shall be submitted in DXF and PDF format. All high and low level networks shall be included. Detail shall be down to the motor control panel or PLC chassis level for high level networks; photoelectric cell (PEC) and/or device for low level networks. Configuration information such as node numbers and IP addresses shall be included.

Section	Requirement
2.2.7.2.5 Control Configuration Architecture, PCL Code	The low level, or PLC control, submission shall include the following at a minimum. **PLC Program:** A copy of the PLC program shall be submitted in its native format for all PLCs included as a part of the CBIS. In the event multiple levels of PLCs are utilized all programs are to be included. This shall include any redundant PLCs that may exist. All software keys and or passwords shall be provided if programs are protected and or locked in some way. **Network Configuration:** A copy of all network configuration files shall be submitted in its native format. This shall include any redundant networks that may exist. **Variable Frequency Drive (VFD) Configuration:** A copy of the configuration of each VFD (including any firmware information) in the CBIS shall be submitted in its native format. The configuration submittal shall include all parameters including unchanged or default settings. **Communication and Other Controllers:** A copy of the configuration and/or code for all other devices as a part of the control system shall be submitted in its native format. An example of these devices might be co-processors or multi-vendor interfaces. **Firmware Configuration:** A spreadsheet listing all control devices and their associated firmware levels, where firmware is used, shall be submitted. This spreadsheet shall be submitted as both a Microsoft Excel document and as a PDF file. All devices which have firmware shall be included. Examples of these devices are PLC chassis, PLCs, I/O modules, Network modules, Communication modules and VFDs.
2.2.7.2.6 Control Configuration Architecture, HMI Configuration	A copy of all HMI configurations shall be submitted in their native format. Examples of these HMIs are control room graphical display systems, operator interface panels, bag display monitors or any other computer or dedicated display modules. Soft copies of these programs shall also be proved including any portion which is required to operate the system. This includes applications such as those residing in touch screens or other types of dedicated displays or interfaces.
2.2.7.3 Control Configuration Architecture, High Level Computer Configuration	A descriptive narrative of the high level computer equipment of the CBIS shall be submitted in Microsoft Word and PDF format. Included in the narrative shall be a description of each computer and the function/task of the computer. Any data exchange between any computer and/or PLC that controls or affects bag decisions shall be included. In addition, the narrative shall describe the results of any computer failure and the ability of the CBIS to continue screening baggage.
2.2.7.4 Control Configuration Architecture, Programming and Configuration Software	A spreadsheet listing all programming and configuration software with the revision level used shall be submitted. This spreadsheet shall be submitted as both a Microsoft Excel document and as a PDF file.
2.2.7.5 Control Configuration Architecture, CBIS/ISAT Benchmark Data	A descriptive summary narrative of the system status at time of submittal shall be included in Microsoft Word and PDF format. This summary shall include, at a minimum, the following information: Scan time for each PLC, average and maximum Memory utilization for each PLC Network utilization for each network, high and low level networks. Where deterministic networks with set update times are used provide all settings and times.

Section	Requirement
2.2.7.6 Control Configuration Architecture, Electronic File Naming Convention	The electronic file names shall conform to the following convention: ABC_XXXX_LOCATION_MMDDYYYY_TYPE_DESCRIPTION.EXT
2.2.7.7 Control Configuration Architecture, Change Summary Log	A log of all changes made to the CBIS post-ISAT shall be maintained. The log shall be an itemized list of all the implemented and pending changes to date. This log shall be included in all submittals after its creation. The log shall include the following data at a minimum: CBIS designation Name of Change Description of change Status of change (i.e., in testing, operational, pending, etc.) Date of TSA approval Date of live operational use

The objective of a CBIS project is to identify, design, and implement appropriately sized, functional, supportable, maintainable, and cost-effective baggage screening systems for each airport. The benefits of an effective design and review process include minimizing project costs, schedule delays, and adverse impacts to airline and airport operations, while also maximizing system functionality and overall security. The process for submittal, review, and TSA approval for each CBIS is described in this chapter.

It is assumed that the Project Sponsor will establish a program for design and implementation of the optimal screening system and that this program will be submitted to TSA in compliance with the Pre-Design Phase submittal milestones described below. TSA approval of these milestones will trigger initiation of the Schematic Design Phase.

2.1 Roles and Responsibilities

The following paragraphs summarize the roles and responsibilities of the parties involved in design and implementation of a CBIS.

2.1.1 Project Stakeholders

The project stakeholders list should be customized to reflect the relevant stakeholders at the specific airport, including external stakeholders associated with the project, and should include the following individuals representing primary functional areas:

- **Airport** – Engineering, Operations, Information Technology (IT), Maintenance, Planning and Design, Project Management, and others, as appropriate

- **Air Carrier(s)** – Headquarters, Operations, Corporate Real Estate, IT, Maintenance, Engineering, Planning, Security Technology Officer(s), Station Manager(s), and others, as appropriate
- **TSA** – Federal Security Director (FSD), Deputy FSD, Assistant FSD-Operations, Assistant FSD-Screening, Stakeholder Manager, Organizational Occupational Safety and Health (OSH) Specialist, Regional OSH Manager, and other technical representatives designated by the FSD and the TSA Headquarters representatives from the Office of Security Capabilities (Checked Baggage Technologies Division, Deployment Division, Mission Analysis Division – System Optimization and Support Team) and the Office of Security Operations (Operational Performance Division)

It is anticipated that the following additional project stakeholders (or designees) will be included in some phases of the process (as required):

- **Law Enforcement** – Local law enforcement (the entity responsible for procedures to handle alarmed bags not cleared at level 3 screening in the CBRA by ETD)
- **Technology Vendors** – EDS equipment providers and manufacturers

Project stakeholders should be periodically briefed on the progress of the planning and design effort.

2.1.2 Integrated Local Design Team

As part of the design process, an Integrated Local Design Team (ILDT) that includes representatives of the above-mentioned stakeholders should be formed. In addition, the ILDT should include a professional planning and design team comprised of architects, engineers, planners, CBIS designers, cost estimators, safety professionals and project managers. The design team is also likely to include specialty consultants, such as simulation analysts, on an as-needed basis.

Key benefits of the ILDT include:

- Facilitation of overall project coordination and information sharing between all project stakeholders throughout the life of the project
- Improved coordination of contingency plans and continuity of operations
- Representation of all project stakeholders in the decision making process
- A spirit of collaboration among stakeholders, which facilitates stakeholder buy-in from the early phases of the project

Responsibilities of the ILDT include:

- Development of alternative screening concepts, evaluation of those concepts, and generation of design drawings/submittals
- Assessment of specific local conditions affecting the CBIS design, as well as the requirements to be met by the design. After proper evaluation of local conditions and the CBIS design, the ILDT can petition TSA via the Project Sponsor for an exemption from the process, performance, or design requirements set forth in this PGDS if the ILDT concludes that these requirements cannot be met by the CBIS designs due to local constraints. The ILDT shall assess all implications of an exemption from any requirements set forth in the PGDS due to local constraints and include full documentation supporting the request. The Request for PGDS Variance Template can be found in Appendix A, Section A.11).
- Submission of Engineering Change Requests (Change Request). A change request is submitted by the ILDT when a change to the system is required at the construction contractor level but does not change the other transactional agreement (OTA) scope.
  - When any change to the CBIS is required during the Test Readiness Review, a change request shall be submitted to and approved by TSA's Site Integration (SI) contractor prior to implementation. The same CBIS Change Request (CCR) form and included information used for post-ISAT change requests, as defined in Appendix A, Section A.9, shall be used.
  - When any change to the CBIS is required post-TRN, between the Test Readiness Review and the completion of ISAT, a change request shall be submitted to and approved by TSA's Acceptance Testing contractor prior to implementation. The same CCR form and included information used for post-ISAT change requests, as defined in Appendix A, Section A.9, shall be used. The only difference for changes made during this part of commissioning is that the CCR form is to be submitted to the Acceptance Testing Contractor Site Lead in addition to TSA SOS Engineering.
  - When any change to the CBIS is required post-ISAT, a change request shall be submitted to and approved by TSA SOS Engineering prior to implementation. The process and requirements for post-ISAT change requests are described in the next section and Appendix A, Section A.9 provides example changes and the CCR form that shall be used.

If Passenger Facility Charge funding is contemplated, regular communication with the local FAA Airports Office servicing the airport should be included in the ILDT planning process since TSA does not provide such communication or coordination.

The responsibilities of individual ILDT members must be fully understood and properly integrated to ensure the effective design and implementation of the optimal screening system.

2.1.2.1 System Change Implementation and Test Data

A descriptive summary narrative of the procedures and protocols in place to implement, test, and document changes made to the CBIS post-ISAT. This shall include at a minimum the items listed in this section.

2.1.2.1.1 Change Request Proposal

Any changes made to the CBIS post-ISAT must be approved by the TSA prior to implementation. All requests for changes shall be submitted to TSA SOS Engineering at OSTCBD@tsa.dhs.gov. A change request log detailing the proposed change(s) shall be included in the change request submittal.

2.1.2.1.2 Change Request Log

A log of each change made to the CBIS post-ISAT shall be maintained. This log shall be included in the change request submittal for TSA approval. The log shall include the following data at a minimum:

- CBIS designation
- Name of person(s) implementing the change
- Description of change
  - Reason for the change (i.e., problem being resolved)
  - Expected resolution
- Identification / location of the change
  - Name of device (e.g., PLC-1, HM1-1, SC-1, etc.)
  - Name of program / subprogram
  - Location in the program / subprogram (e.g., rung 1, line 1, etc.)
- Test methodology
  - Description of test
  - Expected results

2.1.2.1.3 TSA Approval

In response to the change request submittal, the TSA will provide direction on the request. The proposed change shall be implemented for testing and live operations if and only if approved by the TSA. The testing results shall be submitted to the TSA within five business days upon the completion of testing.

2.1.2.1.4 Testing Procedures

Testing procedures shall be developed and followed during any BHS testing on the CBIS post-ISAT. At a minimum, the procedures shall include:

- Available times for testing
- Contingency plan
- Documentation
- Definition of testing process
  - Software download / upload
  - Hardware modification / restoration
  - Wiring modification / restoration
- Notification to all stakeholders
  - Testing Period
  - Live Operations

2.1.2.1.5 Test Results

Empirical data shall be recorded during testing. A summary of the data shall be provided explaining how the collected data met (or did not meet) the expected results.

2.1.3 Project Sponsor

The Project Sponsor is assumed to be an airport owner/operator. Key responsibilities of the Project Sponsor include:

- Initiation and execution of CBIS planning and design
- Formation of the ILDT and selection of a professional planning and design team. If an ILDT is not formed, the Project Sponsor shall assume the responsibilities of the ILDT as defined in Section 2.1.2.
- Identification of a point-of-contact who is responsible for stakeholder outreach during each phase of the project
- Application for TSA or other funding

- Initiation and execution of construction, as well as testing and commissioning of the CBIS
- Operation and maintenance of the BHS portion of the CBIS

2.1.4 TSA Headquarters

Representatives from TSA Headquarters will be responsible for reviewing and approving or rejecting design submittals. TSA will determine funding eligibility and prioritization as well as assess issues related to occupational safety, health, and the environment.

Typical TSA Headquarters representatives include the Office of Security Capabilities (Checked Baggage Technologies Division, Deployment Division, Mission Analysis Division – System Optimization and Support Team) and the Office of Security Operations (Operational Performance Division).

Specifically, key responsibilities of TSA Headquarters include:

- Facilitating a regular forum for exchanging lessons learned as implementation moves forward and regularly updating the PGDS
- Performing technical and operational review of designs
- Reviewing the impact of potential screening protocol changes (such as cost implications of Canadian and international recheck screening)
- Conveying design best practices to the aviation industry
- Managing the EBSP, including providing periodic updates to the Strategic Plan as warranted by technology or other critical changes and making best efforts to provide the TSA resources needed for the project
- Providing a stakeholder forum to brainstorm operation and policy issues as needed

2.1.5 High Level Overview of Design Review Process Interactions between the Project Sponsor, ILDT, and TSA Headquarters

The following TSA stakeholders are involved in the design review process: design reviewers, site leads, engineering staff, life cycle support staff, and Project Coordinator. In general, the design review process consists of the following steps for each design phase:

- The Project Sponsor submits the design submittals to the TSA.
- After reviewing the Project Sponsor's submittals, if TSA determines additional data is needed, the TSA site lead instructs the Project Sponsor to provide any missing information to the TSA design review team.

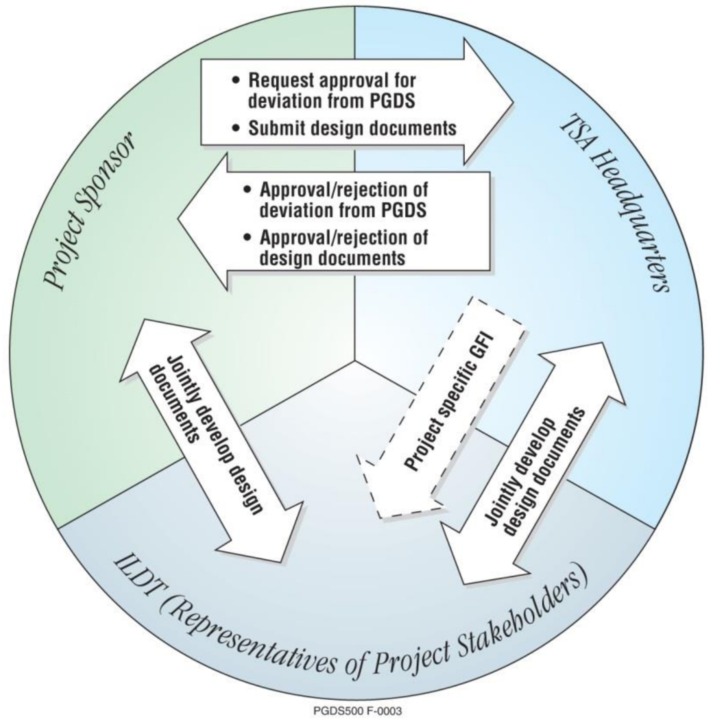
- Following receipt of the requested data, TSA will complete the review process and provide written review comments including either acceptance or rejection of the submittals to the Project Sponsor. This may be followed by a meeting or teleconference between the TSA, the Project Sponsor, and the CBIS Designer to discuss TSA's comments, particularly if submittals are rejected.
- The Project Sponsor shall provide a written response to each TSA comment on the form and in the space provided.
- Based on the Project Sponsor's response to the comments and any subsequent discussions and clarifications, the TSA will accept or reject the submittals.

In addition, TSA will determine the specific EDS equipment type to be used and schedule the testing and commissioning of the equipment.

Upon notification to TSA of a Request Management Group submission, integration information pertaining to the specific EDS equipment to be deployed at the airport in question will be provided by the TSA.

Figure 2-1 summarizes the interactions between the Project Sponsor, ILDT, and TSA Headquarters.

Figure 2-1: Summary of Responsibilities During the Design Process



2.1.6 Submittals Formatting

All design submittals shall be made electronically in print-ready Portable Document Format (PDF) and shall include the following:

- The title of the design shall be located on the front page and in the footer section, and shall state the applicable PGDS version at the time.
- Each design package shall begin with a table of contents.
- All chapters/submittals shall be indexed electronically within the file.

- A table of contents listing headings and page numbers shall be included in the front of each chapter/submittal.
- Each chapter shall be identified with an electronic PDF bookmark.

2.2 Project Phasing

All projects shall follow the phasing listed in Section 2.1.6. The project phases are listed below in sequence:

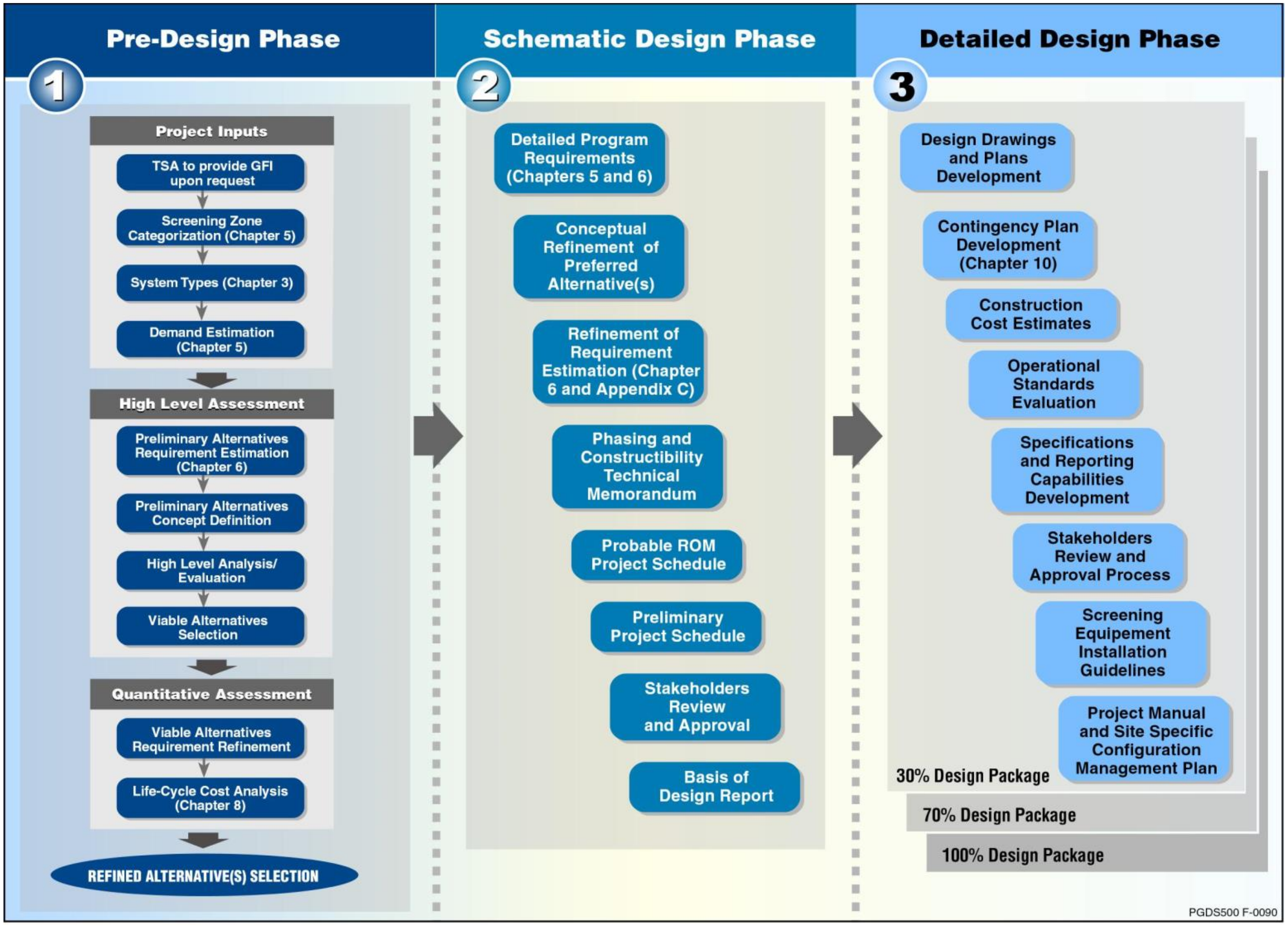
- **Pre-Design Phase** – The design-year baggage screening demand is estimated and a recommended conceptual alternative is developed. This involves identifying existing baseline conditions and selecting a preferred alternative through an iterative process of developing and analyzing a range of candidate alternatives. TSA will provide airport specific GFI if available. TSA may provide a list of optimal preliminary alternatives for the Project Sponsor to consider.
- **Schematic Design Phase** – The work product of the Pre-Design Phase is used to further develop and refine the preferred alternative(s), including initial development of design drawings, more detailed rough-order-of-magnitude construction cost estimates, and program schedule, resulting in an approved Basis of Design Report.
- **Detailed Design Phase** – The Basis of Design Report is used to refine and finalize detailed design drawings, rough order-of-magnitude construction cost estimates, and program schedule. Three sub-phases are assumed as milestones: 30%, 70%, and 100% design.
- **Construction Phase** – The CBIS is constructed following the 100% detailed design documents. Any changes to the approved documents are submitted to TSA for approval. The construction schedule, equipment delivery schedule, and the schedule for testing are finalized.
- **Training Phase** – CBIS Use and Logistics training, distinct from maintenance training, is provided by the Project Sponsor to TSA for mechanical, electrical, and computer functions required to properly operate the staffed portions of the system.
- **Testing and Commissioning Phase** – All required tests are conducted before the system is commissioned.
- **Project Closeout Phase** – TSA provides final approval of the CBIS for beneficial use and the final documentation, including as-built drawings, is submitted to TSA.

TSA may choose to allow the Project Sponsor to forgo certain project phase submissions at its discretion. The Project Sponsor may also request to forgo project phases through the Request for Variance (RFV) process as detailed in Appendix A, Section A.11. During the entirety of the design phase:

- All formulas and calculations for figures shall be submitted.
- All PGDS or other TSA-provided rates and numbers shall be used in all submittals unless a RFV is submitted to and approved by TSA.
- All rates and numbers supplied shall be accompanied by all the supporting numbers and calculations, as detailed in Chapter 5 and Chapter 6.

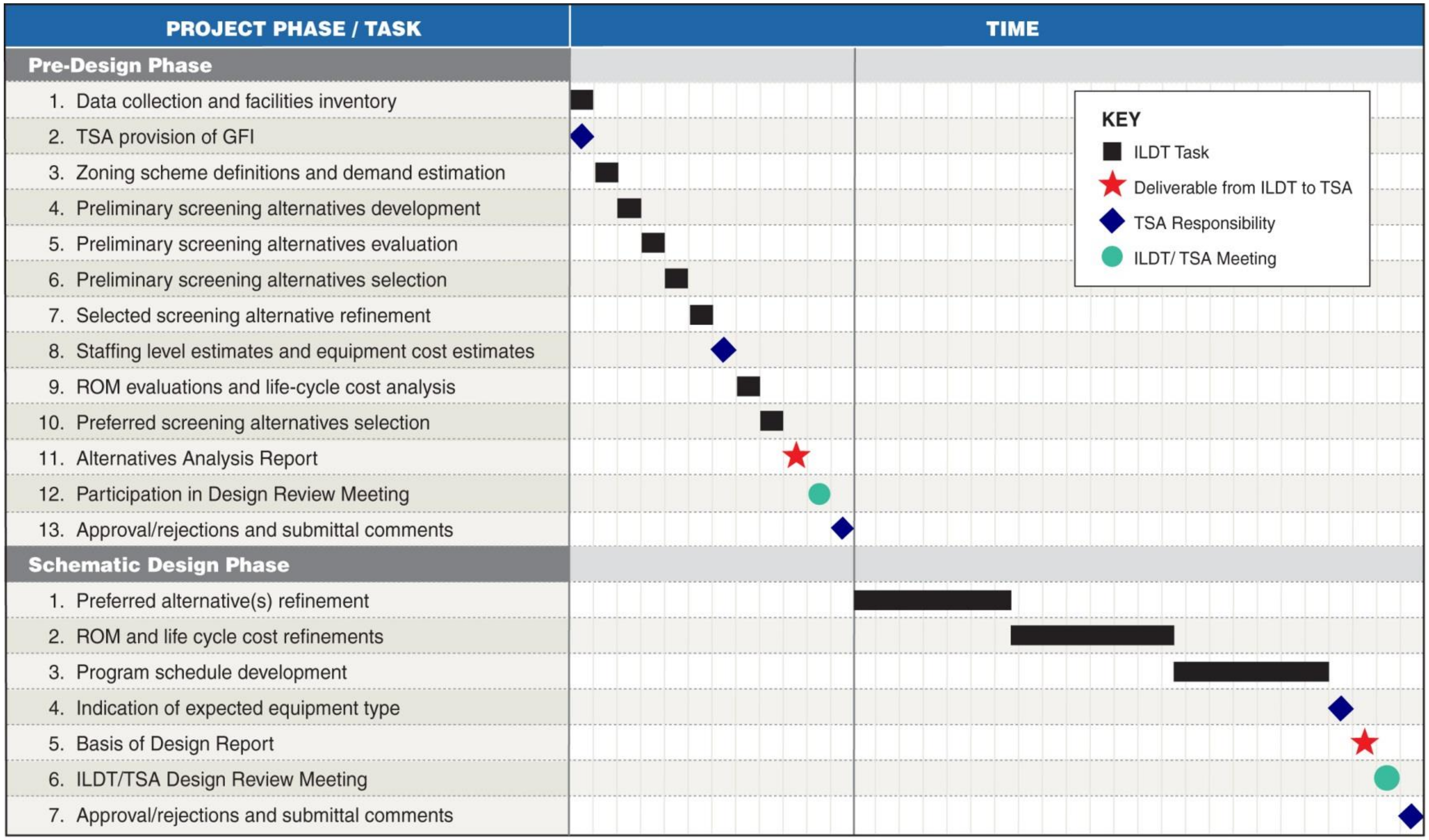
Figure 2-2 summarizes the design phases (pre-design, schematic design, and detailed design) and the applicable chapters of the PGDS.

Figure 2-2: Summary of Project Design Phases



The high-level Gantt chart shown in Figure 2-3 summarizes the planning (i.e., pre-design), design, construction, testing, commissioning, and project closeout phases, as well as key milestones and submittals within each phase.

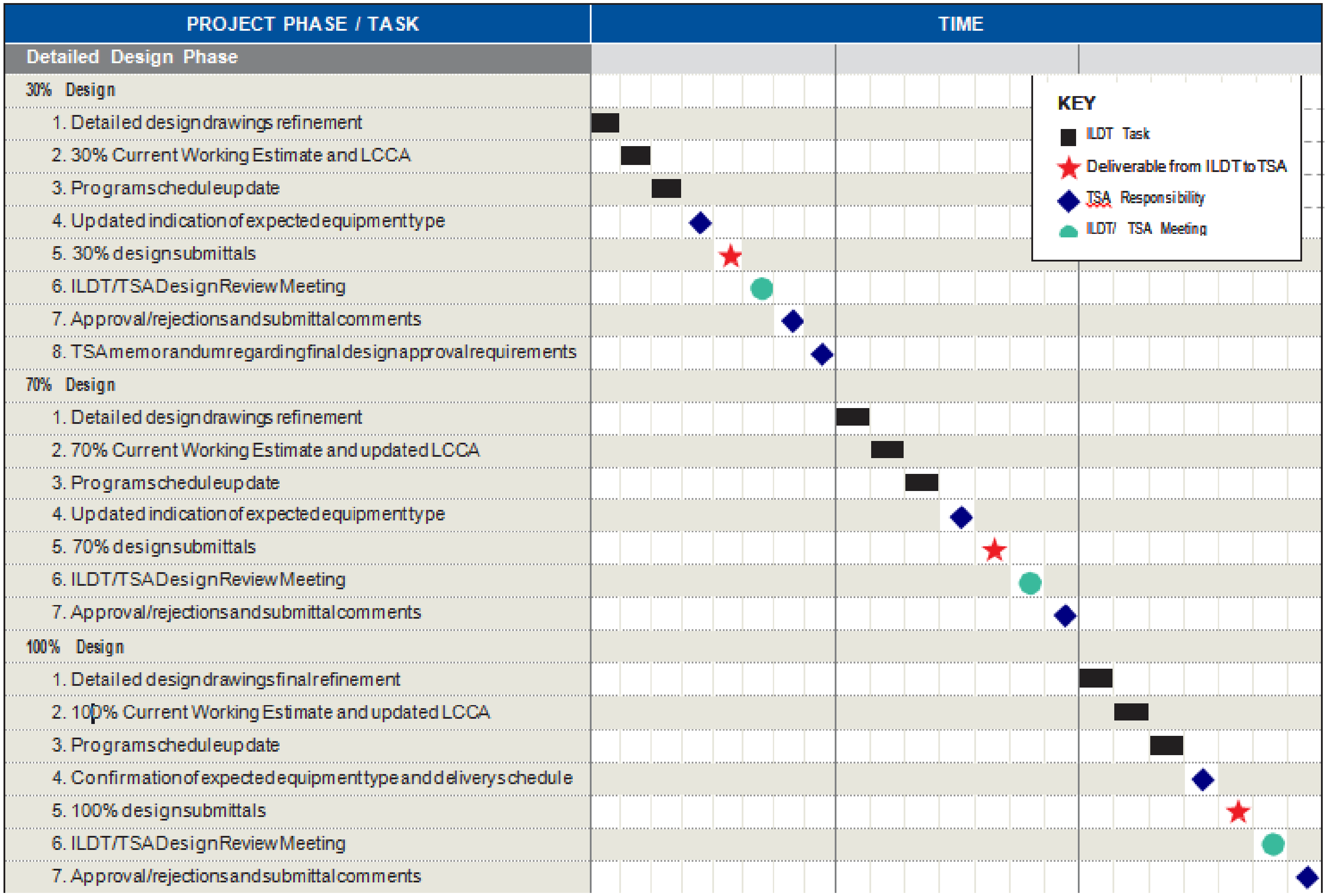
Figure 2-3: Summary of Planning and Design Process Phases



Note: The timetable does not reflect actual task duration.

PGDS500 F-0007a

Figure 2-3 (page 2 of 3): Summary of Planning and Design Process Phases



Note: The timetable does not reflect actual task duration.

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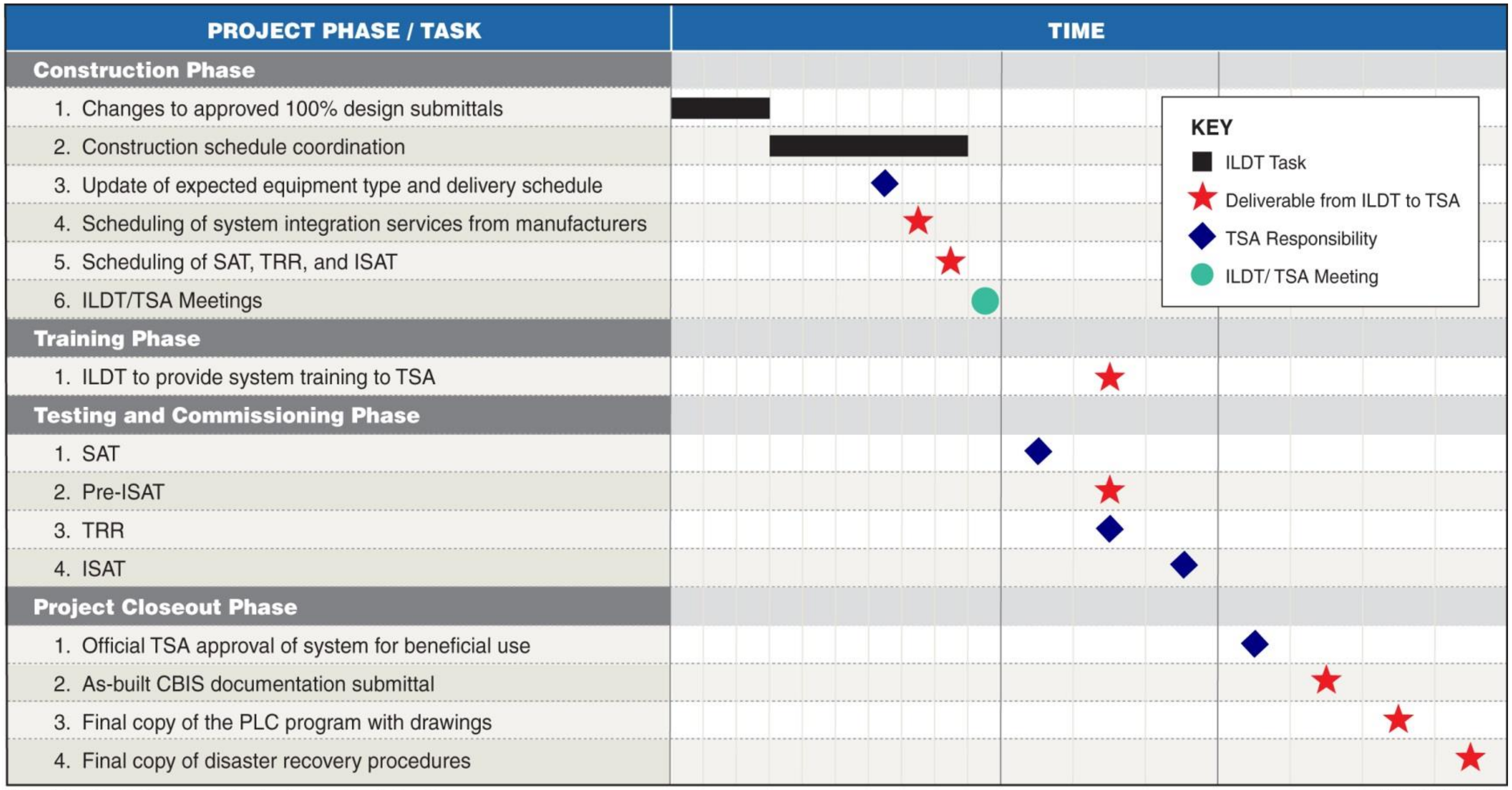
Figure 2-3 (page 3 of 3): Summary of Planning and Design Process Phases



Note: The timetable does not reflect actual task duration.

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Deliverables by phase for in-line and mini in-line CBIS are shown in Table 2-1 through Table 2-5.

Table 2-1: Pre-Design and Schematic Design Phase Deliverables for In-Line and Mini In-Line CBIS

Pre-Design and Schematic Design Phase Deliverables – In-Line and Mini In-Line CBIS
Pre-Design Phase (Section 2.2.1)
• Alternatives Analysis Report
• Preliminary contingency plan (only applicable to mini in-lines at this phase)
Schematic Design Phase (Section 2.2.2)
Basis of Design Report
• Detailed program requirements
• Preferred EDS equipment make and model
• High-level flow-based modeling assumptions and results
• Preliminary concept plans
• Contingency plan (only applicable to mini in-lines at this phase)
• Phasing and constructability technical memoranda
• ROM estimate of probable construction costs and O&M costs
• Stakeholder notification documentation
• Preliminary project schedule
• Environmental conditions compatibility assessment
• Written response to each TSA comment using TSA comment spreadsheet

Table 2-2: 30% Design Phase Deliverables for In-Line and Mini In-Line CBIS

30% Design Phase Deliverables – In-Line and Mini In-Line CBIS
Detailed Design Phase (Section 2.2.3)
30% Design Submittals (Section 2.2.3.1)
• Updated Basis of Design Report
• Preliminary plans
• Cross sections
• Concept of operations
• Contingency plan (only applicable to mini in-lines at this phase)
• Baggage and data flow charts
• Table of Contents for CBIS
• Screening equipment installation guidelines
• Outline of reporting capabilities
• National Environmental Policy Act form completion
• Stakeholder notification documentation
• 30% Current Working Estimate and LCCA
• Preliminary phasing schedule
• Conveyor manifest
• EDS equipment list
• Response to TSA comments using TSA comment spreadsheet

Table 2-3: 70% Design Phase Deliverables for In-Line CBIS Only (Mini In-Line Exempt)

70% Design Phase Deliverables – In-Line CBIS
Detailed Design Phase (Section 2.2.3)
70% Design Submittals (Section 2.2.3.2)
• Updated Basis of Design Report
• 70% design drawings
• Cross sections
• Refinements to description of operations
• Preliminary contingency plan
• 70% specifications
• Draft site-specific configuration management plan
• Stakeholder notification documentation
• 70% Current Working Estimate and updated LCCA
• Refined phasing plan and schedule
• Conveyor manifest
• Updated EDS equipment list
• Response to TSA comments using TSA comment spreadsheet

Table 2-4: 100% Design Phase Deliverables for In-Line and Mini In-Line CBIS

100% Design Phase Deliverables – In-Line and Mini In-Line CBIS
Detailed Design Phase (Section 2.2.3)
100% Design Submittals (Section 2.2.3.3)
• Bid documents
• Final Basis of Design Report including PDF
• Final description of operations
• Final Contingency Plans
• Project specifications
• Final site-specific configuration management plan
• National Environmental Policy Act form confirmation
• Stakeholder notification documentation
• Final 100% Current Working Estimate and updated LCCA
• Final phasing plan and schedule
• Updated EDS equipment list
• Updated conveyor manifest
• Written response to TSA comments using TSA comment spreadsheet

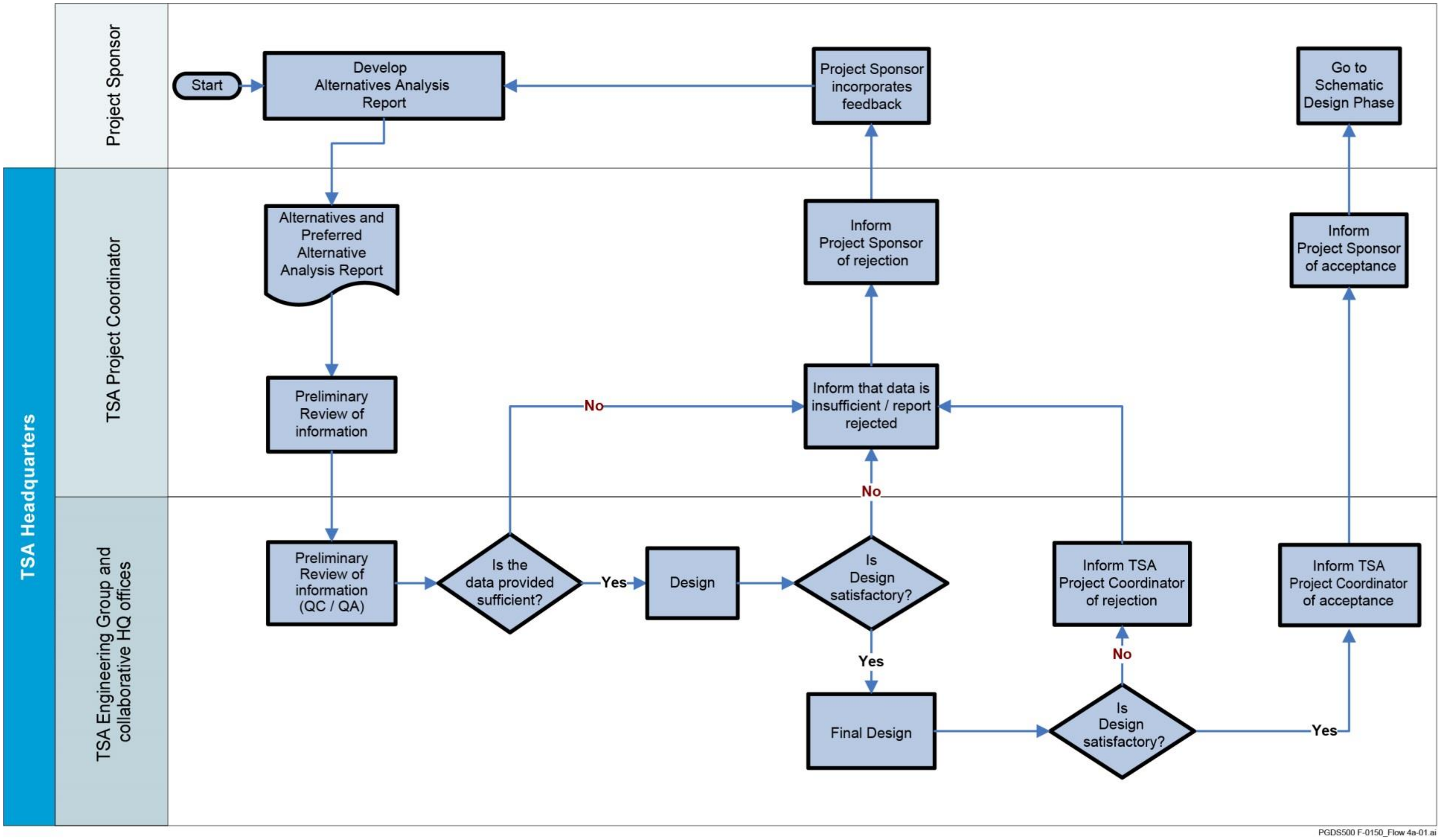
Table 2-5: Construction, Training, Testing and Closeout Phase Deliverables for In-Line and Mini In-Line CBIS

Construction, Training, Testing and Closeout Phase Deliverables – In-Line and Mini In-Line CBIS
Construction Phase (Section 2.2.4)
• Changes to approved 100% design submittals
• Construction schedules
• Courtesy copies of shop and installation drawings
Training Phase (Section 2.2.5)
• Training materials and documentation
Testing and Commissioning Phase (Section 2.2.6)
• Pre-ISAT documentation
• ISAT documentation
Project Closeout Phase (Section 2.2.7)
• As-built CBIS documentation submittal
• Final copy of the PLC program with drawings
• Final copy of disaster recovery procedures

2.2.1 Pre-Design Phase

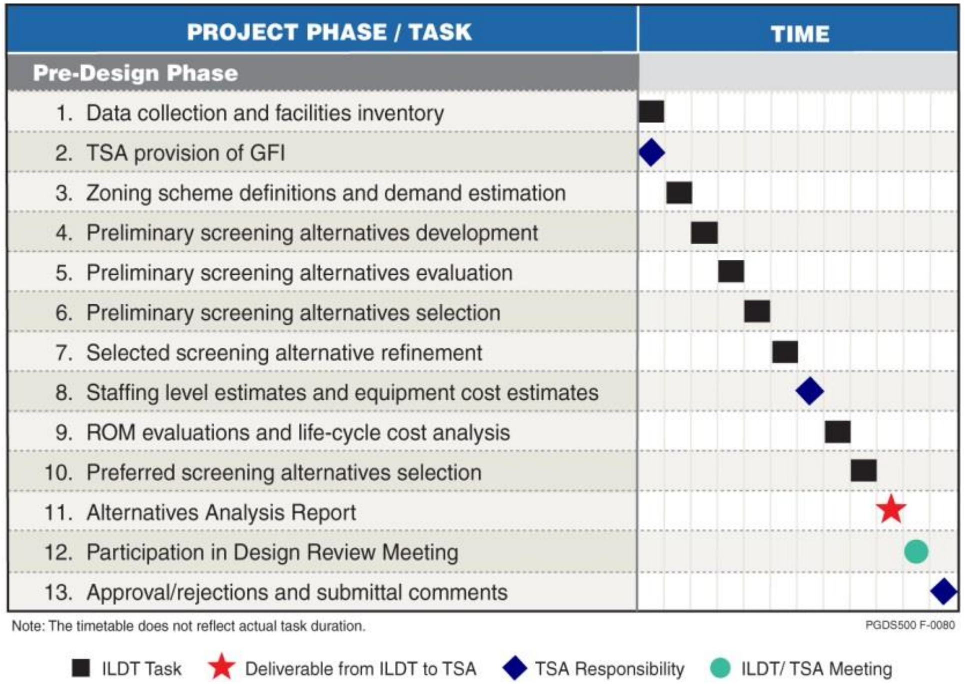
A process flow chart of the Pre-Design Phase is displayed in Figure 2-4. The primary purpose of this phase is to identify a recommended conceptual alternative for submittal to TSA before the initiation of schematic design. This phase requires the identification of existing baseline conditions; estimation of design-year baggage screening demand; and development, analysis, and evaluation of alternative screening concepts. This phase represents an iterative process for selecting a preferred alternative from a range of candidates. In each iterative cycle, alternatives are further refined and evaluated.

Figure 2-4: Pre-Design Phase Process Flow



The end product of this phase will be an Alternatives Analysis Report to be submitted to TSA describing the preferred alternative and the process and rationale used in its selection. To satisfy TSA requirements, the report should provide sufficient documentation to indicate that a reasonably diverse range of PGDS-compliant alternatives was explored and that the preferred alternative is operationally viable, meets level-of-service requirements, and is the most cost-effective solution. Figure 2-5 summarizes ILDT tasks, deliverables, and TSA responsibilities for the Pre-Design Phase.

Figure 2-5: Summary of Pre-Design Phase



2.2.1.1 Project Sponsor and ILDT Pre-Design Phase Responsibilities

The tasks involved in the Pre-Design Phase that are the responsibility of the Project Sponsor and ILDT are outlined below:

- Collect the necessary data, conduct a facilities inventory and participate in a project expectation meeting with TSA to review any available GFI.
- Define the zoning scheme, select system types, and estimate design-year baggage screening demand (see Chapter 5 for detailed description of estimating baggage screening demand). The TSA possesses information that is pertinent to the design review process, especially at the Pre-Design level. The Project Sponsor should interact with the TSA to obtain realistic historical values for bags per passenger, peak values for passenger arrivals, passenger arrival curves, etc.

- Develop preliminary screening alternatives as described in Chapter 4, Chapter 5 and Chapter 6. These screening alternatives should be similar to the various system types described in Chapter 3.
- Analyze the preliminary alternatives by conducting qualitative and high-level quantitative assessments (e.g., spatial analyses, assessment of compatibility with airline business models), including security screening equipment requirements (see Chapter 6 for additional details on the high-level quantitative assessment of equipment requirements and Appendix C for an example of how a qualitative and high-level quantitative assessment of screening alternatives could be performed).
- Select the most promising alternatives for further development and evaluation (see Appendix C for an example of selecting the most promising screening alternatives).
- Refine the level of definition needed for the selected alternatives to support more detailed evaluations (e.g., specific screening equipment types as well as screening equipment requirements).
- Obtain TSA staff, equipment, and maintenance cost estimates to perform the life cycle cost analysis.
- Perform rough order-of-magnitude (ROM) evaluations, including 20-year life cycle cost analyses (see Chapter 8).
- Select the Preferred Alternative (i.e., the alternative that is operationally viable, and meets the level-of-service requirements and has the lowest present value life cycle costs); in addition, other promising alternatives could be carried forward to the Schematic Design Phase at the discretion of the Project Sponsor (see Chapter 8 as well as Appendix C regarding the process of selecting the lowest present value life cycle cost alternative).
- Submit Alternatives Analysis Report to TSA (see below)
- Participate in a meeting with the TSA Design Review Team in the event the Project Sponsor or ILDT requires clarification on the comments and disposition of the submittal.
- Receive TSA comments on the Alternatives Analysis Report and formal approval or rejection.

2.2.1.2 Deliverables

The Pre-Design package shall include the deliverables described below:

- **Alternatives Analysis Report**. This report documents the assumptions and methodology used to derive the design-year baggage screening demand, the process used to develop alternatives, a description of all alternatives considered, and a list of the preliminary set of alternatives to be carried forward for analysis on a life cycle cost basis.
  - This report will be used as the basis for requesting staffing estimates from TSA for use in the life cycle cost analysis, as described in Chapter 8. See Chapter 3 for a list of various screening system types. See Chapter 4 for a detailed description of how to develop screening alternatives and Chapter 6 for determining screening equipment requirements for the various screening alternatives.

  - This report also documents the life cycle cost analysis and basis for selection of the preferred alternative(s) to be further developed in the Schematic Design Phase; Chapter 3, Chapter 4, Chapter 5, Chapter 6 and Chapter 8 collectively provide an explanation of how to select the preferred alternative from a universe of screening options.

- **Preliminary contingency plan** (only applicable to mini in-lines at this phase)

2.2.1.3 TSA Responsibilities in Pre-Design Phase

At the beginning of the Pre-Design Phase, TSA will initiate a project expectation meeting with the Project Sponsor/ILDT and provide GFI relevant to the project. If available, TSA will provide:

- Historical data and the analysis required to render the baggage design 10-minute rate
- Out-of-Gauge (OOG) percentage for current EDS at site
- TSA Enhanced Staffing Model arrival curves and demand assumptions
- PMIS reports

The Project Sponsor is advised to review the provided GFI. Using the GFI as a starting point could help to shorten the design process and possibly nullify the need for a Flight Schedule Analysis.

As part of the review process during the Pre-Design Phase, TSA Headquarters is expected to provide the Project Sponsor with the following:

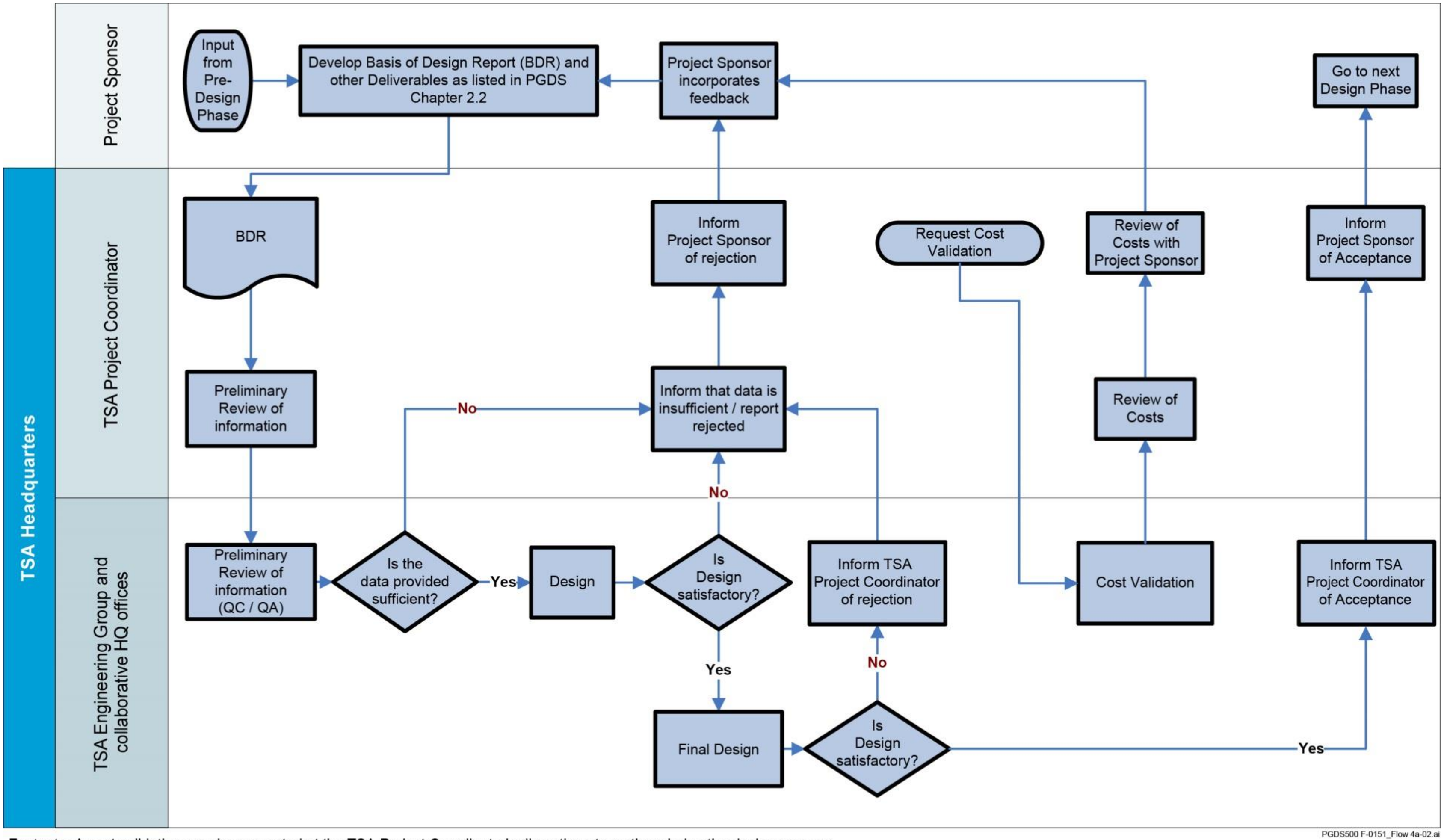
- Estimates of staffing levels necessary to complete the life cycle cost analysis in preparing the Preferred Alternatives Analysis Report
- A Design Review Meeting with the Project Sponsor, ILDT, and TSA project coordinators
- Formal approval/rejection and comments on the report submittals

2.2.2 Schematic Design Phase

A process flow chart of this Schematic Design Phase is displayed in Figure 2-6. During this phase, the work product of the Pre-Design Phase is used to further develop and refine the Preferred Alternative, including initial development of concept-level design drawings and a program schedule, as well as more detailed ROM construction cost estimates. The Basis of Design Report is the end product of the Schematic Phase.

In the design packages that must be submitted during this phase, increased emphasis is placed on economic analysis, contingency operations plans, and conformance with operational performance standards.

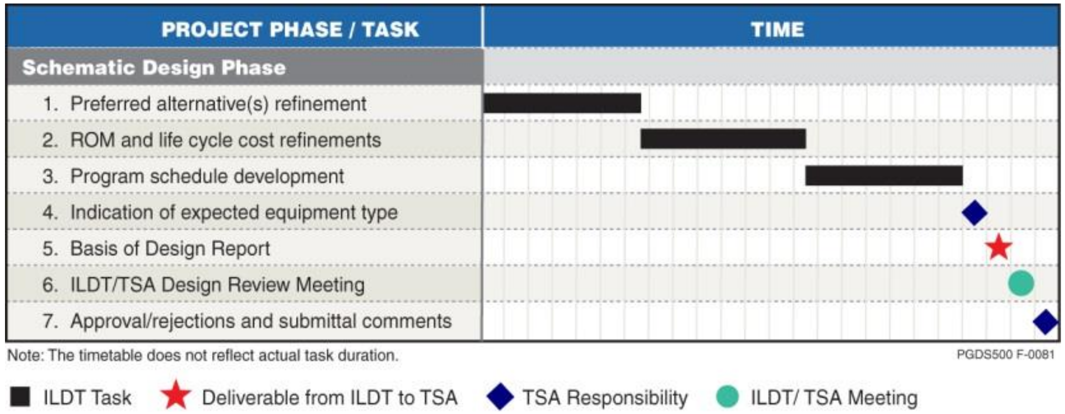
Figure 2-6: Schematic Design Phase Design Process Flow



Footnote: A cost validation may be requested at the TSA Project Coordinator's discretion at any time during the design process.

ILDT tasks, deliverables, TSA responsibilities, and meetings during the Schematic Design Phase are addressed in the following paragraphs and summarized in Figure 2-7.

Figure 2-7: Summary of Schematic Design Phase



2.2.2.1 Project Sponsor and ILDT Schematic Design Phase Responsibilities

The tasks that are the responsibility of the Project Sponsor and ILDT involved in the Schematic Design Phase are outlined below:

- Further develop and refine the preferred alternative(s), including the initial development of design drawings.
- Develop a more detailed ROM construction cost estimate to be incorporated into the life cycle cost analysis performed in the Pre-Design Phase.
- Develop a program schedule.
- Obtain a preliminary indication of expected equipment types from TSA: EDS unit availability and characteristics are subject to the outcome of TSA's competitive procurement.
- Submit the Basis of Design Report (see below).
- Participate in a meeting with the TSA Design Review Team in the event the Project Sponsor/ILDT requires clarification on the comments and disposition of the submittal. Receive comments on the Basis of Design Report and formal approval or rejection.

2.2.2.2 Deliverables

The Schematic Design package shall include the **Basis of Design Report**, which shall add the following elements to the Alternatives Analysis Report described in the Pre-Design phase:

- **Detailed program requirements**, including planning and modeling assumptions and results, a conceptual system overview, and a system evaluation of the preferred alternative (see Chapter 4 for further information on the selection of the preferred alternative); Planners shall make specific reference to TSA-specified CBIS design performance requirements and current commissioning requirements outlined in Chapter 7 and Appendix D and also make specific reference to the equipment that TSA has identified to perform the screening function
- **Indication of preferred EDS equipment make and model**
- High-level **flow-based modeling** assumptions and results
- **Preliminary concept plans** for the existing BHS, as well as the planned configuration of the in-line CBIS
- **Contingency plan** (only applicable to mini in-lines at this phase)
- **Phasing and constructability technical memoranda** documenting project-specific issues for each discipline, including CBIS design and architectural, structural, mechanical, plumbing, electrical, and communications considerations
- **ROM estimate of probable construction and operating and maintenance (O&M) costs** based on the Basis of Design Report documentation
- **Stakeholder notification documentation**
- **Preliminary project schedule**
- **Environmental compatibility assessment** between environmental conditions that will exist in designed CBIS and environmental requirements of EDS units
- **Written response to each TSA comment** from the design review on the form and in the space provided

It is assumed that the Project Sponsor will engage the services of a professional design team to complete the deliverables for the Schematic Design Phase. The approved Basis of Design Report shall be the basis upon which subsequent design is developed.

2.2.2.3 TSA Responsibilities

As part of the review process at the end of the Schematic Design Phase, TSA Headquarters is expected to provide the Project Sponsor with the following:

- Preliminary indication of expected equipment type to be delivered
- A Design Review Meeting with the Project Sponsor, ILDT, and TSA project coordinators
- Formal approval or rejection and comments on the Basis of Design Report

2.2.2.4 Funding Application

Airports with an eligible in-line CBIS project may request TSA funding in support of the CBIS design and construction. There is a two-step application process which consists of the submission of a ReMAG request as well as an application. Guidance and FAQs on the funding and application processes can be found on TSA's website at http://www.tsa.gov/research-center/airport-checked-baggage-guidance-materials.

2.2.3 Detailed Design Phase

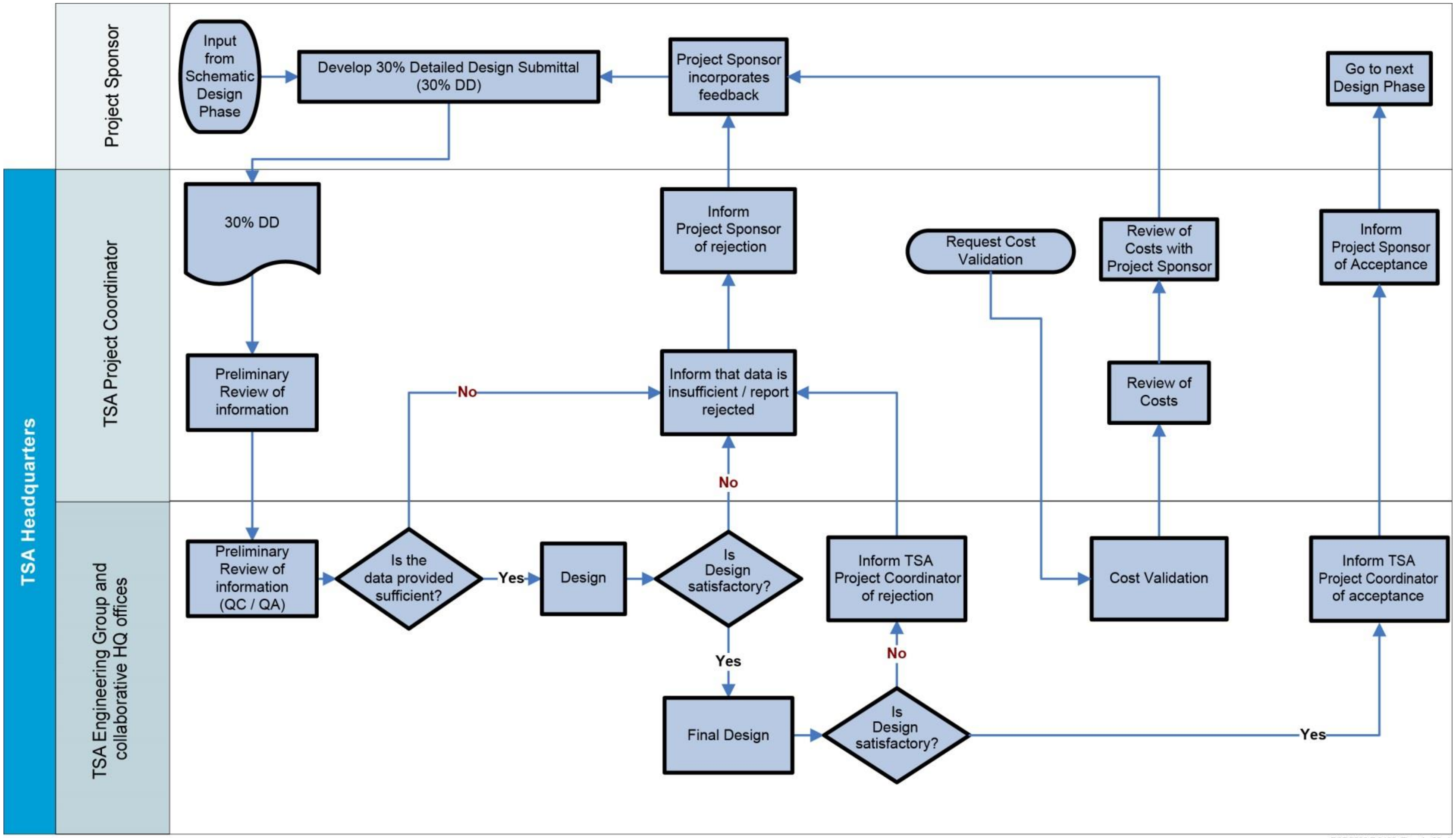
During the Detailed Design Phase the Basis of Design Report is used to refine and finalize detailed design drawings, ROM construction cost estimates, and the program schedule. Three sub-phases are to be used as milestones: 30% design, 70% design, and 100% Construction Documents.

Tasks, deliverables, TSA responsibilities, and meetings for the Detailed Design Phase are addressed in the following paragraphs.

2.2.3.1 30% Design

A process flow chart of the 30% Design Phase is displayed in Figure 2-8.

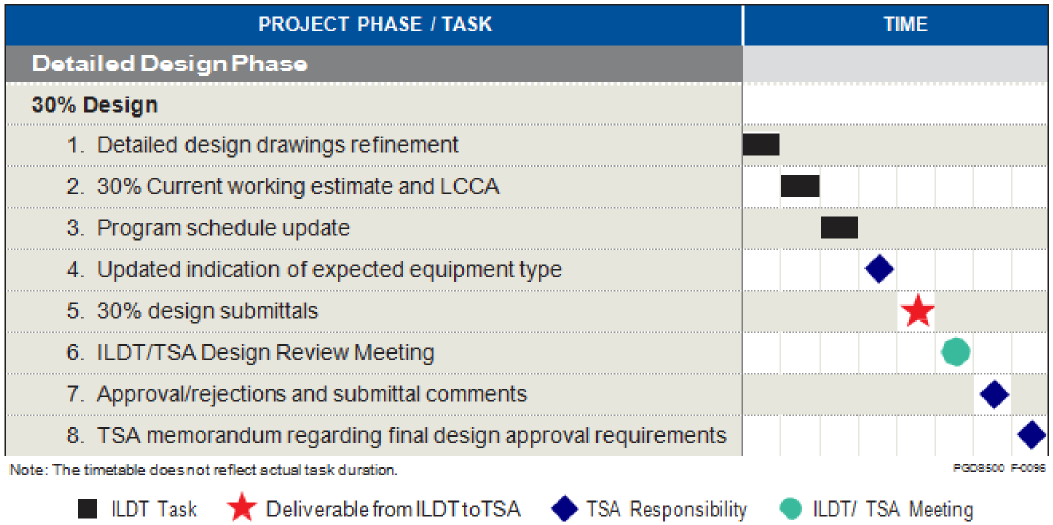
Figure 2-8: Detailed Design Phase, 30% Design Process Flow



Footnote: A cost validation may be requested at the TSA Project Coordinator's discretion at any time during the design process.

Figure 2-9 summarizes ILDT tasks, deliverables, TSA responsibilities and meetings for the 30% Detailed Design Phase.

Figure 2-9: Summary of 30% Detailed Design Phase



2.2.3.1.1 Project Sponsor and ILDT 30% Detailed Design Phase Responsibilities

The tasks that are the responsibility of the Project Sponsor and ILDT involved in the 30% Detailed Design sub-phase are outlined below:

- Refine the detailed design based on the TSA-approved Basis of Design Report.
- Develop 30% level current working estimate and Life-Cycle Cost Analysis (LCCA).
- Update the preliminary program schedule developed in the Schematic Design Phase.
- Obtain an updated indication of expected EDS equipment type(s) from TSA.
- Submit the 30% design deliverables specified below.
- Participate in a meeting with the TSA Design Review Team in the event the Project Sponsor/ILDT requires clarification on the comments and disposition of the submittal.
- Receive comments on the 30% design submittals and formal approval/rejection from TSA.

- Receive TSA memorandum stating that issues identified by TSA must be addressed and that the CBIS design cannot be bid until after TSA approval of the 100% design submittal.

2.2.3.1.2 Deliverables

The 30% design package shall include the following documents, which shall be delivered both in the native format (Word, Excel, AutoCAD, etc.) and as a PDF file (hard copies are not required):

- **Updated Basis of Design Report**
- **Preliminary Plans for all disciplines**, including:
  - Plan views of outlined conveyors and rights of ways, mechanical elements, showing EDS locations and CBRA area(s)
  - EDS unit removal route with locations of quick disconnect conveyors as well as all other O&M-related access
  - Inclines and declines
  - Conveyor delineations, especially near the EDS units and in the CBRA
  - Conveyor identification (ID) labels
  - Elevations of significant areas (floor and wall penetrations, steep gradients, congested areas)
  - Top of Bed approximate elevations
  - Approximate MCP locations
  - CBRA/Level 3 plans shall include:
    - Elevations
    - EDS pedestals if needed
    - Operational description and design prints indicating how the “no lift” policy is to be met
    - Baggage Removal Points (BRPs) and insertion positions in relation to workstations and Transportation Security Officer (TSO) movement space
    - Conops and layout for Oversize (OS) and OOG bags
    - Shrouding materials
    - Flooring material
    - Lighting design
    - Noise reduction design
    - Minimum environmental conditions

  - Printer(s)
  - Universal Power Supply (UPS) and power pole locations
  - Bag Inspection Tables (level 3 alarm resolution stations)
  - Footprints for proper installation of stairs and ladders
  - ETD locations and mounting options
  - Bag Viewing Stations, Remote Resolution Station, FDRS locations
  - Enlarged single-sheet plan view of CBRA/Level 3
- **Cross sections** showing the vertical dimensions of the CBIS including equipment removal paths
- **Concept of Operations** including discussion of how the overall CBIS is intended to work (see discussion in Section 3.1 with emphasis on a detailed concept of operations discussion of the CBRA (see Chapter 9 as guidance) and an emphasis on legacy BHS (if applicable); this shall include a description of compatibility between legacy BHS and new CBIS, contrasting baggage rates and controls methodology as well as the results of time-in-system analyses through simulation studies for time-in-system and time-in-CBRA standards as detailed in Chapter 7
- **Contingency plan** (only applicable to mini in-lines at this phase)
- **Baggage and data flow charts** (detailed EDS/BHS/CBRA data flows and examples for SFO and JFK are included in Appendix A, Section A.5)
- **Table of contents for CBIS** but not limited to specifications for equipment for On-Screen Resolution (OSR) room, CBRA, Bag Status Displays (BSDs), conveyor specifications prior to EDS, insert/removal point of image quality (IQ) bags, and reference to all of the TSA-furnished screening equipment to be used in the CBIS
- **Screening Equipment Installation Guidelines** documenting the satisfactory accommodation of the selected screening equipment in compliance with the manufacturer's site-installation guide
- **Outline of Reporting Capabilities** to be provided by the CBIS (see Appendix A, Section A.8 for examples of detailed reports generated)
- **National Environmental Policy Act form completion (Section IV of TSA form 2601-1)**
- **Stakeholder Notification Documentation**
- **30% Current working estimate and LCCA**
- **Preliminary phasing plan and schedule:**
  - Plan view drawing package showing conveyor layout and BHS/EDS components of the CBIS (i.e., automatic tag readers (ATRs), Baggage Measurement Arrays (BMAs), EDS, CBRA BRPs) at each construction phase; each drawing shall have a title box clearly labeled with a construction phase number with conveyors and components labeled if known

- Brief description of the state of the system represented in each phase drawing, including:
  - The major functional changes of the CBIS in each phase (e.g., what components are removed/replaced, what major additions are made to the network or subsystems)
  - Whether the CBIS will be used operationally following each phase, and a brief description of how operations would be conducted (e.g., which induct points, which screening lines, is CBRA temporary or final configuration, etc.)
  - Number and type of each EDS populating screening lines in each phase
- Schedule showing when each phase is anticipated amongst other major activities impacting the system state by the baggage handling system contractor (BHSC) and EDS Original Equipment Manufacturer (OEM) (e.g., high level of demolition and construction, networking and integration work, etc.)

- **Conveyor manifest** showing:
  - Conveyor identifiers
  - Approximate conveyor lengths
  - Approximate conveyor speeds
- **List of EDS equipment**, by make, model, and serial number, that will be decommissioned after the proposed in-line system is operational
- **Written response to each TSA comment** from the design review on the form and in the space provided

In the event that requirements described in Chapter 7, Design Best Practices and Standards, cannot be met, the TSA Design Review Team will notify the EBSP Program Manager and LCS Manager to determine the life cycle support impact on the EDS equipment.

2.2.3.1.3 TSA Responsibilities

As part of the review process at the end of the 30% Design sub-phase, TSA Headquarters is expected to provide the Project Sponsor with the following:

- Updated indication of expected equipment type to be delivered
- A Design Review Meeting with the TSA project coordinators
- Formal approval or rejection and comments on the 30% design submittals
- A memorandum from TSA stating that TSA issues must be addressed (if appropriate) and that the CBIS design cannot be bid until after TSA approval of the 100% design submittal

NOTE: Ad hoc meetings should be convened as soon as possible with all affected parties to resolve safety-related issues that arise during the 30% design phase.

2.2.3.2 70% Design

A process flow chart of this 70% Detailed Design Phase is displayed in Figure 2-10.

Figure 2-10: Detailed Design Phase, 70% Design Process Flow

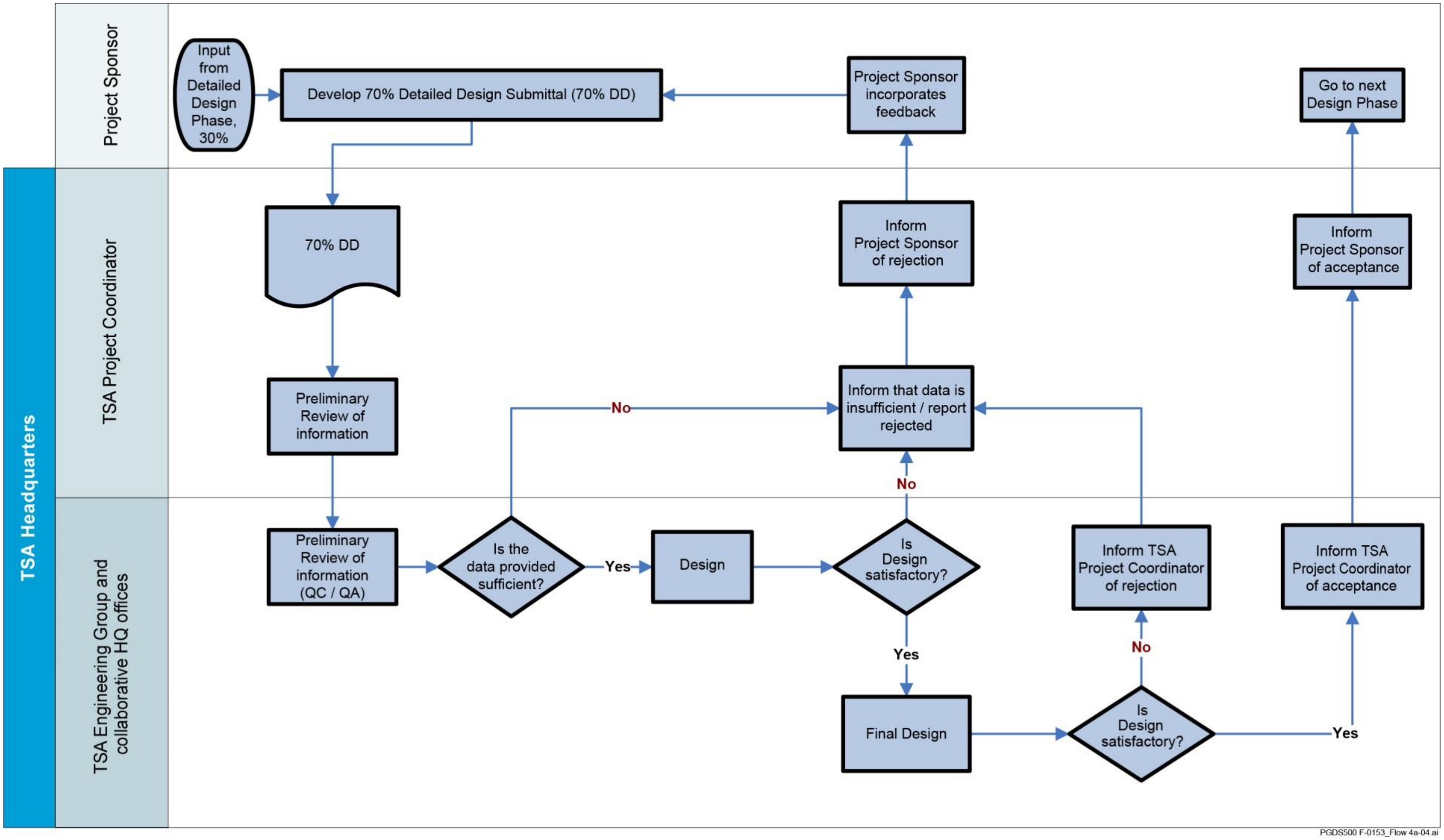
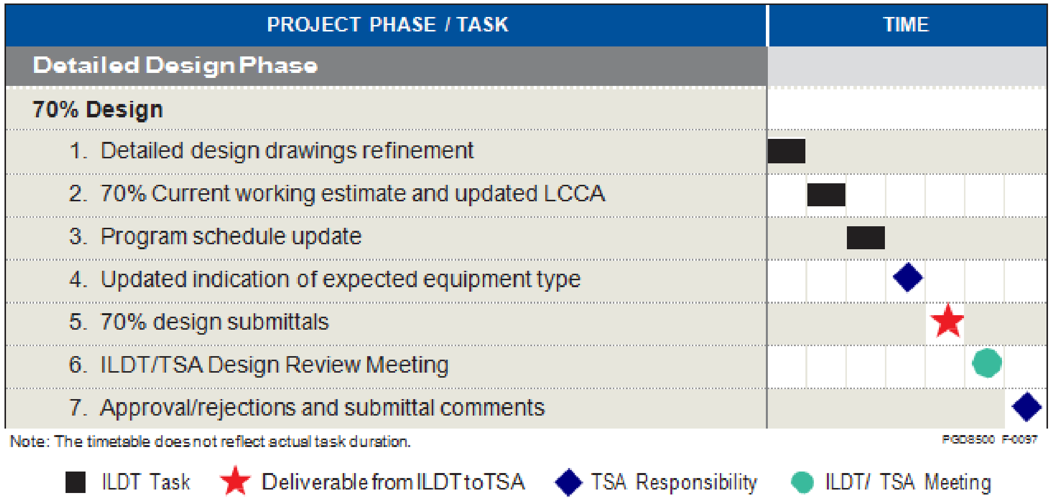


Figure 2-11 summarizes ILDT tasks, deliverables, TSA responsibilities and meetings for the 70% Detailed Design Phase.

Figure 2-11: Summary of 70% Detailed Design Phase



2.2.3.2.1 Project Sponsor and ILDT 70% Detailed Design Phase Responsibilities

The tasks that are the responsibility of the Project Sponsor and ILDT involved in the 70% Detailed Design sub-phase are outlined below:

- Refine detailed design drawings based on TSA comments on the 30% design submittals,
- Refine current working estimate and update LCCA,
- Update the preliminary program schedule developed in the 30% design sub-phase,
- Obtain an updated indication of expected equipment type from TSA,
- Submit the 70% design deliverables specified below,
- Participate in a meeting TSA Design Review Team in the event the Project Sponsor or ILDT requires clarification on the comments and disposition of the submittal,
- Receive TSA comments on the 70% design submittals and formal approval or rejection from TSA,

2.2.3.2.2 Deliverables

Simple mini in-line designs are exempt from this detailed design sub-phase. However, all 70% detailed design deliverables (except dynamic simulation) are required as part of the 100% design sub-phase.

The 70% design package shall include the following documents:

- **Updated Basis of Design Report**
- **70% design drawings** for all disciplines including:
  - Mechanical drawings, including:
    - Motor and drive package locations
    - Catwalks, platforms, ladders, and stairways
    - Dimensions of points of intersection
    - Realistic elevations and Top of Bed identifiers, including areas of interest
    - Pertinent details (maintenance areas around EDS units, CBRA spatial dimensions, egresses for TSA personnel, stairways intended for TSA personnel, EDS unit removal paths, etc.) that refer to the general concerns of the TSA prior to the BHS engineering occurring post bid
    - Notable interference issues
  - Demolition requirements
  - Electrical
    - Control station locations
    - E-stop zones in the CBRA and adjacent to the EDS units (drawings which reflect areas and activating stations)
    - Device locations (photo eyes, shaft encoders, audio and visual alarms)
    - Intended locations and sizes of MCPs
  - EDS unit removal route and all other O&M-related access
  - Control room location (if applicable)
  - Demolition and phasing plans
  - Any refinements to CBRA plans
- **Cross sections** showing the vertical dimensions of the CBIS

- **Refinements to the Description of Operations** including refinements to the discussion of how the system is intended to work with emphasis on the CBRA and legacy BHS (if applicable); this shall include updates to the description of compatibility between legacy BHS and new CBIS, contrasting baggage rates and controls methodology. Any differences between proposed CBRA operations and Chapter 9 requirements shall be documented and submitted on an RFV.
- **Preliminary Contingency Plan** describing contingency operations in the event of:
  - Screening equipment failure
  - Conveyance equipment failure
  - Loss of utility power
  - Unplanned surges in system demand
- **70% specifications** with specific reference to the responsibility of the BHS contractor to meet TSA-specified CBIS design performance requirements and current CBIS commissioning requirements for final TSA approval as well as documentation on the reporting capabilities for which the CBIS is designed and related operational procedures (e.g., jam clear procedures); refer to Chapter 7 for design standards and for detailed information on design performance requirements, and Appendix D for commissioning requirements. BHS specification shall also include detailed requirements for the Baggage Inspection Stations.
- **Draft Site-Specific Configuration Management Plan** including documentation of the screening system boundaries, delineated areas of responsibility among TSA, the Project Sponsor, and the airlines (if they are not the Project Sponsor), and procedures for documenting and informing relevant parties of modifications to the CBIS after submission of documentation for the SSTP. The Configuration Management Plan shall follow the outline provided in Appendix A, Section A.7.
- **Stakeholder Notification Documentation** including responses to comments concerning OSR and CBRA areas for TSA review.
- **70% Current working estimate and updated LCCA**
- **Refined phasing plan and schedule**
  - Plan view drawing package showing conveyor layout and BHS/EDS components of the CBIS (i.e., ATRs, BMAs, EDS, CBRA BRPs) at each construction phase; each drawing shall have a title box clearly labeled with a construction phase number with conveyors and components labeled if known
  - Brief description of the state of the system represented in each phase drawing, including:
    - The major functional changes of the CBIS in each phase (e.g., what components are removed/replaced, what major additions are made to the network or subsystems)
    - Whether the CBIS will be used operationally following each phase, and a brief description of how operations would be conducted (which induct points, which screening lines, is CBRA temporary or final configuration, etc.)
    - Number and type of each EDS populating screening lines in each phase

  - Schedule showing when each phase is anticipated amongst other major activities impacting the system state by the BHSC and EDS OEM (i.e., high level of demolition and construction, networking and integration work, etc.)
- **Conveyor manifest**, including:
  - Motor sizing
  - Total amperage requirements
  - Conveyor speeds (refined)
- **Updated list of EDS equipment**, by make, model, and serial number, that will be decommissioned after the proposed in-line system is operational
- **Written response to each TSA comment** from the design review on the form and in the space provided

2.2.3.2.3 TSA Responsibilities

As part of the review process at the end of the 70% Design sub-phase, TSA Headquarters is expected to provide the Project Sponsor with the following:

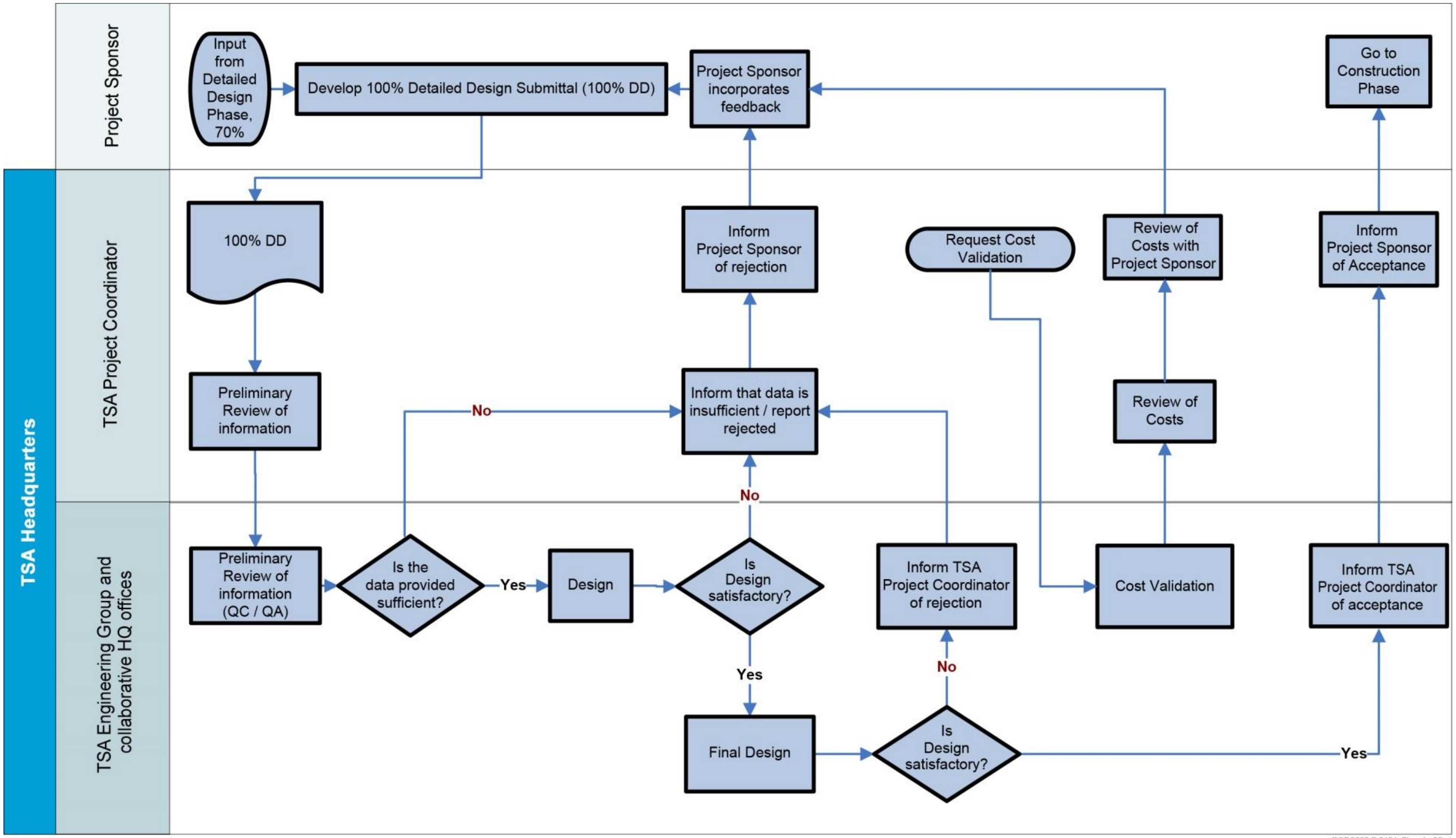
- Updated indication of the expected equipment type to be delivered
- A Design Review Meeting with the Project Sponsor, ILDT, and TSA project coordinators
- Formal approval or rejection and comments on the 70% design submittals

NOTE: Ad hoc meetings should be convened as soon as possible with all affected parties to resolve safety-related issues that arise during the 70% design phase.

2.2.3.3 100% Design

A process flow chart of the 100% Detailed Design Phase is displayed in Figure 2-12.

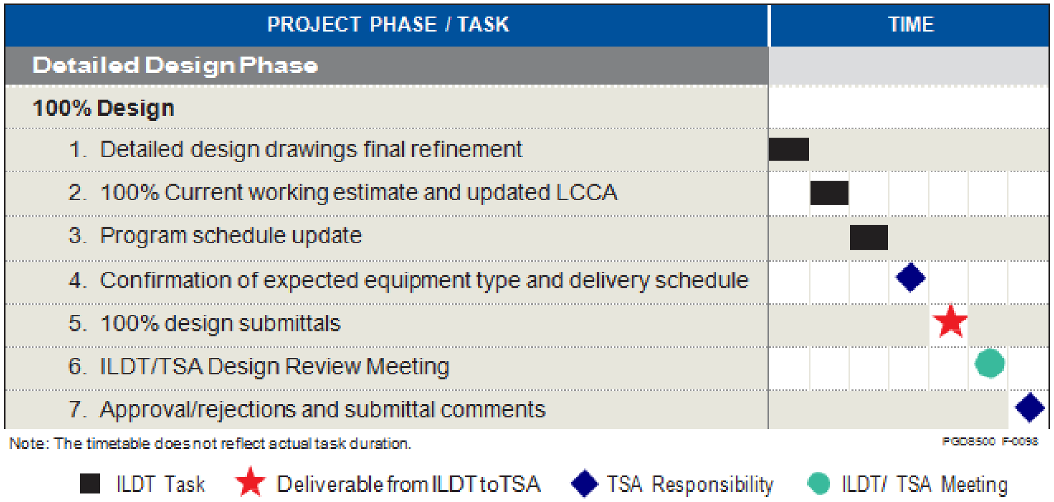
Figure 2-12: Detailed Design Phase, 100% Design Process Flow



Footnote: A cost validation may be requested at the TSA Project Coordinator's discretion at any time during the design process.

Figure 2-13 summarizes tasks, deliverables, TSA responsibilities and meetings for the 100% Detailed Design Phase.

Figure 2-13: Summary Of 100% Detailed Design Phase



2.2.3.3.1 Project Sponsor and ILDT 100% Detailed Design Phase Responsibilities

The tasks that are the responsibility of the Project Sponsor and ILDT involved in the 100% Detailed Design sub-phase are outlined below:

- Refine and finalize detailed design drawings based on TSA comments on the 70% design submittals.
- Refine and finalize 100% level current working estimate and LCCA.
- Update the preliminary program schedule developed in the 70% design sub-phase.
- Confirm with TSA the exact equipment to be delivered and expected delivery schedule.
- Submit the 100% design deliverables specified below.
- Participate in a meeting with the TSA Design Review Team in the event the Project Sponsor or ILDT requires clarification on the comments and disposition of the submittal.
- Receive TSA comments on the 100% design submittals and formal approval/rejection from TSA.

- Provide a final report detailing the life cycle support impacts for airport facilities that do not meet the Chapter 7 Design Best Practices and Standards.

2.2.3.3.2 Deliverables

The 100% design package shall include the following documents:

- **Bid Documents**, including:
  - Cover sheet with noted stakeholders, project locale, title, dates, revision block
  - Drawing index
  - Legend sheet
  - Mechanical
    - Conveyor manifest sheet(s)
    - Plan views, including catwalk, stairs, and egress
    - Elevation views
    - Project specific/standard details
    - Phasing drawings
    - Demolition requirements
  - Electrical
    - Control stations/devices/MCP locations
    - E-stop zones, with relevant control station
  - Demolition and phasing plans
  - EDS unit removal route as well as all other O&M-related access
  - CBRA plans
- **Final Basis of Design Report** including a plan view PDF drawing of the entire system from baggage infeed to make up device
- **Final Description of Operations** including the final discussion of how the system is intended to work with emphasis on the CBRA and legacy BHS (if applicable) including final updates to the description of compatibility between legacy BHS and new CBIS, contrasting baggage rates and controls methodology. Any differences between proposed CBRA operations and current version of Chapter 9 requirements shall be documented and submitted on an RFV.

- **Contingency Plans** including diagrammatic depictions of baggage screening contingencies, as well as other screening methods and mitigation measures. A consolidated document shall be provided to TSA describing the conditions that would trigger mitigation measures and protocols for operation plus a directory of all project stakeholders with direct responsibilities for operation of the CBIS
- **Project specifications** with specific reference to the responsibility of the BHS contractor to meet TSA-specified CBIS design performance requirements and current commissioning requirements for final TSA approval, including functional specifications of the system
- **Final Site-Specific Configuration Management Plan** including any updates on documentation of the boundaries of the screening system, delineated areas of responsibility among TSA, the Project Sponsor, and the airlines (if they are not the Project Sponsor), and procedures for documenting and informing relevant parties of modifications to the CBIS after submission of documentation for the SSTP
- **National Environmental Policy Act form confirmation (Section IV of TSA form 2601-1)**
- **Stakeholder Notification Documentation**
- **Final 100% Current working estimate and LCCA**
- **Final phasing plan and schedule**
  - Plan view drawing package showing conveyor layout and BHS/EDS components of the CBIS (i.e., ATRs, BMAs, EDS, CBRA, BRPs) at each construction phase. Each drawing shall have a title box clearly labeled with a construction phase number with conveyors and components labeled if known. A brief description of the state of the system represented in each phase drawing, including:
    - The major functional changes of the CBIS in each phase (e.g., what components are removed or replaced, what major additions are made to the network or subsystems)
    - Whether the CBIS will be used operationally following each phase, and a brief description of how operations would be conducted (which induct points, which screening lines, is CBRA temporary or final configuration, etc.)
    - Number and type of each EDS populating screening lines in each phase
  - A schedule showing when each phase is anticipated amongst other major activities impacting the system state by the BHSC and EDS OEM (e.g., high level of demolition and construction, networking and integration work, etc.)
- **Updated list of EDS equipment** by make, model, and serial number that will be decommissioned after the proposed in-line system is operational
- **Updated Conveyor manifest**, including:
  - Motor sizing
  - Total amperage requirements
  - Conveyor speeds (refined)
- **Written response to each TSA comment** from the design review on the form and in the space provided

2.2.3.3.3 TSA Responsibilities

As part of the review process at the end of the 100% design sub-phase, TSA Headquarters is expected to provide the Project Sponsor with the following:

- Confirmation of the exact equipment to be delivered and the expected delivery schedule
- A Design Review Meeting with the Project Sponsor, ILDT, and TSA project coordinators
- Formal approval or rejection and comments on the 100% design submittals

NOTE: Ad hoc meetings should be convened as soon as possible with all affected parties to resolve safety-related issues that arise during the 100% design phase.

2.2.3.4 Design-Build Projects

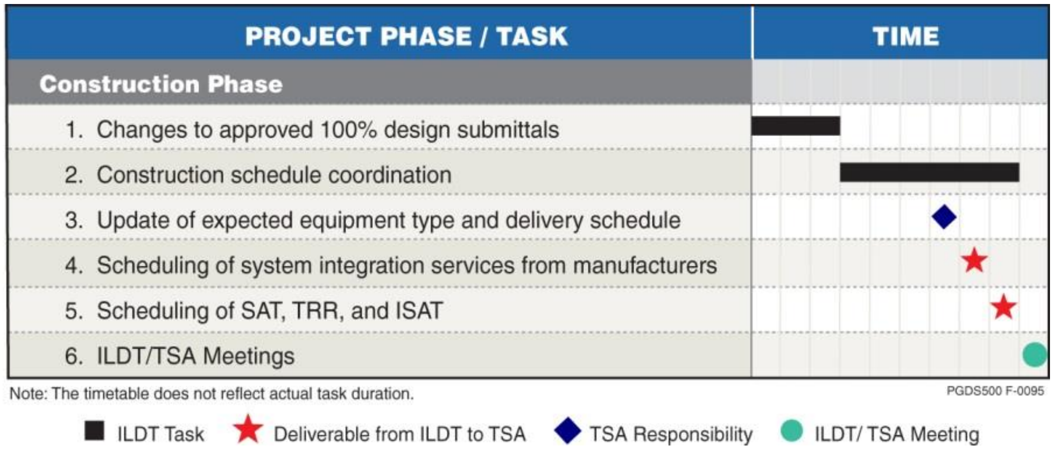
2.2.3.4.1 Deliverables

- Sponsors of projects anticipated for completion through a design-build contract, regardless of the design percentage at which the design-build contract is expected to be awarded, shall provide all documentation outlined above for the 30% design, 70% design, and 100% design submittals.
- These documents shall be provided in accordance with a schedule coordinated by the Project Sponsor and TSA to ensure applicability of the intended system to the guidelines and standards presented herein.
- Additionally, shop drawings and 70% progress drawings shall be provided for CBISs being constructed through design-build contracts to demonstrate that the system being constructed conforms to the design reviewed and approved by TSA.

2.2.4 Construction Phase

Tasks, deliverables, TSA responsibilities, and meetings for the Construction Phase are addressed in the following paragraphs and shown in Figure 2-14.

Figure 2-14: Summary of Construction Phase



The duration of the Construction Phase will vary significantly based on the complexity and size of the approved CBIS.

2.2.4.1 Project Sponsor and ILDT Construction Phase Tasks

The following requirements shall be adhered to during the Construction Phase, regardless of project type (design-bid-build versus design-build):

- To ensure TSA's complete understanding and acceptance of the projected system performance, any changes or amendments to the approved 100% design, including but not limited to contract document addenda or change requests and Requests for Information (RFIs) that affect the functionality of the CBIS, shall be presented for approval to TSA. Any variation from the 100% approved design will not be funded without prior TSA approval of the changes.
- Construction schedules shall include at a minimum key milestones for project completion such as:
  - Design phases
  - Construction bid solicitation
  - Construction award
  - Construction notice to proceed
  - General construction prior to EDS delivery and post-EDS delivery
  - BHS construction prior to EDS delivery and post-EDS delivery

- Substantial completion of facility modification
- EDS delivery
- EDS power readiness and installation
- EDS SAT complete
- Schedule for system integration services
- SSTP Checklist received and completed
- Pre-ISAT
- Test readiness review (TRR)
- ISAT (see Section 2.2.6)
- Live bag screening
- 30-day run-in
- EDS decommission
- Completion of all required deficiency corrections
- Substantial completion
- Project closeout

- TSA Deployment, through its contractor, distributes the uncompleted SSTP Checklist to the Project Sponsor at no less than 180 days before the planned start of ISAT testing, and the project sponsor is to provide Acceptance Testing this completed checklist and the site documentation it defines no less than 120 days before the planned start of ISAT testing.
- The Project Sponsor shall submit an updated Construction Schedule to TSA stakeholders at a minimum of every 30 days after construction award. Most projects conduct a weekly meeting to review project status and shall invite a TSA Deployment representative.
- The project sponsor shall request an update of the availability of equipment and equipment upgrades.
- At a minimum, the following ISAT durations shall be used as initial inputs to the construction schedule with the type of ISAT test being conducted (single-phase or multi-phase):
  - Single-Phase ISAT:
    - One business day for mobilization to site
    - One business day per EDS spur line

    - Three business days for system testing (one business day each for System Mixed Bag, System Dieback, and System Throughput tests)
    - One business day for outbrief and demobilization
  - Multi-Phase ISATs, each phase (except for final phase):
    - One business day for mobilization to site
    - One business day per EDS spur line not tested in previous phase
    - Two business days for system testing (System Mixed Bag and System Dieback)
    - One business day for outbrief and demobilization
  - Final Phase:
    - One business day for mobilization to site
    - One business day per EDS spur line not tested in previous phase
    - Three business days for system testing (System Mixed Bag, System Dieback and System Throughput) conducted across all EDS in final form
    - One business day for outbrief and demobilization
- The Project Sponsor shall consult with the TSA Project Coordinator and their TSA Acceptance Testing representative no later than 90 days prior to ISAT during the SSTP Site Survey to refine projected commissioning durations.

2.2.4.2 Deliverables

The Construction Phase deliverables shall include the following documents:

- **Any changes or amendments to the approved 100% design** including, but not limited to, contract document addenda or change requests and RFIs
- **Construction schedules**
- **Courtesy copies of shop and installation drawings** to ensure the original intent of the design as reviewed up to and including the 100% design review submittal process

2.2.4.3 TSA Responsibilities

During the Construction Phase, based on the construction schedule, TSA Headquarters will confirm the availability of equipment and equipment upgrades and the schedule for delivery of specific equipment.

2.2.4.4 Meetings

Regular meetings shall be conducted with the Project Sponsor/ILDT and TSA to monitor system construction.

NOTE: Ad hoc meetings should be convened as soon as possible with all affected parties to resolve safety-related issues that arise during the construction phase.

2.2.5 Training

2.2.5.1 CBIS Use and Logistics Training

CBIS use and logistics training, distinct from maintenance training, shall be provided by the Project Sponsor to TSA for mechanical, electrical, and computer functions required to properly operate the staffed portions of the system including, but not be limited to:

- Any BHS-provided equipment in the CBRA
- Bag induction and handling procedures
- Any BHS-provided equipment in the OSRA
- BHS control interface provided to conduct the Image Quality Test (IQT) procedures (see Appendix D)
- CBIS orientation and layout
- CBIS fail-safe procedures and layout (see Chapter 7)
- System safety
- Bag jam and fault clearing procedures

The BHSC shall provide training on how to access and download BHS reports as well as Sensitive Security Information (SSI) training for any BHS reports classified as SSI; training must comply with Federal Government SSI guidelines. SSI Best Practices and Quick Reference Guides for more information on SSI handling, sharing, and destroying procedures can be found on the TSA.gov site at https://www.tsa.gov/for-industry/sensitive-security-information.

See Appendix A, Section A.4 for an example documentation outline. All operators or individuals with access to either viewing or printing reports shall have completed SSI procedures training prior to operation. The training sessions shall be conducted prior to the operational startup of the respective BHS.

2.2.5.1.1 Deliverables

- Training materials and documentation to be presented shall be submitted to TSA for review 60 days prior to the first scheduled training session.

2.2.5.2 TSA Training

2.2.5.2.1 EDS Training

Local TSA management must coordinate with the TSA Office of Training and Workforce Engagement to schedule training on the EDS equipment for TSOs and TSA management to be concurrent with CBIS Use and Logistics Training. The training must be specific to the EDS and ETD models utilized in the CBIS and completed prior to the established commission date.

2.2.5.2.2 Procedural Training

Local TSA management must coordinate with the TSA Office of Training and Workforce Engagement (or a local TSA trainer) to schedule training on the current Checked Baggage Standard Operating Procedure (SOP) as it is associated with the On-Screen Alarm Resolution Protocol (OSARP) and CBRA application to ensure qualified TSOs are available to properly staff the OSARP and CBRA functions. This training must be completed (as needed) prior to the established CBIS commission date.

2.2.6 Testing and Commissioning Phase

ILDT Tasks and TSA responsibilities for the Testing and Commissioning phases are addressed in the following paragraphs and shown in Figure 2-15.

Figure 2-15: Summary of Commissioning And Testing Phase

PROJECT PHASE / TASK	TIME		
Testing and Commissioning Phase			
1. SAT	◆		
2. Pre-ISAT		★	
3. TRR		◆	
4. ISAT			◆

Note: The timetable does not reflect actual task duration. PGDS500 F-0093

■ ILDT Task ★ Deliverable from ILDT to TSA ◆ TSA Responsibility ● ILDT/ TSA Meeting

2.2.6.1 Pre-Commissioning Requirements

Prior to the CBIS being approved and used for security screening operations, at a minimum, the activities listed below must be completed. All IATA tags for all phases of BHS testing, Pre-ISAT, TRR, and ISAT shall be provided by the airport or airline tenant.

1. The **Site Acceptance Test (SAT)** is conducted by the OEM and TSA to ensure that EDS equipment meets performance standards.
2. The **Pre-ISAT** (for in-line CBIS only) is a series of independent checks and confidence tests conducted by the Project Sponsor which may be witnessed by TSA and count as the TRR. The Pre-ISAT is intended to independently evaluate CBIS performance and capability to meet the design standards and performance requirements defined in Chapter 7. These tests shall be conducted in accordance with the requirements set forth in Appendix D and detailed in the SSTP. Written documentation of the successful demonstration of the Pre-ISAT shall be provided by the Project Sponsor to TSA.
3. From the TRR forward, the Project Sponsor shall ensure that change management processes are stringently adhered to. Sections 2.1.2 and 2.1.3 detail the conditions under which variance and change requests shall be initiated. In addition to the process outlined in Appendix D, a benchmarked copy of the programmable logic controller (PLC) program controlling CBIS components shall be submitted at the following points:
   - Post-ISAT
   - Post-Operational Run-In

   PLC code representing the CBIS under test shall be provided to TSA's Acceptance Testing Contractor at ISAT, and PLC code representing the post-operational run-in state shall be provided to TSA's Acceptance Testing Contractor during on-site observations for the run-in period or be submitted remotely upon successful completion of the run-in period if observations are not made. Passwords for any and all portions of "locked" PLC code shall be provided along with the code.
4. The **TRR** is a series of tests to be conducted by the Project Sponsor as outlined in the SSTP and witnessed and validated by TSA and/or a TSA contractor to ensure that the CBIS is ready for the Testing and Commissioning phases. The TRR is recommended to be a part of pre-ISAT and does not need to be a separately conducted test from pre-ISAT. If the CBIS fails the TRR, subsequent testing shall be conducted at intervals of no less than 14 calendar days.

   The following guidelines will be used to assist the Project Sponsor with projecting testing schedules for phased recapitalization and optimization projects only:
   - A combined TRR/ISAT consists of the Project Sponsor completing pre-ISAT and requesting TSA's contractor to be on site to conduct record testing. This allows for seamless transition from BHS pre-ISAT to record ISAT testing.
   - A single EDS unit (defined as from spur line divert to Level 1 Decision point) is phased into the existing CBIS – A combined TRR/ISAT may be conducted provided only the EDS line is being modified.

- If changes upstream of the spur line divert and downstream of the Level 1 decision point (including CBRA) are implemented and able to be tested with the first single EDS replacement, a combined TRR/ISAT can still be conducted.
- Testing duration is expected to be no more than three business days if provided a six-hour test window. This would cover line testing, a Mixed Bag System Test and a Dieback Test depending on the changes to the CBIS. Any throughput testing would be conducted after the entire CBIS system is complete.
- Multiple EDS and/or multiple changes to the in-feed, out-feed and/or OSR/CBRA subsystems - A combined pre-ISAT/TRR shall be conducted with the ISAT scheduled separately.
- TSA testing will be conducted based on the total changes made to the system.
- Questions on ISAT schedules should be directed to the Acceptance Test Lead.

To initiate deployment of an ISAT Team for combined TRR/ISAT, a written notice from the Project Sponsor must be provided to the TSA OAPM Project Coordinator Acceptance Test Lead and TSA Acceptance Testing Contractor Test Lead declaring successful pre-ISAT and indicating that the CBIS is ready for ISAT. The notification should be provided at least 3 business days in advance of the planned ISAT start date. This is required to provide assurance from the Project Sponsor that the CBIS is in a state of readiness for record testing and will permit TSA's testing contractor to arrange travel to support the scheduled ISAT start date. The notice needs to be accompanied by backup test documentation indicating successful completion of the tests and the following information:

- The PGDS/SSTP Tests ran (Line Tests, Fail-Safe, System Tests, etc.)
- Quantity and type of bags used for each test
- Applicable results of each test against PGDS criteria including the average screening throughput capacity per EDS unit, invalid CBRA arrival rate, fail-safe rate, jam rate, or other applicable criteria as identified in the PGDS and SSTP

5. The **ISAT** (for in-line CBIS only) is conducted by TSA (following the completion of all pre-requisite milestones shown in Figure 2-16) with logistical/labor support from the Project Sponsor.

Figure 2-16: ISAT Pre-Requisite Milestones

ISAT PRE-REQUISITE MILESTONES	TIME (Prior to start of ISAT testing)				
	180 days	120 days	90 days	60 days	30 days
Site Planning Checklist distributed to the ILDT	◆				
Site data provided to aceptance testing contractor		★			
Draft SSTP developed and provided to ILDT			◆		
Acceptance testing contractor to coordinate on-site meetings			●		●
Complete and provide final version of SSTP				◆	

■ ILDT Task ★ Deliverable from ILDT to TSA ◆ TSA Responsiblity ● ILDT/TSA Meeting

<u>Logistical/labor support shall include but is not limited to the following:</u>

- <u>Operational EDS Network Printers to print EDS images</u>
- <u>Operational BHS network printers to print BHS reports</u>
- <u>Baggage handlers to assist in bag induction</u>
- <u>Tugs and carts to move test bags to test locations</u>
- <u>Fork lift support for TSA-owned Unit Load Devices that transport test bags</u>
- <u>Bag tags for test bags</u>
- <u>Secure storage space for test bags</u>
- <u>Security Identification Display Area (SIDA) badging support for TSA contractor test team</u>
- <u>SIDA escort support</u>

TSA will ensure that the CBIS meets design performance requirements set forth in Chapter 7. This test is conducted for all in-line CBIS types in accordance with the requirements set forth in Appendix D. Test bags will be provided by TSA.

TSA test bag dimensions are included in Appendix D.

<u>If the CBIS fails the ISAT conducted by TSA, subsequent testing shall be conducted at intervals of no less than 30 calendar days.</u>

6. <u>The **Run-In Period** shall consist of a 30-day period to collect meaningful operational data (BHS and EDS) to support a well-rounded test summary report that accurately depicts system performance characteristics.</u> The Run-In period may be extended at TSA direction until open issues are resolved or if new defects are detected during the operational run-in. For multi-phased projects, incremental 1-2 week data collection periods may be conducted until the final phase of ISAT.

During the Run-In period, the Project Sponsor or its designee(s) shall submit weekly data reports in electronic format, preferably in Portable Document Format (PDF) or native Comma-Separated Values (CSV) file format to the TSA Acceptance Testing Contractor. Should native CSV format not allow correct separation of tabular data, especially for event reports where locations and events are listed, reports should be available in Microsoft Excel (.xls or .xlsx) format. These reports shall include all BHS reports required by PGDS Section 7.2.13 (CBIS Reporting Requirements) as well as select EDS reports. Prior to the Run-In period, the TSA Acceptance Testing Contractor will provide points of contact for delivery, delivery dates, report format, report time-frames, submission method, specific report names, and other Run-In data collection details.

The Acceptance Testing Contractor will visit the site to verify the status of open deficiencies from ISAT and observe the system's operation against reported data. This on-site observation will normally occur over a minimum of three days.

7. The Post-ISAT Audit will be directed by TSA on a periodic recurring basis or as the result of reported system performance anomalies.

   Upon notification from TSA OAPM that a Post-ISAT Audit has been directed, the authority with jurisdiction at the airport (along with local TSA) shall submit to the TSA Acceptance Testing Contractor and/or the TSA SOS Engineering Team, the immediate past 30 days of BHS and EDS reports in electronic format, preferably in native CSV or PDF format. Should native CSV format not allow correct separation of tabular data, especially for event reports where locations and events are listed, reports should be available in MS Excel (.xls or .xlsx) format. These reports shall include all BHS reports required by PGDS Section 7.2.13 (CBIS Reporting Requirements) as well as select EDS Reports. Prior to the Post-ISAT Audit, the TSA Acceptance Testing Contractor and/or the TSA Engineering Team will provide points of contact for delivery, delivery dates, report format, report time-frames, submission method, specific report names, and other Run-In data collection details.

TSA does not test a partial or incomplete CBIS. The system must be in final configuration for ISAT as defined below. Any CBIS components not in final configuration, or any situation requiring phased commissioning (see also the ILDT Section 2.1.2 and Project Sponsor Responsibility Section 2.1.3 above), shall be submitted to TSA for approval using the Request for PGDS Variance Template found in Appendix A, Section A.11 prior to the start of TRR testing. Final configuration is defined as when the physical, programming, networking, and reporting capabilities of the entire CBIS are in final operational state. More specifically, this includes (except by approved RFV).

- All induction points tied in (unless phased);
- All BHS conveyors, pathways, and components are operational (CBRA lines, OOG/OS lines, Re-insert lines, clear outbound paths, BMAs, ATRs, etc.) including legacy BHS components delivering bags to and taking bags away from the CBIS;
- All BHS interfaces are operational (including manual encode stations, IQ, E-stops, BIS BSDs, jam control stations, etc.);
- All BHS functionality (e.g., bag allocation, load leveling, merge logic, purge logic, and other conditional performance programming) is complete;
- All EDS components (EDS, CI, primary viewing stations (PVS), secondary viewing stations (SVS), printers) are installed and networked in final - not temporary - configuration, to include redundancy if applicable;

- BHS network in final configuration accessible via the BHS control room and its interfaces, including redundancy if applicable; and
- Complete BHS/CBIS reports are available.

TSA does test a CBIS once it is tied in to the broader BHS. However, to avoid costly change requests to the CBIS after TSA testing (as a result of failed tests that may require a CBIS change), it is recommended that testing by the Project Sponsor's contractor and designer be conducted prior to TSA testing. It is recommended that the test be conducted as soon as the operator receives the TSA test plan, but prior to the TSA ISAT to ensure that TSA can officially complete the test in the allotted time.

2.2.6.2 Deliverables

The Testing and Commissioning Phase deliverables shall include the following:

- Pre-ISAT documentation
- ISAT documentation

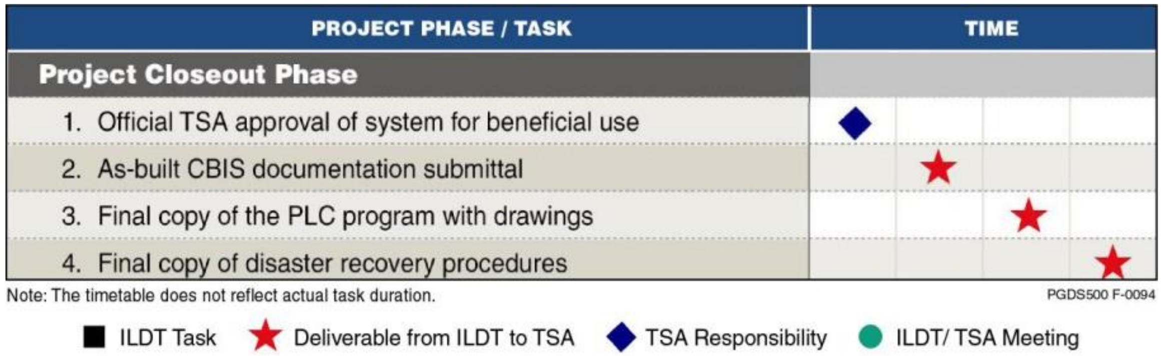
2.2.6.3 TSA Responsibilities

- Conducting SAT
- Witnessing the TRR
- Conducting the ISAT

2.2.7 Project Closeout Phase

Deliverables and TSA responsibilities for the Project Closeout Phase are listed below and shown in Figure 2-17.

Figure 2-17: Summary of Project Closeout Phase



Once the CBIS has been allowed to proceed to Live Bag Screening operations and all CBIS deficiencies have been corrected, TSA will provide official approval of the CBIS for beneficial use and the following actions are the responsibility of the Project Sponsor and ILDT to close out the project. Please see a complete list of configuration information in Section 2.2.7.2.

2.2.7.1 Deliverables

The Project Closeout Phase deliverables shall include the following:

- **As-built CBIS documentation** shall be submitted to TSA, in both CAD and PDF file format, as follows:
  - Final Description of Operations
  - A complete set of BHS as-built mechanical and electrical drawings, including:
    - Mechanical
    - Cover Sheet & Index
    - Legend
    - Overall Plan View
    - Overall Plan Existing (if available)
    - Isometric (if 3D)
    - CBRA Egress Plan
    - ETD Egress Plan
    - EDS Egress Plan

  - EDS Removal Path
  - ETD Plan View (1/2" scale if possible)
  - CBRA Plan View (1/2" scale, if possible)
  - Flow Chart
  - Standard Details
  - 1/8" scale plan views
  - 1/4" scale elevation views
  - Catwalk Drawings
  - Structural attachment drawings (including load drawings)
  - Structural Details
  - Phasing Drawings
  - Electrical Sheet
  - Cover Sheet & Index
  - Legend
  - Manifest with power summary and belt speeds
  - Control Device Plans 1/8" scale
  - E-Stop Zones
  - Control Device Details
  - Network Architecture
    - Upper (Sort Controller)
    - Lower (PLC)
- **The PLC program** shall be submitted to TSA in accordance with Section 2.2.6 above.
- **PLC and software disaster recovery procedures** shall be submitted to TSA including software recovery application(s).

2.2.7.2 Control Configuration Architecture Overview

The TSA requires that all configuration information be submitted at various stages of the system life-cycle for each and every CBIS. The requirements of these submittals are contained herein.

2.2.7.2.1 Submittal Requirements

The submittal data described herein shall be submitted to the TSA as follows:

- **30-Day Post DBU Submission:** Within 30 days following DBU, the initial submittal, as defined in Section 2.2.6, shall be made.
- **Submission Procedure:** Submission of all data shall be coordinated with the FSD or designee. All data shall be submitted via electronic files – paper copies will not be accepted.

2.2.7.2.2 Summary

A descriptive summary narrative of the submittal shall be included in Microsoft Word and PDF format. Refer to Section 2.2.7.6 for the electronic file naming convention. This summary shall include, at a minimum, the following information:

- Airport name and area of the airport included in the submittal such as terminal, matrix, node, etc.
- Description of the included area including:
  - Number and type of EDS units
  - type and quantity of infeed conveyor systems such as ticket counter sub-systems, curbside sub-systems, mainlines, etc.
  - type and quantity of outfeed conveyor systems such as mainlines to sort piers, make-up units, etc.
- Description of the conveyors / sub-systems and their controller equipment. At a minimum, the following information shall be provided:
  - List of each PLC and the conveyors / sub-systems it controls
  - List of each MCP and the conveyors / sub-systems it controls
- Contact information for:
  - Airport director, engineering manager or other primary contact point responsible for this CBIS
  - Airline(s) primary contact for this CBIS
  - Operation and/or maintenance contractor (if applicable) primary point of contact
  - Point of contact responsible for follow-up submittals

2.2.7.2.3 Index

An index of the documents included in the submittal shall be included. This index shall be submitted in Microsoft Excel and PDF format. The index shall include, at a minimum, the title of each file, the file date and the electronic file name.

2.2.7.2.4 Control System Architecture Drawing

A control system architecture drawing shall be summated for each CBIS. This drawing shall be submitted in DXF and PDF format. All high and low level networks shall be included. Detail shall be down to the motor control panel or PLC chassis level for high level networks; photoelectric cell (PEC) and/or device for low level networks. Configuration information such as node numbers and IP addresses shall be included. Multiple drawings by different network types will be acceptable provided a high level overall drawing is provided. This information may be segregated by airport, terminal, matrix or other functional level to correspond with individual projects.

2.2.7.2.5 PLC Code and Associated Configuration Information

The low level, or PLC control, submission shall include the following at a minimum.

- **PLC Program:** A copy of the PLC program shall be submitted in its native format for all PLCs included as a part of the CBIS. In the event multiple levels of PLCs are utilized all programs are to be included. This shall include any redundant PLCs that may exist. All software keys and or passwords shall be provided if programs are protected and or locked in some way.
- **Network Configuration:** A copy of all network configuration files shall be submitted in its native format. This shall include any redundant networks that may exist.
- **Variable Frequency Drive (VFD) Configuration:** A copy of the configuration of each VFD (including any firmware information) in the CBIS shall be submitted in its native format. The configuration submittal shall include all parameters including unchanged or default settings.
- **Communication and Other Controllers:** A copy of the configuration and/or code for all other devices as a part of the control system shall be submitted in its native format. An example of these devices might be co-processors or multi-vendor interfaces.
- **Firmware Configuration:** A spreadsheet listing all control devices and their associated firmware levels, where firmware is used, shall be submitted. This spreadsheet shall be submitted as both a Microsoft Excel document and as a PDF file. All devices which have firmware shall be included. Examples of these devices are PLC chassis, PLCs, I/O modules, Network modules, Communication modules and VFDs.

2.2.7.2.6 HMI Configuration

A copy of all HMI configurations shall be submitted in their native format. Examples of these HMIs are control room graphical display systems, operator interface panels, bag display monitors or any other computer or dedicated display modules. Refer to Section 2.2.7.4 for configuration software requirements.

Soft copies of these programs shall also be proved including any portion which is required to operate the system. This includes applications such as those residing in touch screens or other types of dedicated displays or interfaces.

2.2.7.3 High Level Computer Configuration

A descriptive narrative of the high level computer equipment of the CBIS shall be submitted in Microsoft Word and PDF format. Included in the narrative shall be a description of each computer and the function/task of the computer. Any data exchange between any computer and/or PLC that controls or affects bag decisions shall be included. In addition, the narrative shall describe the results of any computer failure and the ability of the CBIS to continue screening baggage.

2.2.7.4 Programming and Configuration Software

A spreadsheet listing all programming and configuration software with the revision level used shall be submitted. This spreadsheet shall be submitted as both a Microsoft Excel document and as a PDF file. Examples of this software are PLC programming software, network configuration software, HMI configuration software and multi-vendor interface programming / configuration software.

2.2.7.5 CBIS/ISAT Benchmark Data

A descriptive summary narrative of the system status at time of submittal shall be included in Microsoft Word and PDF format. This summary shall include, at a minimum, the following information:

- Scan time for each PLC, average and maximum
- Memory utilization for each PLC
- Network utilization for each network, high and low level networks. Where deterministic networks with set update times are used provide all settings and times.

2.2.7.6 Electronic File Naming Convention

The electronic file names shall conform to the following convention:

ABC_XXXX_LOCATION_MMDDYYYY_TYPE_DESCRIPTION.EXT

Where:

- ABC is the FAA airport identifier
- XXXX is the International Air Transport Association (IATA) airport identifier
- LOCATION is a unique description of the project location such as T1, NODE1, etc.
- MMDDYYYY is the file date represented as month, day, and year utilizing leading zeroes where applicable
- TYPE is the file type as follows:
  - NARR is a narrative
  - PLC is a PLC program
  - NET is a network configuration
  - DWG is a drawing
  - VFD is a VFD configuration
  - IDX is an index
  - HMI is an HMI configuration
  - LIST is a spreadsheet list
  - FIRM is a firmware listing
- DESCRIPTION is a free text field to describe the file contents
- EXT is the file extension

2.2.7.7 Change Summary Log

A log of all changes made to the CBIS post-ISAT shall be maintained. The log shall be an itemized list of all the implemented and pending changes to date. This log shall be included in all submittals after its creation. The log shall include the following data at a minimum:

- CBIS designation
- Name of Change

- Description of change
- Status of change (i.e., in testing, operational, pending, etc.)
- Date of TSA approval
- Date of live operational use

CHAPTER 3:

SCREENING PROCESS AND CBIS TYPES

REQUIREMENTS TABLE

Section	Requirement
3 Screening Process and CBIS Types	When TSA funds the design and construction of a CBIS project, the project sponsor shall design their CBIS for incorporation of TSA qualified EDS unit(s). In the event that the airport is funding both the design and construction of a project, the airport may assume the costs and schedule risks of designing for a TSA Certified EDS unit, with the understanding that only TSA qualified EDS units provided by TSA may be employed once the project is ready for EDS deployment and integration.
3.1.4 CBIS Nomenclature Standardization	The following nomenclatures shall be used by CBIS designers: • Mainline Feeds: SF (Security Feed) • Shunt: SS (Security Shunt) • Out-of-Gauge: OOG • OSR Line: OSR • Clear Line: CL • Alarm Line: AL • Re-Insert Line: RL • Oversize: OS • Crossovers: XO
3.2.1.1 In-Line CBIS	The CBIS shall be designed to allow EDS listed in Table 3-1 to achieve the 95% Throughput indicated.
3.2.2.2 Stand-Alone EDS Systems	Stand-alone EDS layout designs shall ensure TSA personnel do not handle baggage more than 8-feet from the entrance or exit of the baggage screening location footprint (as validated by the local FSD) for the purposes of picking up a bag for screening or returning a screened bag to the aircraft operator, as referenced in the TSA's Checked Baggage SOP.
Table 3-1	Throughput for Individual Carrier Systems (ICS) shall be calculated based upon the carrier size and the EDS manufacturers minimum spacing requirements.
Table 3-1, Table 3-3, Table 3-4, Figure 3-7, Figure 3-8, Figure 3-15, Figure 3-16, Figure 3-17	New CBIS design shall not include legacy units.
Figure 3-5, Figure 3-6, Figure 3-7, Figure 3-8, Figure 3-14, Figure 3-15, Figure 3-16, Figure 3-17, Figure 3-19, Figure 3-20, Figure 3-21	The Project Sponsor shall coordinate with the TSA Project Coordinator for any needed SSI information and to make a final determination on the conveyable bag dimensions.

3.1 Introduction to the Checked Baggage Screening Process

As previously indicated in Chapter 1, the goal of the PGDS is to assist designers in developing several CBIS alternatives and identifying preferred CBIS solutions for specific airports.

Every terminal at every airport is unique, with a particular set of zones and specific demand levels. As such, all approved CBIS types should be considered to find the optimal CBIS solution for each terminal. Many factors should be considered when selecting a specific system configuration—such as the airport or terminal zone scheme, demand levels for the various zones, and the capital, operating, and maintenance costs associated with each alternative for each zone—to determine the most cost-effective solution that is optimally-scaled for that airport or terminal. The methodology for developing alternatives, comparing them, and selecting the preferred alternative is discussed in Chapter 4.

Planners and designers should consider various alternative solutions during the early design process. CBIS designs use two types of EDS for primary screening:

- EDS Type I:
  - Intended use case: Integration of two or more EDS units with the same baggage conveyance system and providing resource balancing across the EDS units and shared network assets
  - Type I EDS units screen bags at a rate no less than 400 bags per hour (bph)
- EDS Type II:
  - Intended use case: Screening with one EDS unit and dedicated assets
  - Type II EDS units screen bags at a rate no less than 150 bph when operated in accordance with approved staffing levels

A CBIS with very low throughput may be designed to accomplish primary screening using only ETDs (ETD CBIS). Qualified ETD equipment is listed in Table 3-3

Within each CBIS type, several acceptable screening equipment models may be available, with similar throughput rates, false alarm rates, and OSR rates. When TSA funds the design and construction of a CBIS project, the project sponsor shall design their CBIS for incorporation of TSA qualified EDS unit(s). In the event that the airport is funding both the design and construction of a project, the airport may assume the costs and schedule risks of designing for a TSA Certified EDS unit, with the understanding that only TSA qualified EDS units provided by TSA may be employed once the project is ready for EDS deployment and integration. Appendix B provides examples of generic concepts of baggage screening systems, operational assumptions for the generic baggage screening concepts, and best practices captured in these generic concepts.

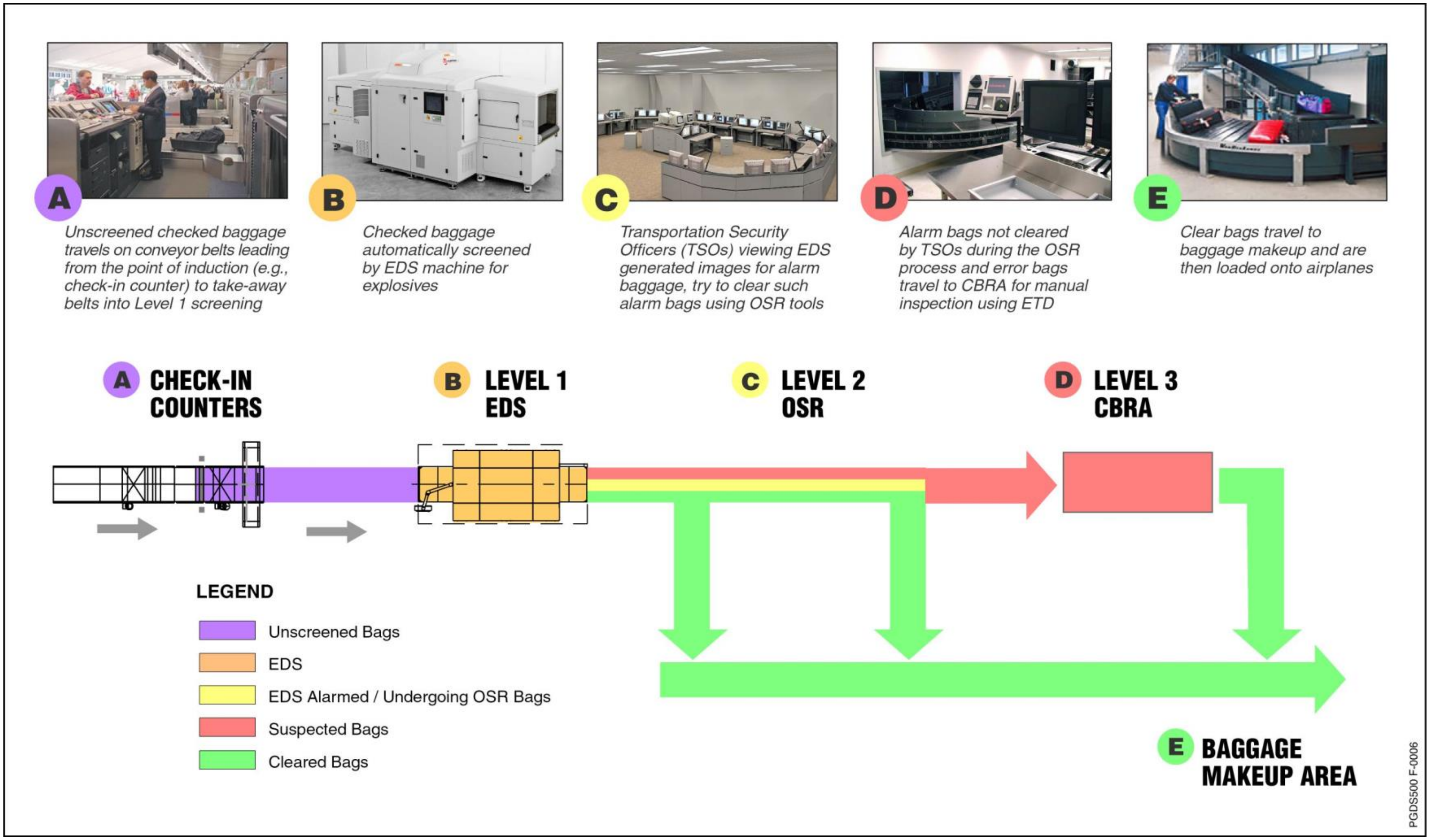
This chapter provides information about CBIS types and their associated concepts of operation, as well as currently available and future screening equipment that can be used in the various system types.

3.1.1 Checked Baggage Screening Levels

The TSA utilizes a multi-level screening process to inspect checked baggage. With the exception of ETD-only screening, this screening process is applicable to all CBIS types discussed later in this chapter.

In an in-line CBIS, screening operations are integrated with the outbound baggage handling system, as shown in Figure 3-1.

Figure 3-1: Generic In-Line Checked Baggage Inspection System



3.1.1.1 Level 1 – EDS

Passenger baggage that is checked in at the airlines ticket counters, kiosk or curbside is transported to a CBIS via conveyor systems for inspection. Once at the EDS, bag data is collected and an image is generated. The EDS unit screens the bag and each bag exiting the EDS unit receives a Level 1 security status of Clear or of Non-Clear. Clear bags are diverted to the make-up area at the first-decision point, while Non-Clear bags continue onto the OSR line.

3.1.1.2 Level 2 – On-Screen Resolution

Images of Non-Clear bags are sent to a PVS for further inspection by a TSO and are assigned a Level 2 security screening status of Clear or of Non-Clear. Clear bags are diverted to the make-up area at the second-decision point, while Non-Clear bags continue on to the CBRA line.

The Level 2 screening typically takes place concurrently with baggage conveyance. BHS configurations typically allow for 45 seconds of travel time for each bag between the exit of the EDS unit and the second decision point. If a Level 2 disposition isn't available before the bag reaches the second decision point, the bag is automatically deemed Non-Clear, and continues onto the CBRA line.

3.1.1.3 Level 3 – Checked Baggage Resolution Area

Bags traveling on the CBRA line are sent to a dedicated area for manual inspection. These Non-Clear bags are sent to individual BISs equipped with a SVS where TSOs conduct a directed search. A directed search utilizes the image generated at Level 1 and the individual dispositions from Level 2, to aid the TSO to target the objects of concern. Once all objects have been inspected and cleared, a Level 3 security status of Clear is assigned, the bag is transferred to the Clear Line and sent to the make-up area.

Bags that do not receive a Level 3 security status of Clear are considered Alarmed and must be processed by the Law Enforcement Officers (LEOs).

The following sections further describe key elements of an in-line CBIS.

3.1.2 Conveyor Inputs

Checked bags typically originate at induction belts located on the public side of the terminal, which deliver bags from ticket counters and curbside check-in facilities to the baggage screening zone. In addition, the baggage screening zone may be served by input points for international or interline recheck baggage.

Depending on the specific CBIS design, bags typically travel along the mainline conveyors to the screening zone (optionally, bags can travel over several types of load-balancing devices prior to arriving at the screening zone).

- Pre-EDS mainlines are conveyor lines where input lines are merged to create a main delivery conveyor line that delivers baggage for diversion to individual EDS lines.
- Post-EDS mainlines are conveyor lines where all EDS Clear Lines, which includes Level 1, Level 2, and Level 3 cleared baggage, are merged for transport to the make-up area.

- EDS lines are the conveyors that transport baggage from diversion off of the mainline through the EDS unit to diversion onto either the Clear Line or the OSR line (they are also often referred to as spurs, shunts, or subsystems).

A BMA is typically used to identify bags that are too large to fit into the EDS (defined as OOG bags) for downstream diversion to a separate conveyor that transfers the bags directly to Level 3 screening at the CBRA (also known as Baggage Inspection Room) to be screened manually using ETD equipment.

Positive tracking must be maintained within the Security Tracking Zone (STZ) of the CBIS as stated in the requirement in Chapter 7. This zone starts at the point at which the BHS acquires positive tracking of a bag prior to the EDS (normally at a BMA, an ATR, or a Photocell where the BHS Tracking ID is assigned). The STZ extends to the diversion(s) to a Clear Line and to the BRPs in the CBRA.

3.1.3 EDS Multiplexed Network

In-line CBISs should always be networked. TSA typically deploys fully-integrated EDS in a Multiplex Network configuration for a CBIS size of three EDS or more. This configuration allows one or more EDS to communicate with two or more network elements such a PVS for OSR, a SVS in CBRA, a network master control station (MCS), or a printer. A typical Multiplex Network consists of servers, racks, switches, cables, UPS, EDS components, and various other hardware and software components that are required to establish the Multiplex Network configuration.

The EDS Multiplexed Network capabilities are critical to successful fully-integrated EDS operations and are verified prior to ISAT of a given CBIS. A Multiplex Network transmits bag images and threat data from an EDS unit to one of several PVS units for Level 2 resolution and to one of several SVSs for Level 3 resolution. In contrast, in a non-multiplexed system, an EDS is associated with a specific PVS and SVS. Other EDS Multiplexed Network capabilities include, but are not limited to, server redundancy, network size scalability, utilization of TCP/IP, network fault monitoring, management of network configurations and settings, user database management, image archive and recall features, and access to FDRS data.

The following list represents the potential EDS Multiplex Network configuration options for a given fully-integrated and networked CBIS requirement. Figure 3-2 shows a comparison of each type based on various factors.

Figure 3-2: Networking Type Comparison

FACTOR	NETWORK OPTIONS			
	1 - Dedicated	2 - Split	3 - Consolidated	4 - Remote
Staffing per EDS	Baseline	↑	↓	↓
EDS Network Hardware Requirements per EDS	Baseline	↑	Baseline	↑
Network Infrastructure Requirements per EDS	Baseline	↑	↓	↑
Operational Redundancy	Baseline	Baseline	↓	Baseline
Pro	Separate operations for all zones	Separate operations, CBIS phasing, network reliability	Staffing savings per EDS, less hardware, network size scalability	Ideal for limited cargo applications, reduced network infrastructure
Con	Increased staffing and dedicated infrastructure requirements	Increased staffing and dedicated infrastructure requirements	Redundant network fail-over fault	Dedicated network hardware

- **Dedicated OSR Area (or Room)** – Applies to new in-line, recapitalization, and/or existing multiple CBIS zone requirements where each screening zone is supported with a dedicated multiplexed network server physically located in separated OSR rooms.
- **Split OSR Area (or Room)** – Applies to CBIS expansions, recapitalization, and/or EDS upgrade requirements where two separate networks are co-located together in the same physical OSR area (or room). This configuration will require dedicated network servers and MCS for each screening zone co-located within the OSR area (or room).

- **Consolidated OSR Area (or Room)** – Applies to CBIS expansions, recapitalization, and/or EDS upgrade requirements where two or more dedicated OSR areas are networked together. This configuration may require EDS component upgrades and requires a split OSR area (or room) initially while the existing OSR network elements are transitioned to the new network.
- **Remote Network** – Applies to CBIS expansions and/or multiple CBIS zone requirements where a subset of EDS units are physically located remotely from the primary CBIS screening zone but share OSR and/or CBRA functions with the primary CBIS. This configuration will utilize a remote server and switch to plug into the existing network in order to minimize network cabling requirements and may optionally utilize a dedicated MCS.

3.1.4 CBIS Nomenclature Standardization

Whenever feasible, all lines should be given a standard, two-letter designation. The two-letter designation can be followed by the line or belt number.

The following nomenclatures shall be used by CBIS designers:

- Mainline Feeds: SF (Security Feed)
- Shunt: SS (Security Shunt)
- Out-of-Gauge: OOG
- OSR Line: OSR
- Clear Line: CL
- Alarm Line: AL
- Re-Insert Line: RL
- Oversize: OS
- Crossovers: XO

3.2 CBIS Configurations

Four CBIS configurations are described below. Alarm rates and resolution rates for the units listed are SSI and denoted as such. Environmental restrictions for all units include non-condensing (NC) levels of humidity.

The tables at the beginning of each CBIS type subsection summarize the candidate screening equipment and throughput ranges for this screening equipment.

3.2.1 CBIS Using Type I EDS

3.2.1.1 In-Line CBIS

In-line systems are assumed to have a very high level of integration and a sophisticated in-line conveyor infrastructure, providing sufficient queuing capacity and OSR circulation time while maintaining high throughput and accurate bag tracking. These systems are assumed to have multiplexed EDS technology (i.e., the capability of linking multiple EDS units with multiple viewing stations), centralized control room(s), OSR capability, multiple baggage inputs, and CBRAs. Typically, these systems require automated baggage sortation. Type I EDS units used in this CBIS type are intended to provide solutions for airports that require fully automated in-line systems designed to handle very high peak baggage screening demand.

The In-Line CBIS shall be designed to allow EDS listed in Table 3-1 to achieve the 95% Throughput indicated.

Table 3-1: Type I EDS

Classification	Product	False Alarm Rate[1]	OSR Clear Rate[2]	Average OSR Time (sec)	Belt Speed (feet/ minute)[3]	Idealized Throughput (28" bag with 12" spacing)[4]	95% Throughput (bags/hour)[5]	Current Status
EDS-CP	L-3 eXaminer 3DX 6700	SSI	SSI	20	30	532	505	Qualified (EDS-CP)[7]
EDS-CP	L-3 eXaminer 3DX 6700 ES	SSI	SSI	20	40	709	674	Qualified (EDS-CP)[7]
EDS-CP	MD CTX-9800 DSi	SSI	SSI	20	40	709	674	Qualified (EDS-CP)[7]
Legacy	L-3 eXaminer 3DX 6600	SSI	SSI	20	30	532	505	Qualified (Legacy)[8]
Legacy	L-3 eXaminer 3DX 6600 ES	SSI	SSI	20	40	709	674	Qualified (Legacy)[8]
Legacy	MD CTX-9400 DSi	SSI	SSI	20	N/A[6]	458	435	Qualified (Legacy)[8]

Notes

New CBIS design shall not include legacy units.

Throughput for Individual Carrier Systems (ICS) shall be calculated based upon the carrier size and the EDS manufacturers minimum spacing requirements.

1. False Alarm Rate can vary from airport to airport so each project sponsor should contact their TSA Project Coordinator for airport specific alarm rate data.
2. OSR Clear Rate based on values used for TSA staffing and intended to be used as a national average. Airport specific data may be available from the TSA Project Coordinator.
3. Belt Speed converted to English standard from metric units (meter/second) and rounded.
4. Idealized Throughput calculation based on converting metric unit belt speed to English standard and using 28" long bags with 12" spacing between each one.
5. 95% value predicated on assumption that not all bags will be perfectly aligned when presented to the EDS units. This is influenced by several factors as part of the intrinsic design of the CBIS such as merging conveyors, diverting operations, inclines/declines, conveyor speed changes, etc. CBIS screening throughput capacity requirements are presented in Section 7.2.2.
6. All L-3 units: Continuous baggage flow, three separate belts with gradually increasing belt speeds
   MD CTX-9800 DSi: Continuous baggage flow, single belt with constant belt speed
   MD CTX-9400 DSi: Intermittent baggage flow, three separate belts with belt speeds dependent upon BHS interface requirements

7. "Qualified (EDS-CP)" is defined as those systems that have successfully completed detection Certification, TSIF Evaluation, and Operational Test and Evaluation against EDS-CP requirements and may be available for procurement by TSA. Project sponsors should ask their TSA Project Coordinator to confirm availability of specific models with TSA's Checked Baggage Technology Division.
8. "Qualified (Legacy)" is defined as those systems that have successfully completed detection Certification and some level of Operational Test & Evaluations to pre-EDS-CP requirements. Legacy EDS units may be available to be redeployed by TSA from existing sites and storage. No new procurement of these EDS units is currently planned.

The information included in this table is current as of the publication date of this document. If you would like to obtain the most up to date information on qualified EDS please reach out to PGDS@tsa.dhs.gov

Figure 3-3 shows a schematic visualization of an In-line CBIS with Type I EDS.

Figure 3-3: Schematic Visualization of an In-Line CBIS Using Type I EDS

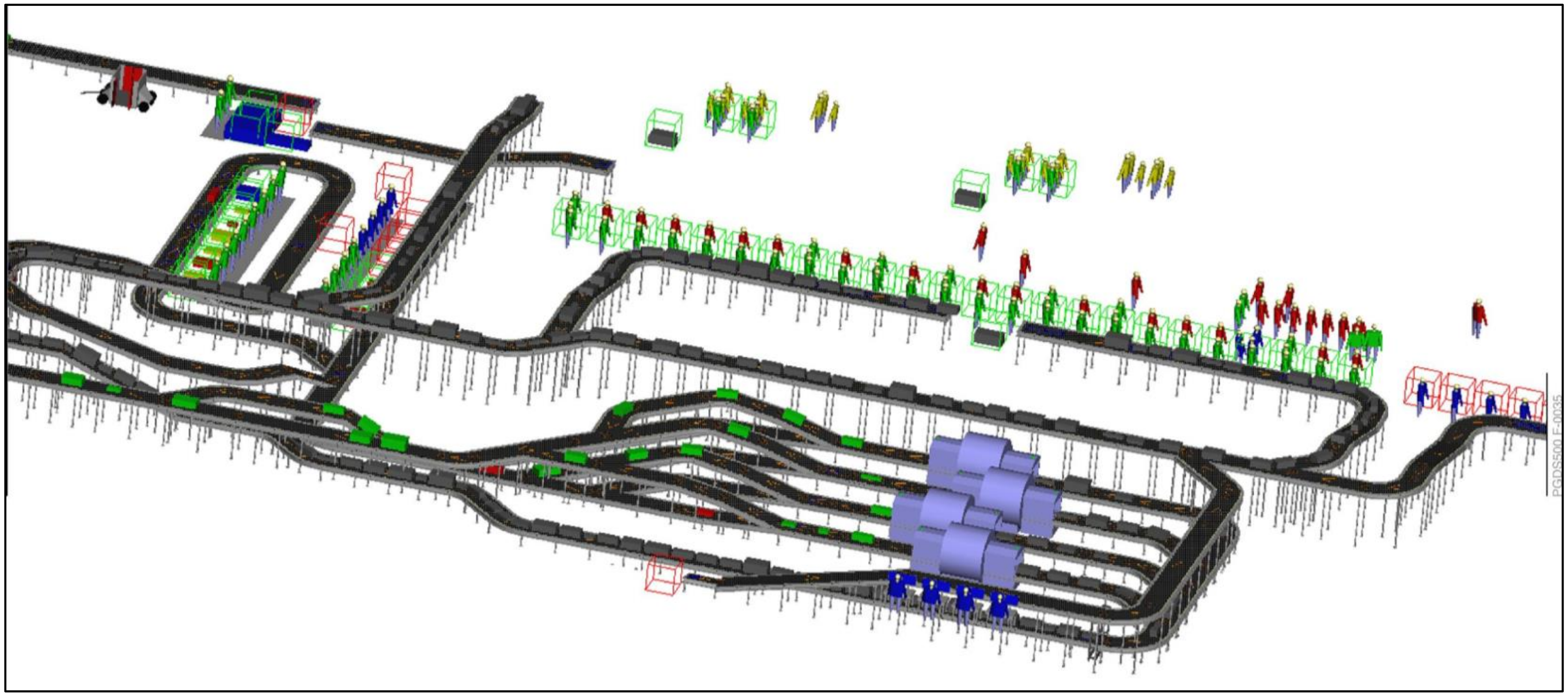
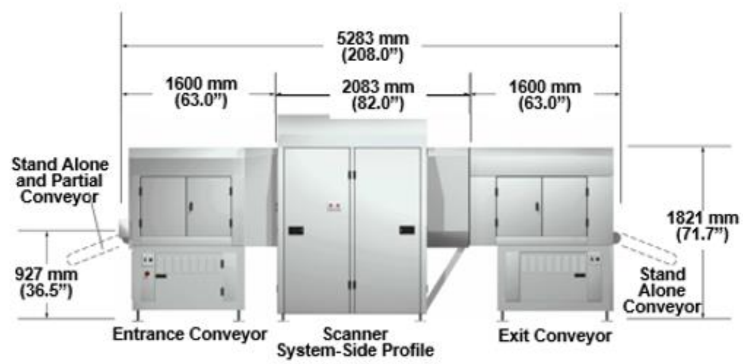
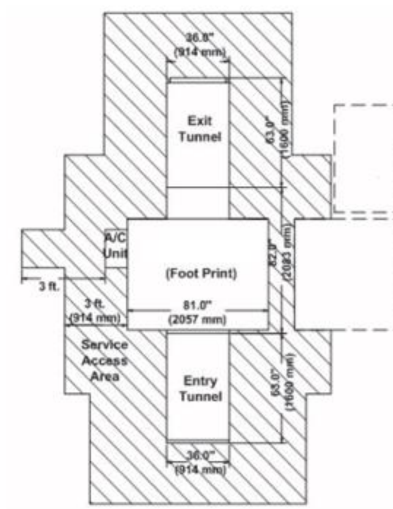


Figure 3-4 through Figure 3-7 provide graphical representations and summarize equipment assumptions for current qualified Type I EDS units.

Figure 3-4: L-3 eXaminer 3DX 6700 and eXaminer 3DX 6700 ES
Applicable System Type: In-line

SPECIFICATIONS	
False alarm rate	SSI
OSR clear rate	SSI
Average OSR time (sec)	20
Environmental operating envelope	Temp. 32-104°F/Humid. 10-85% NC
Weight (lb)	8,800
Floor loading (lb/sq ft)	158
Max bag size (L_1/L_2 x W x H inch)	100/65 x 31 x 24.5
Current status	Qualified (EDS-CP)[1]



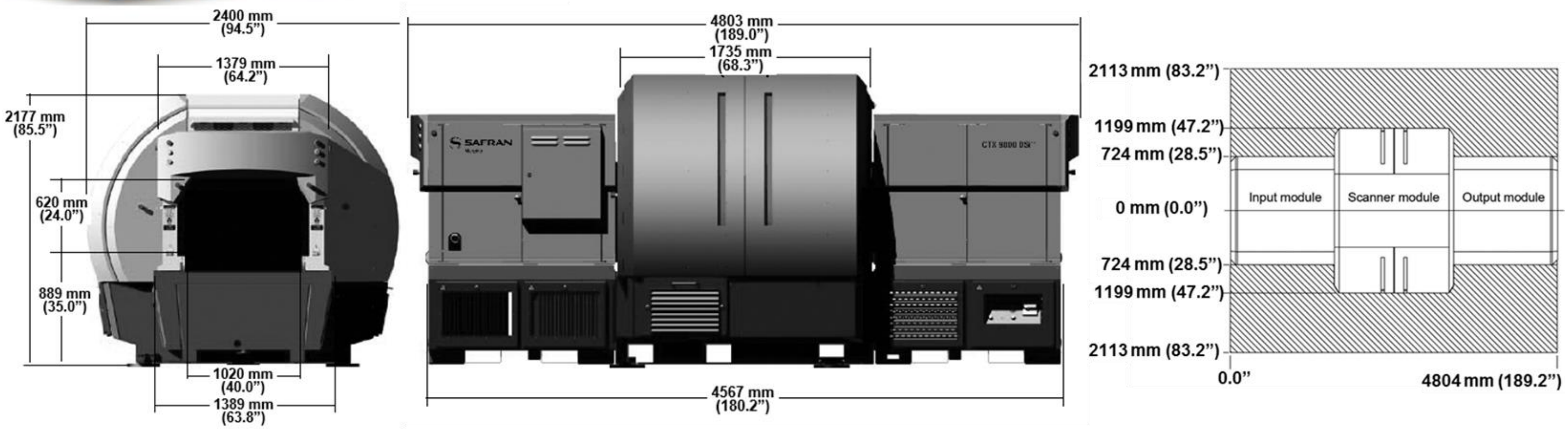


Notes:
The Project Sponsor shall coordinate with the TSA Project Coordinator for any needed SSI information and to make a final determination on the conveyable bag dimensions.
L_1 = Maximum bag length unit can scan (see Section 3.3.2).
L_2 = Standard bag length unit can scan (see Section 3.3.2).
1 = "Qualified (EDS-CP)" is defined as those systems that have successfully completed detection Certification, TSIF Evaluation, and Operational Test and Evaluation against EDS-CP requirements and are available for procurement by TSA.

Figure 3-5: MD CTX 9800 DSi (SEIO)

Applicable System Type: In-line

SPECIFICATIONS	
False alarm rate	SSI
OSR clear rate	SSI
Average OSR time (sec)	20
Environmental operating envelope	Temp. 19-120°F/Humid. 10-95% NC
Weight (lb)	15,700
Floor loading (lb/sq ft)	425
Max bag size (L x W x H inch)	98.4 x 39 x 23.6[1]
Current status	Qualified (EDS-CP)[2]



Notes:

<u>The Project Sponsor shall coordinate with the TSA Project Coordinator for any needed SSI information and to make a final determination on the conveyable bag dimensions.</u>

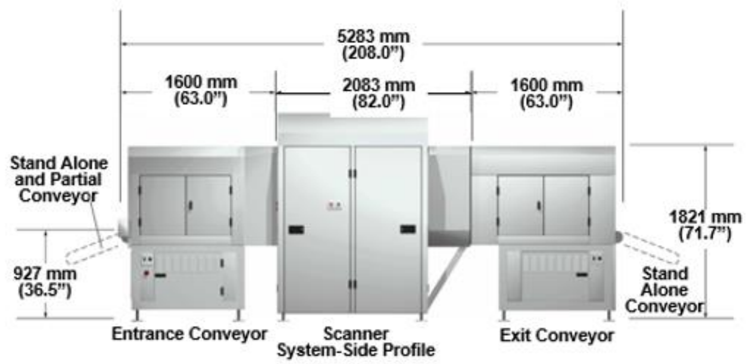
1 = Due to the concave opening of the unit, the maximum height will drop with increasing bag width.

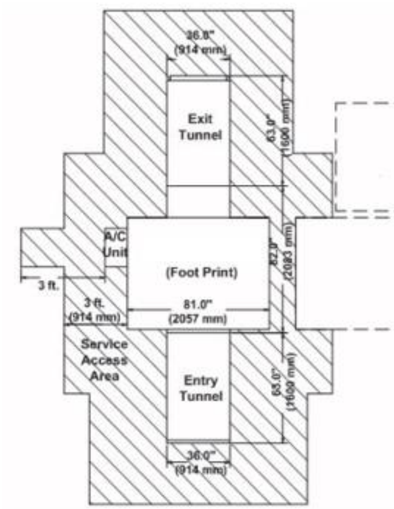
2 = "Qualified (EDS-CP)" is defined as those systems that have successfully completed detection Certification, TSIF Evaluation, and Operational Test and Evaluation against EDS-CP requirements and are available for procurement by TSA.

Figure 3-6: L-3 eXaminer 3DX 6600 and eXaminer 3DX 6600 ES

Applicable System Type: In-line

SPECIFICATIONS	
False alarm rate	SSI
OSR clear rate	SSI
Average OSR time (sec)	20
Environmental operating envelope	Temp. 32-104°F/Humid. 10-85% NC
Weight (lb)	8,800
Floor loading (lb/sq ft)	158
Max bag size (L_1/L_2 x W x H inch)	100/65 x 31 x 24.5
Current status	Qualified (Legacy)[1]





Notes:

The Project Sponsor shall coordinate with the TSA Project Coordinator for any needed SSI information and to make a final determination on the conveyable bag dimensions. New CBIS shall not be designed with legacy units.

L_1 = Maximum bag length unit can scan (see Section 3.3.2).

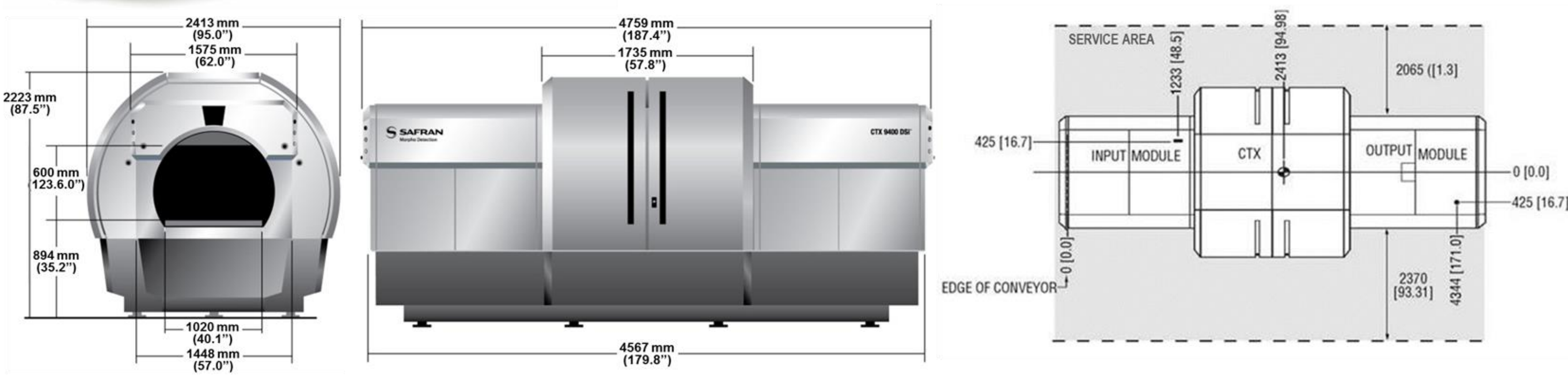
L_2 = Standard bag length unit can scan (see Section 3.3.2).

1 = "Qualified (Legacy)" is defined as those systems that have successfully completed detection certification and some level of Operational Test & Evaluations to pre-EDS-CP requirements. Legacy EDS units may be available to be redeployed by TSA from existing sites and storage. No new procurement of these EDS units is currently planned.

Figure 3-7: MD CTX 9400 DSi

Applicable System Type: In-line

SPECIFICATIONS	
False alarm rate	SSI
OSR clear rate	SSI
Average OSR time (sec)	20
Environmental operating envelope	Temp. 15-120°F/Humid. 10-85% NC
Weight (lb)	17,000
Floor loading (lb/sq ft)	488
Max bag size (L x W x H inch)	55 x 40 x 24[1]
Current status	Qualified (Legacy)[2]



Notes:

The Project Sponsor shall coordinate with the TSA Project Coordinator for any needed SSI information and to make a final determination on the conveyable bag dimensions. New CBIS shall not be designed with legacy units.

1 = Due to the concave opening of the unit, the maximum height will drop with increasing bag width.

2 = "Qualified (Legacy)" is defined as those systems that have successfully completed detection Certification and some level of Operational Test & Evaluations to pre-EDS-CP requirements. Legacy EDS units may be available to be redeployed by TSA from existing sites and storage. No new procurement of these EDS units is currently planned.

3.2.2 CBIS Using Type II EDS

Type II EDS are designed for situations with lower throughput than those using Type I EDS systems. The two CBIS configurations that use Type II EDS are mini in-line and stand-alone.

3.2.2.1 Mini In-Line CBIS

A cost-effective solution for airports or bag zones with low bag screening throughput needs is a mini in-line design. This CBIS type provides fully automated operations at a fraction of the cost when compared to an in-line system. Other advantages include reduced space requirements, capital and operational costs, and construction time.

It is important to understand that mini in-line designs are tailored to the site-specific needs, demographics, and operations, resulting in unique configurations for every design.

Due to the smaller footprint, the system's ability to queue bags is minimized. As a result, system diebacks are expected to occur for short periods of time, but can be minimized with proper analysis and bag flow control.

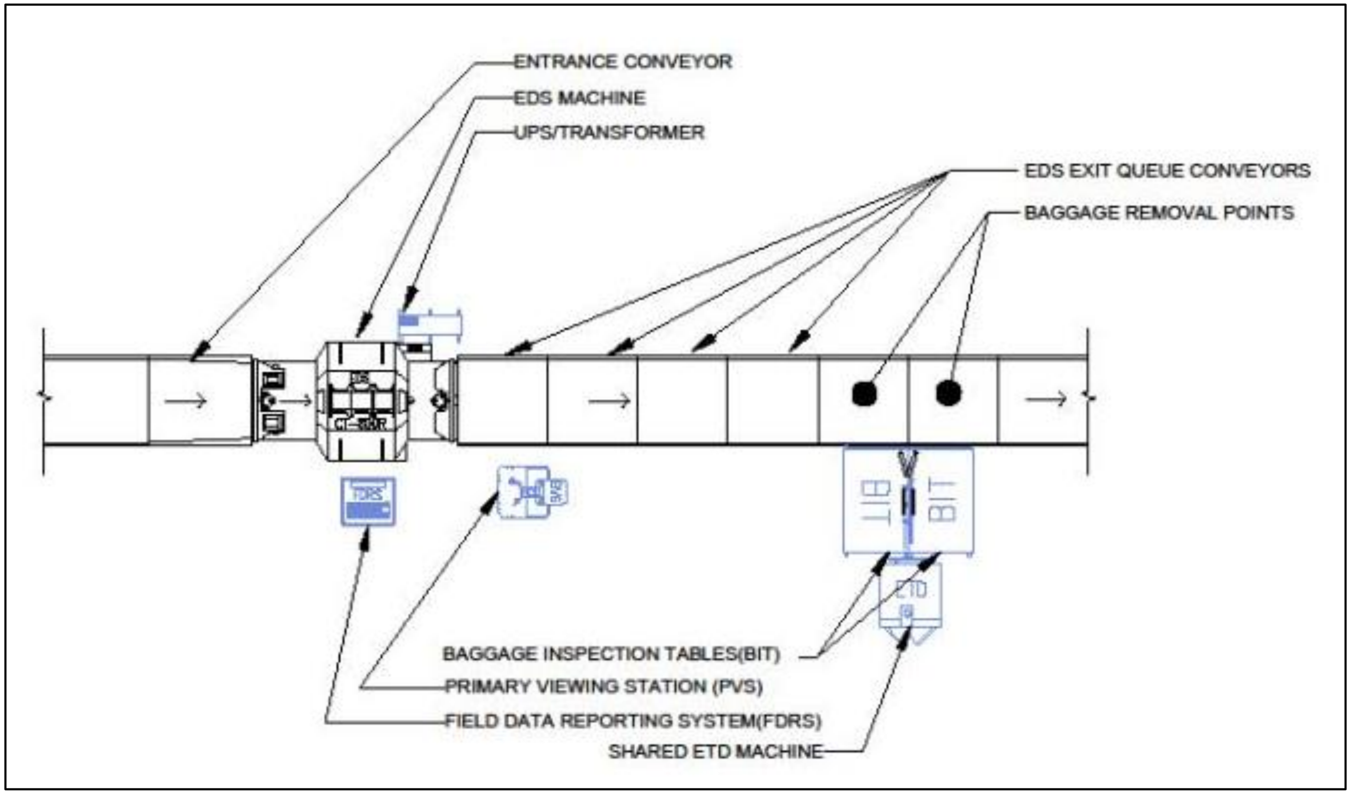
A mini in-line design is defined by the following criteria:

- Single Type II EDS configuration
- Throughput less than 180 bph
- No redundant EDS

Contingency alternatives will be considered on a case by case basis and must be discussed with the TSA. Most airports have multiple mini in-line systems located nearby to each other that may serve as a redundant system in the event of an EDS or BHS failure. If other nearby systems aren't available, the TSA will analyze the baggage profile (how often does the peak occur and for how long) to determine other viable and cost-effective alternatives to ensure that operations continue during any system failures (additional ETDs, inspection stations, etc.)

Figure 3-8 shows an example of a mini in-line solution.

Figure 3-8: Example Mini In-Line Configuration



3.2.2.2 Stand-Alone EDS

In small airports or in specific zones with low baggage volumes at larger airports, stand-alone EDS may be the most cost-effective option. Qualified Type II EDS for stand-alone configurations are listed in Table 3-2.

Table 3-2: Type II EDS for Stand-Alone CBIS Configuration

Classification	Models	False Alarm Rate[1]	OSR Clear Rate[2]	Average OSR Time (sec)	Throughput (bags/hour)[3]	Current Status
EDS-CP	Reveal CT-80DR+	SSI	SSI	30	177	Qualified (EDS-CP)[4]
Legacy	MD CTX 5500 DS	SSI	SSI	30	231	Qualified (Legacy)[5]
Legacy	Reveal CT-80DR	SSI	SSI	30	230	Qualified (Legacy)[5]
Legacy	Reveal CT-80DRXL	SSI	SSI	30	187	Qualified (Legacy)[5]

Notes
New CBIS shall not be designed with legacy units.

1. False Alarm Rate based on System Evaluation Report (SER) and/or FDRS data from fielded systems and intended to be used as a national average. Airport specific data may be available from the TSA Project Coordinator.
2. OSR Clear Rate based on values used for TSA staffing and intended to be used as a national average. Airport specific data may be available from the TSA Project Coordinator.
3. Throughput value based on operational data analyzed from FDRS reports of fielded equipment.
4. "Qualified (EDS-CP)" is defined as those systems that have successfully completed detection Certification, TSIF Evaluation, and Operational Test and Evaluation against EDS-CP requirements and may be available for procurement by TSA. Project sponsors should ask their TSA Project Coordinator to confirm availability of specific models with TSA's Checked Baggage Technology Division.
5. "Qualified (Legacy)" is defined as those systems that have successfully completed detection Certification and some level of Operational Test & Evaluations to pre-EDS-CP requirements. Legacy EDS units may be available to be redeployed by TSA from existing sites and storage. No new procurement of these EDS units is currently planned.

The information included in this table is current as of the publication date of this document. If you would like to obtain the most up to date information on qualified EDS please reach out to PGDS@tsa.dhs.gov.

As shown in Figure 3-9 and Figure 3-10, a stand-alone EDS operates in a manner similar to lobby screening nodes installed today at many Category X and Category I airports; however, stand-alone equipment should be installed in baggage makeup areas or other appropriate locations to reduce lobby congestion where possible. This CBIS type is relatively labor intensive, but minimal capital investment is required to install the system and support the operation. Note that no redundant stand-alone units will be provided by TSA.

Figure 3-9: Schematic Visualization of a MD CTX 5500 Stand-Alone EDS

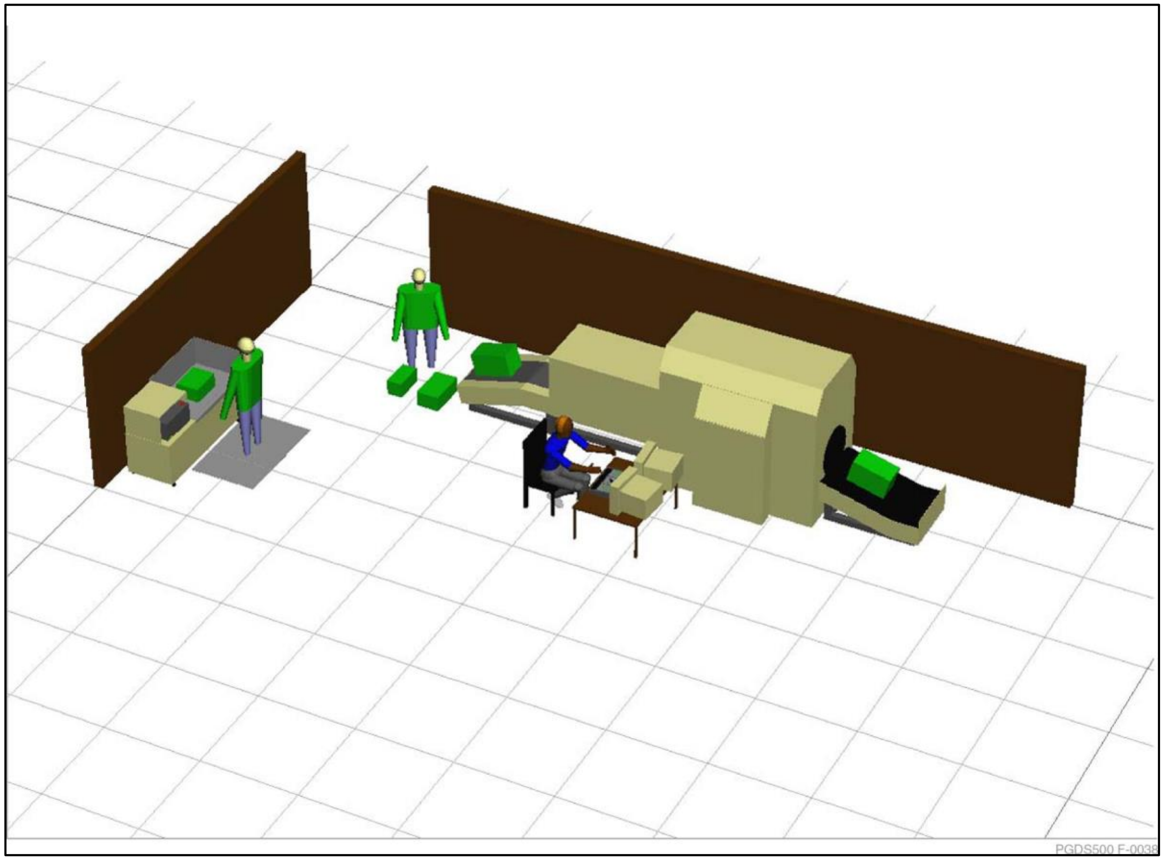
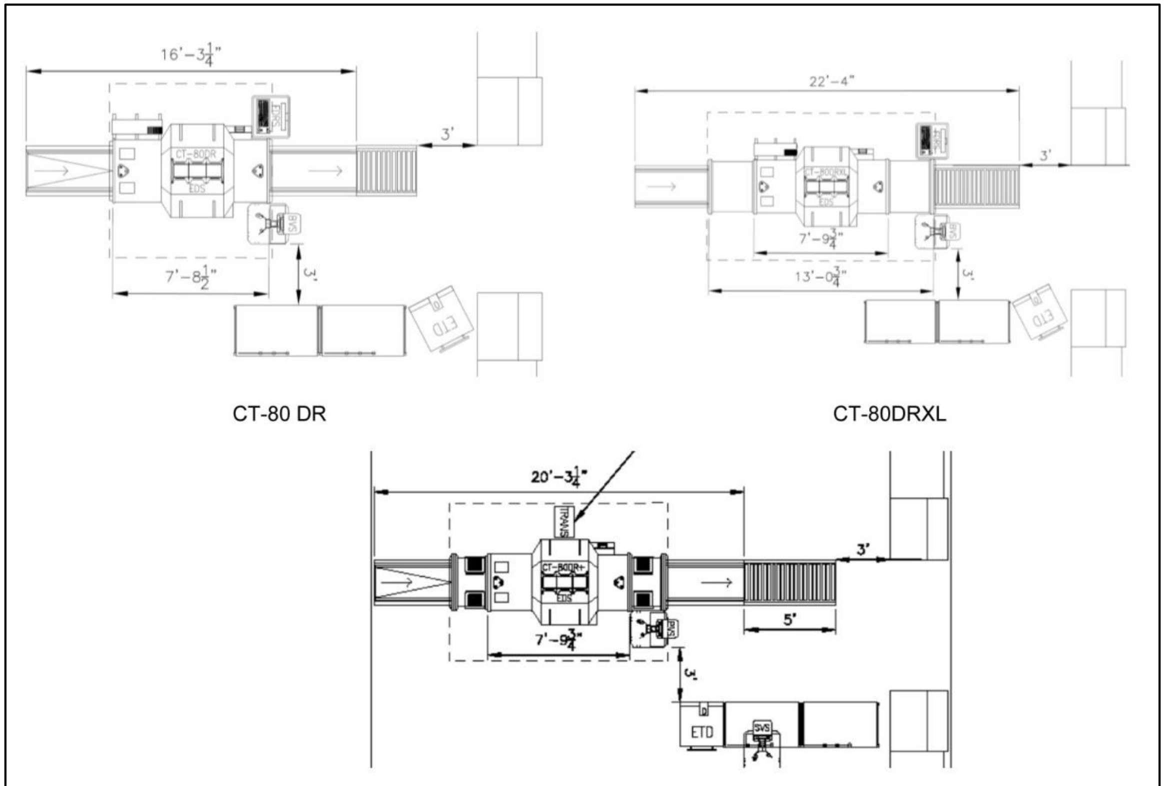


Figure 3-10: Schematic Visualization of Reveal Stand-Alone EDS Configurations



<u>Stand-alone EDS layout designs shall ensure TSA personnel do not handle baggage more than 8 feet from the entrance or exit of the baggage screening location footprint (as validated by the local FSD) for the purposes of picking up a bag for screening or returning a screened bag to the aircraft operator, as referenced in the TSA's Checked Baggage SOP.</u>

A stand-alone system option would significantly reduce up-front capital costs by using currently available EDS units with throughputs of at least 100 bags per hour in locations where no economic justification exists to design and implement an in-line system. Typical screening capacities range from 100 to 230 bph for stand-alone EDS CBIS types.

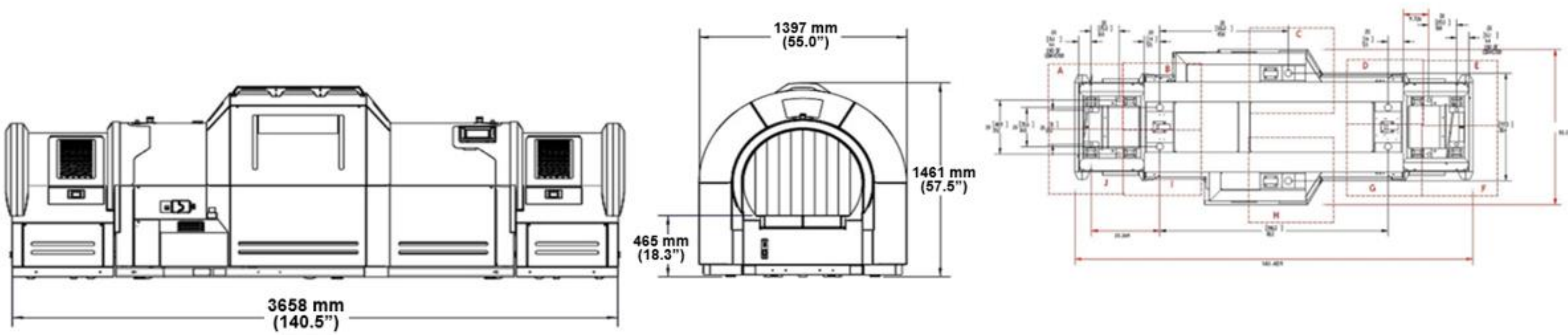
Most stand-alone EDS may be installed with either flat or incline/decline conveyor belts at the entrance and exit of the unit. The preferred configuration of these belts may vary from site to site and the availability may vary from model to model. Please refer to the EDS OEM Installation Guide for the available options associated with each model.

Level 3 screening operations for stand-alone EDS will vary based on the type of EDS used. EDS-CP EDS units all have the ability to recall bag images on SVSs for Level 3 screening, and the CONOPs for these units may include the use of visual light indicators, conveyor functionality, search list criteria, and manual bag ID entry. Most legacy EDS units do not have dedicated SVS capability and will follow local procedures for alarm resolution with ETD. Accordingly, each deployment layout for legacy EDS must accommodate the footprint required for alarm resolution dictated by local policy. A key consideration is the space necessary to support multiple TSOs assigned to the EDS traveling between the PVS and alarm resolution work areas.

Figure 3-11, Figure 3-12, Figure 3-13, and Figure 3-14 provide graphical representations and summarize equipment assumptions for current and future stand-alone EDS units that are not already presented as part of the mini in-line CBIS type.

Figure 3-11: Reveal CT-80DR+
Applicable System Type: Stand-Alone

SPECIFICATIONS	
False alarm rate	SSI
OSR clear rate	SSI
Average OSR time (sec)	30
Environmental operating envelope	Temp. 41-90°F/Humid. 5-85% NC
Weight (lb)	3,635
Floor loading (lb/sq ft)	79.5
Max bag size (L x W x H inch)	63.0 x 24.5 x 19.8
Current status	Qualified (EDS-CP)[1]

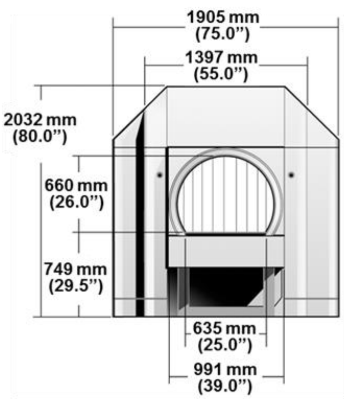


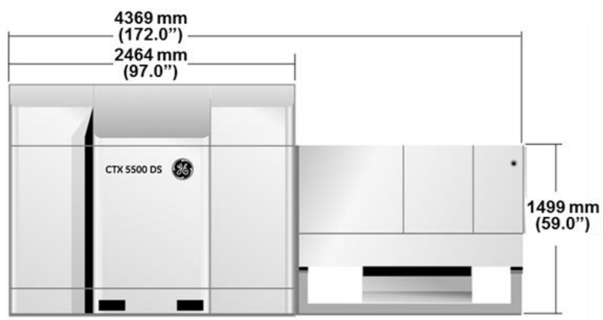
Notes:
<u>The Project Sponsor shall coordinate with the TSA Project Coordinator for any needed SSI information and to make a final determination on the conveyable bag dimensions.</u>
L_1 = Standard
L_2 = Long
L_3 = XL
1 = "Qualified (EDS-CP)" is defined as those systems that have successfully completed detection Certification, TSIF Evaluation, and Operational Test and Evaluation against EDS-CP requirements and are available for procurement by TSA.

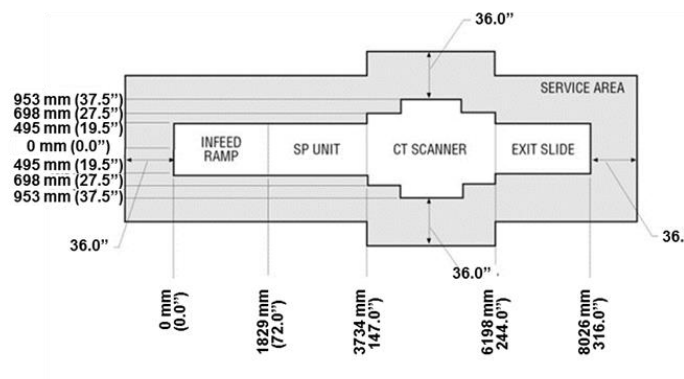
Figure 3-12: MD CTX 5500 DSi

Applicable System Type: Stand-Alone

SPECIFICATIONS	
False alarm rate	SSI
OSR clear rate	SSI
Average OSR time (sec)	30
Environmental operating envelope	Temp. 50-80°F/Humid. 10-60% NC
Weight (lb)	9,350
Floor loading (lb/sq ft)	145
Max bag size (L x W x H inch)	39 x 25 x 22[1]
Current status	Qualified (Legacy)[2]







Notes:

<u>The Project Sponsor shall coordinate with the TSA Project Coordinator for any needed SSI information and to make a final determination on the conveyable bag dimensions.</u>

<u>New CBIS shall not be designed with legacy units.</u>

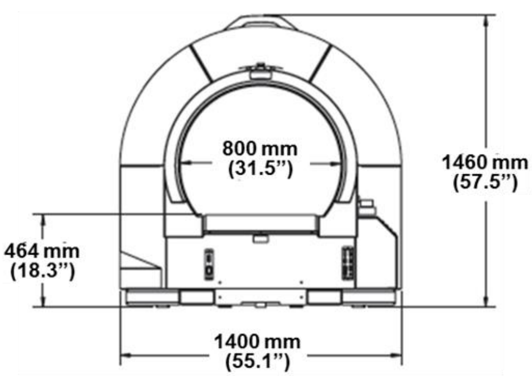
1 = Due to the concave opening of the unit, the maximum height will drop with increasing bag width.

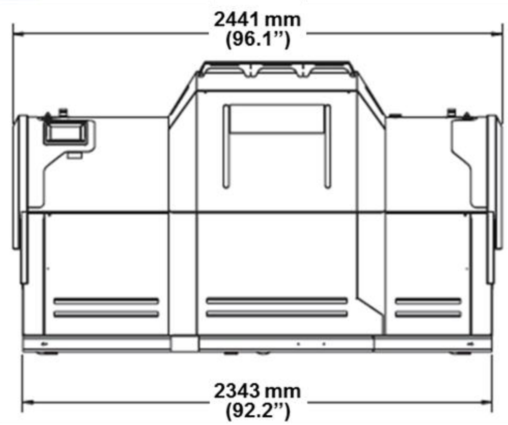
2 = "Qualified (Legacy)" is defined as those systems that have successfully completed detection Certification and some level of Operational Test & Evaluations to pre-EDS-CP requirements. Legacy EDS units may be available to be redeployed by TSA from existing sites and storage. No new procurement of these EDS units is currently planned.

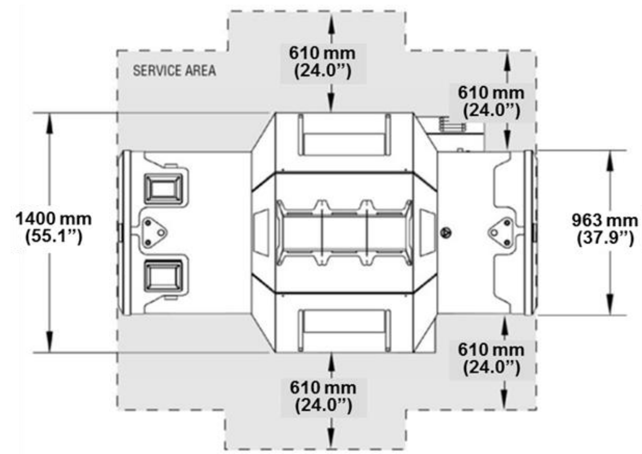
Figure 3-13: Reveal CT-80DR

Applicable System Types: Mini Inline/Stand-Alone

SPECIFICATIONS	
False alarm rate	SSI
OSR clear rate	SSI
Average OSR time (sec)	30
Environmental operating envelope	Temp. 41-90°F/Humid. 5-85% NC
Weight (lb)	3,700
Floor loading (lb/sq ft)	101
Max bag size (L_1/L_2/L_3 x W x H inch)	47.2/63.0/98.4 x 25 x 24.8[1]
Current status	Qualified (Legacy)[2]







Notes:
<u>The Project Sponsor shall coordinate with the TSA Project Coordinator for any needed SSI information and to make a final determination on the conveyable bag dimensions.</u>
<u>New CBIS shall not be designed with legacy units.</u>

L_1 = Standard
L_2 = Long
L_3 = XL

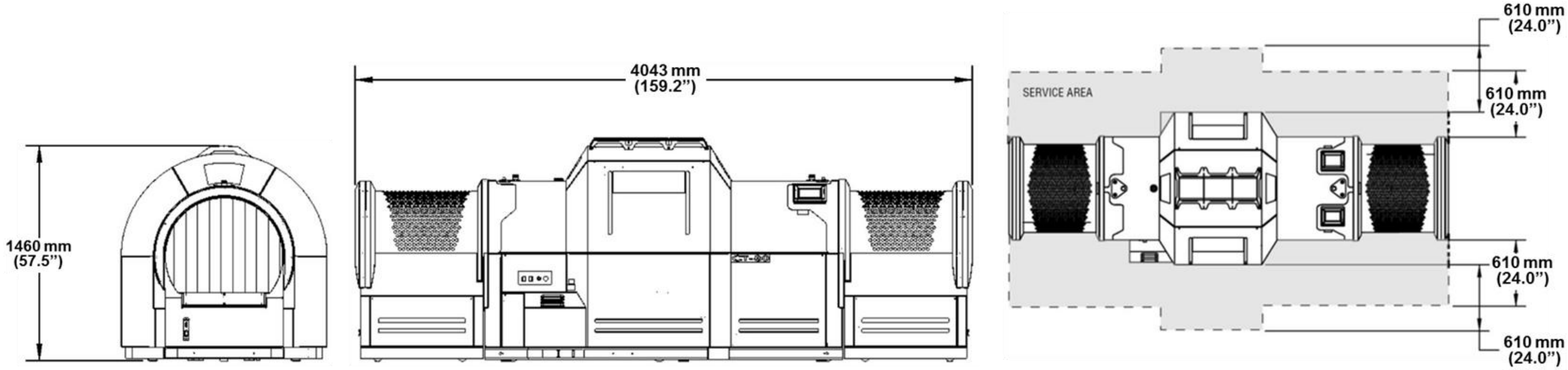
1 = Due to the concave opening of the unit, the maximum height will drop with increasing bag width.

2 = "Qualified (Legacy)" is defined as those systems that have successfully completed detection Certification and some level of Operational Test & Evaluations to pre-EDS-CP requirements. Legacy EDS units may be available to be redeployed by TSA from existing sites and storage. No new procurement of these EDS units is currently planned.

Figure 3-14: Reveal CT-80DRXL

Applicable System Types: Stand-Alone

SPECIFICATIONS	
False alarm rate	SSI
OSR clear rate	SSI
Average OSR time (sec)	30
Environmental operating envelope	Temp. 41-90°F/Humid. 5-85% NC
Weight (lb)	3,920
Floor loading (lb/sq ft)	102
Max bag size (L x W x H inch)	98.4 x 31.5 x 25[1]
Current status	Qualified (Legacy)[2]



Notes:

The Project Sponsor shall coordinate with the TSA Project Coordinator for any needed SSI information and to make a final determination on the conveyable bag dimensions.

New CBIS shall not be designed with legacy units.

1 = Due to the concave opening of the unit, the maximum height will drop with increasing bag width.

2 = "Qualified (Legacy)" is defined as those systems that have successfully completed detection Certification and some level of Operational Test & Evaluations to pre-EDS-CP requirements. Legacy EDS units may be available to be redeployed by TSA from existing sites and storage. No new procurement of these EDS units is currently planned.

3.2.3 ETD-Only CBIS

ETD equipment is currently used for primary screening (as an alternative to EDS screening and as a means to screen out-of-gauge, oversize, fragile, and other baggage that cannot be screened using EDS) and for resolution of EDS alarms. ETD systems for both applications are described below. Typical screening capacities for stand-alone ETD CBIS types is approximately 50 bph. Out-of-Gauge is defined as exceeding the maximum baggage dimensions which can physically be screened by the EDS machine. Oversize is defined as exceeding the maximum conveyable baggage dimensions of the standard-width BHS conveyors.

Table 3-3: Stand-Alone ETD

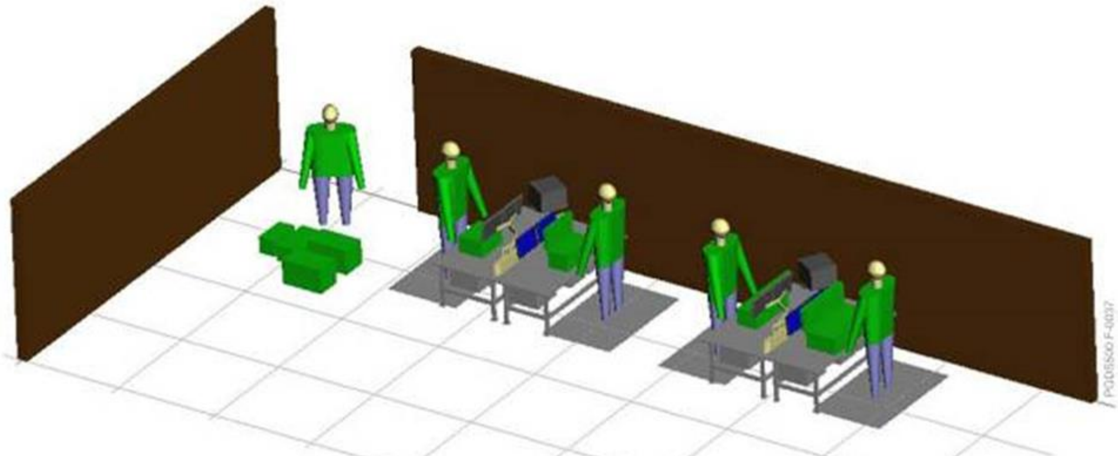
Classification	Models	False Alarm Rate	Maximum Average Analysis Time (sec)	ETD Protocol Screening Method Projected Throughput (bph)	Directed Search Screening Method Projected Throughput (bph)	Current Status
Current	Smiths IONSCAN 500DT	SSI	8	SSI	SSI	Qualified[1]
Current	Implant Sciences QS-B220	SSI	8	SSI	SSI	Qualified[1]
Legacy	MD Itemiser DX	SSI	8	SSI	SSI	Qualified[2]

Notes:
New CBIS shall not be designed with legacy units.
1. Certified to the 2012 Trace Detection Standard by the Transportation Security Laboratory for use in Checkpoint and Checked Baggage screening.
2. Certified to the 2006 Trace Detection Standard by the Transportation Security Laboratory for use in Checkpoint and Checked Baggage screening. No new procurements of these ETD machines is currently planned.

The information included in this table is current as of the publication date of this document. If you would like to obtain the most up to date information on qualified EDS please reach out to PGDS@tsa.dhs.gov

A schematic view of a stand-alone ETD system for primary screening is shown in Figure 3-15.

Figure 3-15: Schematic Visualization of a Stand-Alone ETD System



3.2.3.1 Primary Screening

Stand-alone ETD equipment can currently be used for 100% checked baggage screening in lobbies, baggage makeup areas, or other appropriate locations when no EDS is present. Primary screening with ETD can be used to screen oversize, fragile, and other baggage that cannot be screened using EDS. The rates for this process are listed under ETD Protocol Screening Method in Table 3-3.

As ETD screening is the most labor-intensive screening method and has the lowest throughput compared with all other screening methods, ETD primary screening is typically only appropriate in lieu of EDS screening at airport zones with low baggage volumes.

Figure 3-16 and Figure 3-17 provide graphical representations and summarize equipment assumptions for current and future stand-alone ETD machines.

Figure 3-16: Smiths IonScan 500DT
Applicable System Type: Stand-Alone ETD

SPECIFICATIONS	
False alarm rate	SSI
Environmental operating envelope	Temp. 32-104°F Humid. up to 95% NC
Weight (lb)	43.5
Current status	Qualified

Notes:
The Project Sponsor shall coordinate with the TSA Project Coordinator for any needed SSI information.

Figure 3-17: Implant Sciences QS-B220
Applicable System Type: Stand-Alone ETD

SPECIFICATIONS	
False alarm rate	SSI
Environmental operating envelope	Temp. 14-131°F Humid. up to 95% NC
Weight (lb)	32.1
Current status	Qualified

Notes:
The Project Sponsor shall coordinate with the TSA Project Coordinator for any needed SSI information.

3.2.3.2 Alarm Resolution

ETD equipment is also used to screen EDS-alarmed bags that have not been cleared by operators using an OSR protocol (based on viewing bag images). This method is referred to as the Directed Search Screening Method (as listed in Table 3-3) and is focused on identifying and locating objects within baggage that have triggered EDS alarms.

In the event that a bag image is not available for an EDS-alarmed bag, additional screening measures are employed by the TSA screener to perform alarm resolution using ETD.

3.2.4 Other Baggage Conveying System Types

The previous discussions have assumed the traditional "friction belt on slider bed" technology, but there are alternate types of baggage systems which utilize other means to accomplish the same goals. Individual Carrier Systems (ICS) are examples of alternate technologies for transporting baggage, and are often seen as destination coded vehicles, tote-transport systems, etc.

An ICS-based CBIS design concept typically uses individual carriers to carry baggage through a transport and sortation system, which allows for the distribution of bags to the EDS units as well as to the CBRA, and if so designed, for the automated sortation of bags to multiple makeup devices. ICSs typically consist of a closed-loop conveying system on which special-purpose carriers (each accommodating a single bag and possessing a unique radio frequency identification (RFID) tag) are transported to the EDS. In this type of system, the bag remains in the carrier throughout the screening and sortation processes. Alarmed baggage is transported to the CBRA (in the carrier) while cleared baggage is conveyed to the sortation system. The ICS concept is presented to provide planners with a broad range of potential CBIS concepts for consideration during the Pre-Design Phase. Please reference Figure B-3 in Appendix B for more information.

A key consideration in this type of design is that once loaded into the ICS carrier, the bag must remain associated with that carrier throughout the screening process. Upon arrival into the CBRA, the bag cannot be unloaded/removed from the carrier until an operator is available to screen the bag. Once the bag is removed from the carrier by sliding the bag (lifting should not be required), the carrier must remain at that location until the bag has been screened and loaded back into the same carrier to maintain positive tracking. Depending on the CBRA design, bags may remain in the carrier during the physical inspection process.

ICS is most beneficial in a centralized screening operational design, where EDS and CBRA staff can be minimized without compromising time-in-system constraints.

A Mobile Inspection Table (MIT) may be used to transport bags to the TSOs for inspection in the CBRA. The MIT consists of a table top integrated into an automated cart that transports bags along a path of magnetic tape affixed to the floor. Bags are loaded onto the MIT automatically and are delivered directly to the TSOs for inspection. The bag is positively tracked with the MIT. The MIT utilizes RFID transponders to positively update its position. After inspection the bag is automatically delivered to the clear line conveyor system for sortation or driven directly to the make-up area. Error bags can be sent to a reinsertion line.

3.3 General Notes on Screening Equipment Assumptions

The following assumptions apply to system types described in previous sections.

3.3.1 False Alarm Rate and OSR Clear Rate Assumptions

- The range of expected annual average false alarm rates for EDS can vary based on domestic flights (at the low-end) and international flights (at the high-end) with varying bag content.
- False alarm rates for international flights are typically higher as checked bags for these flights tend to be bigger and have a higher ratio of alarms per bag due to relatively dense or highly cluttered bag content.
- The OSR clear rate and clear time estimates are based on approved TSA alarm resolution protocol as well as expected EDS image quality and alarm resolution tools provided to screeners on EDS bag viewing stations (or threat resolution interfaces).
- The estimated OSR clear rate and OSR clear time are annual averages for domestic and international flights (with varying bag content and varying bag images).

3.3.2 Out-of-Gauge Screened Baggage Assumptions

- Maximum baggage dimensions represent the maximum in every dimension and not maximum dimensions of an actual bag that can fit into the EDS. For example, with the L-3 eXaminer 3DX, at maximum width of 32 inches the maximum height of a bag is 14 inches and at a width of 21.5 inches the maximum height of the bag is 21.5 inches.
- The OOG percentage is based on annual and national averages for domestic and international flights (with varying bag sizes) and on maximum bag dimensions specified by baggage handling system designers and EDS manufacturers. The OOG percentage is based on the EDS model selected for the CBIS. The airport specific OOG percentage may differ from the national average based on the unique mix of bag sizes and types specific to the airport.

CHAPTER 4:

DEVELOPMENT AND EVALUATION OF ALTERNATIVES

REQUIREMENTS TABLE

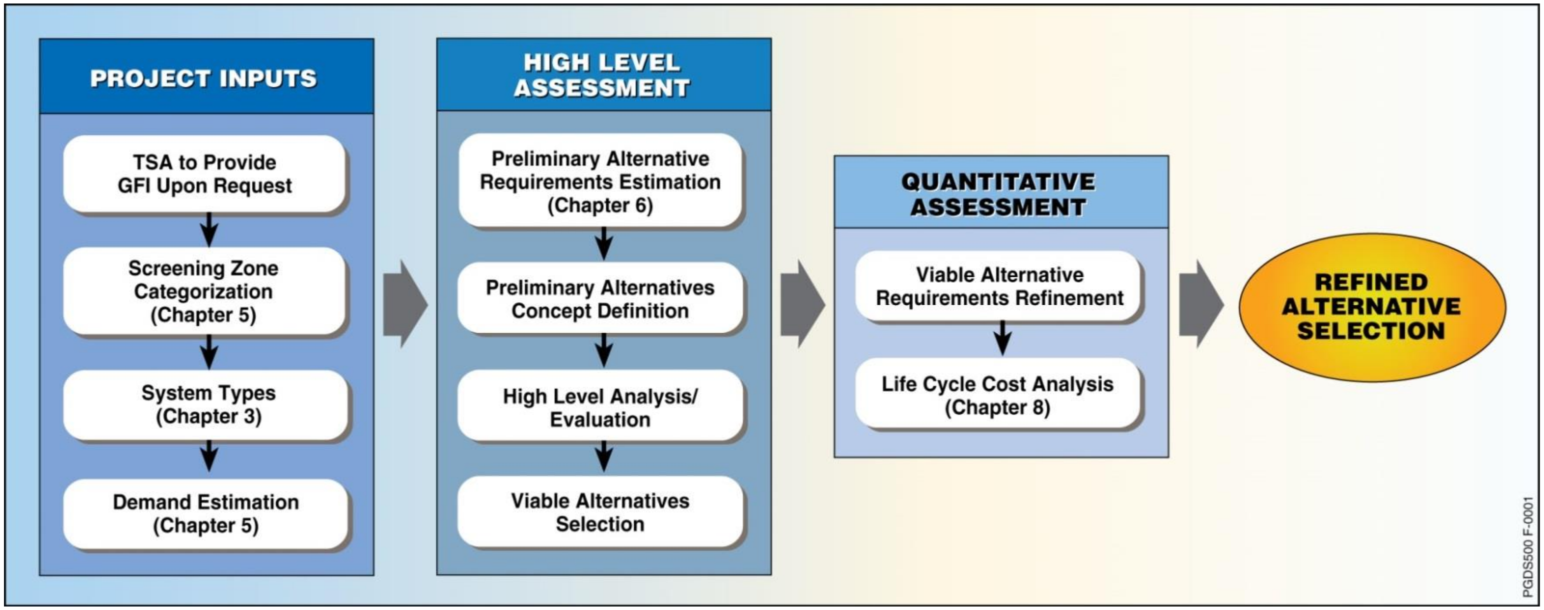
Section	Requirement
4.1 Alternatives Development	When developing the Alternatives Analysis report as stated in the requirements for Pre-Design Phase in Chapter 2, planners shall follow the requirements listed in Chapters 3, 5, 6, and 8.
4.1 Alternatives Development	Spatially and operationally feasible alternatives shall be evaluated on the basis of a 20-year life cycle cost analysis detailed in Chapter 8 for implementing, maintaining, and replacing the screening system.
4.1.4 Alternatives Equipment Requirements Estimation	For each alternative proposed, planners shall have determined the CBIS type (e.g., In-line, Mini In-line, Stand-Alone) and number of units required for each screening zone.
4.1.5.1 Tradeoff between Upfront Capacity and Incremental Capacity	The ultimate terminal or airport capacity shall be the upper limit for demand estimates for the purposes of CBIS design.

4.1 Alternatives Development

Several elements of the planning process are presented together in this chapter enabling planners to develop and evaluate various screening solution alternatives for a particular airport or terminal.

Figure 4-1 summarizes the alternatives development and evaluation process to be carried out during the Pre-Design and Schematic Phases.

Figure 4-1: Pre-Design Phase Alternatives Development And Evaluation



When developing the Alternatives Analysis report as stated in the requirements for Pre-Design Phase in Chapter 2, planners shall follow the requirements listed in Chapter 3, Chapter 5, Chapter 6, and Chapter 8, and should develop optimally-scaled screening alternatives taking into account the following:

- **Airport Spatial Data** – Terminal configurations, airline assignments, and architectural constraints that will affect the categorization into screening zones (see Chapter 5).
- **CBIS Capacity Data** – Data related to the number and type of screening systems and screening equipment (see Chapter 3 and Chapter 6).
- **Baggage Screening Demand Data** – Factors affecting current and future baggage flow into the CBIS, such as existing infrastructure including ticket counter and curbside check-in positions, numbers of gates, and runway capacities (see Chapter 5).
- **Cost Data** – Equipment, infrastructure, O&M, and staffing costs (see Chapter 8).

Planners are encouraged to develop various alternatives based on conditions at the specific airport. An initial high-level assessment identifies spatially and operationally feasible alternatives. Spatially and operationally feasible alternatives shall be evaluated on the basis of a 20-year life cycle cost analysis detailed in Chapter 8 for implementing, maintaining, and replacing the screening system.

The methodology for developing alternatives, assumptions for assessing the cost effectiveness of the alternatives, and the evaluation process for selecting the preferred alternative(s) are discussed in this chapter. Appendix C provides a case study of an airport installation where this methodology was applied.

Chapter 5 defines the screening alternatives development based on airline groupings (screening zones). Chapter 3 describes the system types. Tradeoff assessment between upfront capacity and incremental capacity at an airport is discussed in Section 5.3. Chapter 6 defines the methodology for determining the screening equipment requirements.

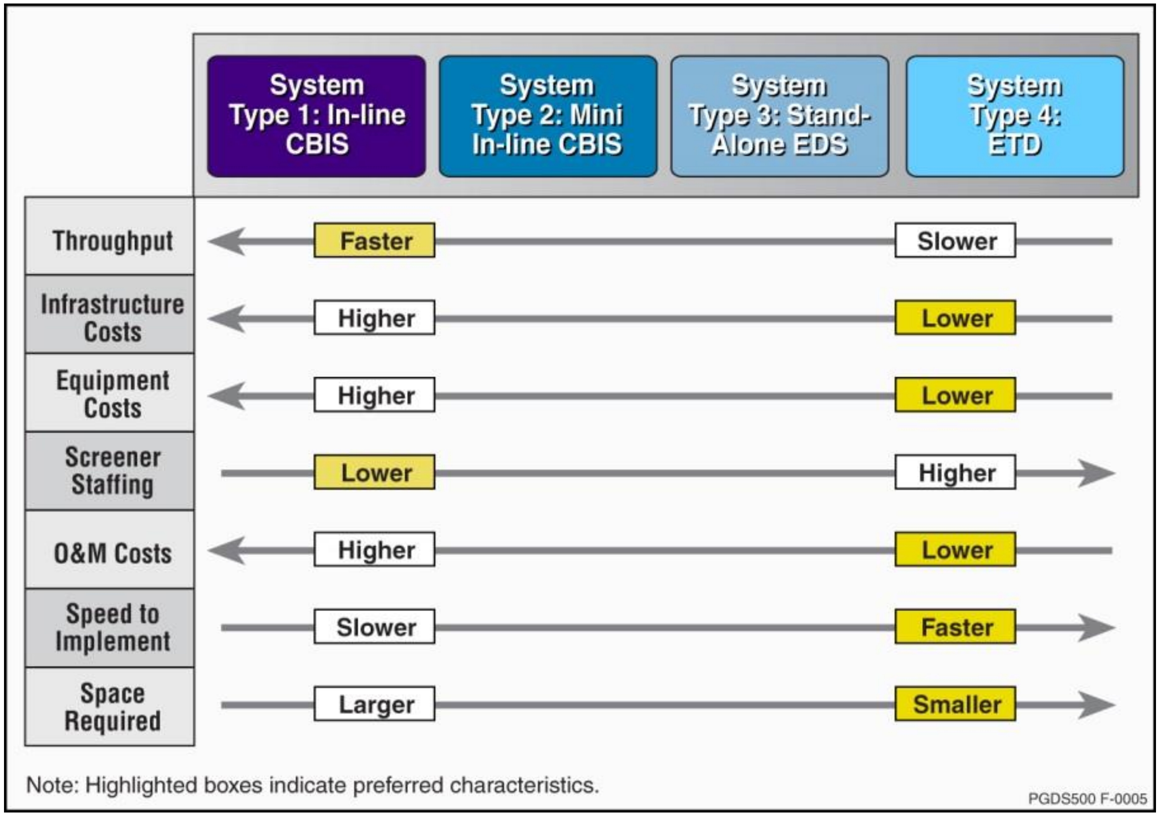
4.1.1 Screening Zone Categorization

As discussed in Chapter 5, checked baggage screening systems can be designed to combine baggage flows from several airlines in a single screening system. When defining the set of screening alternatives, planners should compare screening solutions for different combinations of baggage flows. Whenever possible, at least two different combinations of baggage flows should be analyzed to provide a meaningful comparison (e.g., centralized zones vs. airline-specific zones).

4.1.2 CBIS Type Selection

Several screening system types could serve demand in each screening zone. The CBIS types defined in Chapter 3 provide different tradeoffs between upfront capital costs and recurring staffing and O&M costs, as illustrated in Figure 4-2 and summarized below:

Figure 4-2: System Type Comparison



- **In-Line CBIS**. In-line systems are likely to be used in centralizing screening zones that serve one or more airlines. They are generally the most efficient from the perspectives of EDS unit and staff utilization. However, the centralized nature of these systems may require more complex conveyor arrangements and extensive building modifications, therefore, associated upfront capital investment and O&M costs may be high. These systems may contain extensive buffering space and sections of conveyor allowing for sufficient OSR time.

  This system type corresponds to the Qualified Type I EDS as specified in the TSA Procurement Specification (see Section 3.2.1.1).

- **Mini In-line CBIS**. Mini in-line systems are decentralized systems that incorporate a simpler conveyor design and require a smaller footprint. These systems are likely to be located closer to airline ticket counters or baggage make-up devices. Travel times are thus reduced, as is the likelihood of improper baggage sortation. However, staff and equipment utilization for a mini in-line system is typically lower than for an In-Line system given the lower demand placed on the system and more peaked load requirements. As a result of lower facility and conveyor modification impacts, capital and O&M costs are expected to be lower for mini in-line systems than for In-Line CBIS types (see Section 3.2.2).

- **Stand-Alone EDS**. For facilities with very low throughput requirements or where architectural conditions may render other systems cost prohibitive, a solution based on a stand-alone EDS unit (see Chapter 3 for a list stand-alone EDS units) may be the most economical. A conveyor infrastructure is not required with a stand-alone EDS and, therefore, no significant incremental increase in airport/airline O&M costs is expected. These systems offer an even lower capital cost on a per unit basis, but are also less efficient in terms of staff and unit utilization than System Type 2 (see Section 3.2.2.2).
- **Stand-Alone ETD Systems**. Primary screening with ETD should only be used to screen OOG, OS, fragile, and other baggage that cannot be screened using EDS or at airports with very low bag volume that cannot justify an EDS unit. ETD solutions are typically deployed in lobbies or baggage make-up rooms and are the most labor-intensive solutions. A conveyor infrastructure is not required and, therefore, these systems offer the lowest capital and O&M cost (see Section 3.2.3).

Centralized screening zones require a fully automated in-line system (System Type 1). Smaller in-line systems or mini in-line systems are typically better suited for more decentralized zones (such as bag rooms accommodating one or more airlines). Mini in-line systems and stand-alone systems are typically better suited for highly decentralized zones. However, planners should not explicitly assume this relationship and need to select the optimal screening system for a zone based on the particular characteristics of the zone regardless of the level of centralization.

4.1.3 Baggage Screening Demand Estimation

Once the screening zones are defined, planners estimate baggage screening demand for each screening zone as explained in detail in Chapter 5.

4.1.4 Alternatives Equipment Requirements Estimation

The design year baggage flow and the selected system types are used to calculate equipment requirements as explained in detail in Chapter 6.

<u>For each alternative proposed, planners shall determine the CBIS type (e.g., in-line, mini In-line, stand-alone) and number of units required for each screening zone.</u>

4.1.5 Alternatives Concept Definition

Screening alternatives should be developed based on the type of screening equipment and number of units required which, in turn, are based on the screening demand and system types initially selected.

As mentioned in previous paragraphs, planners are encouraged to develop as many screening alternatives as possible within the existing physical constraints.

These initial concepts do not require a high level of detail, however, planners should be able to qualitatively assess potential impacts on existing facilities and operations.

4.1.5.1 Tradeoff between Upfront Capacity and Incremental Capacity

Specifically, planners should assess the tradeoffs between (1) incurring additional upfront costs to increase design flexibility for accommodating future demand growth, and (2) accommodating growth based on modifying the initial system incrementally over the 20-year analysis period for the purposes of conducting alternative analysis through the use of 20-year life cycle cost assessment. This tradeoff assessment may indicate, for instance, that systems at critical airports (such as airline hubs) should be designed with additional space to accommodate future EDS units.

Airport planners typically assess the capacity of functional components at an airport (e.g., ticket counters, gates, runways) to determine the ultimate capacity of the terminal. The ultimate terminal or airport capacity shall be the upper limit for demand estimates for the purposes of CBIS design. For example, if a 20-year demand analysis indicates that additional ticket counters, gates, or runway capacity is required beyond that available in the current terminal or airport, then planners would assume that such requirements are beyond the scope of the CBIS design. Capital-intensive expansions to accommodate additional demand at other airport functional components should also include consideration of additional baggage screening capacity to accommodate future growth of baggage demand beyond the ultimate capacity considered in the CBIS design.

4.1.5.2 Contingency Planning

Even though a contingency plan is required only at the end of the Schematic Design Phase, planners should consider the implications of potential mitigation measures regarding the development of alternatives early on, as some measures could affect the alternative system layout and level of complexity. A more detailed explanation of the contingency planning process, contingency plan development, and evaluation of contingency alternatives is included in Chapter 11.

4.2 Alternatives Evaluation and Selection

Once alternative concepts have been developed, a high-level assessment should be conducted to determine which alternatives are viable and should be considered in the life cycle cost analysis. The life cycle cost analysis will provide present value costs for each viable alternative so that the alternatives can be evaluated quantitatively based on these costs and the preferred alternative(s) selected.

4.2.1 High-Level Assessment

A high-level assessment is a qualitative evaluation based on general criteria with the objective of helping planners and stakeholders understand which alternatives are viable and should be considered further in the evaluation process.

The criteria to be used in the high-level assessment depend on the airport and should be developed in close coordination with project stakeholders. The following are examples of criteria used in the case study provided in Appendix C:

- **Customer Level of Service** – The effect of each alternative on the passenger's experience at the airport
- **Effect on Airport Operations** – The reliability and maintainability of the EDS equipment and the contingency procedures that could be implemented if a unit were inoperative during a peak period, as well as the effect that the alternative would have on the airlines
- **Economic Considerations** – These costs will include those to be borne by TSA as well as airport operators and airlines. The costs associated with TSA staff salaries as well as implementing and maintaining the alternative
- **Design Criteria** – The effect that the alternative would have on existing facilities, as well as the ease with which the alternative could be constructed, expanded, and commissioned
- **Ergonomic Considerations** – The accessibility of the system to personnel; inclusive of stairs, ladders, spatial considerations, egresses, and when the manual transport of baggage is required

Based on criteria similar to those listed above, planners and stakeholders should evaluate the alternatives and eliminate those that are not viable. It might be helpful to develop a high-level assessment matrix similar to the one shown in Appendix C, Section C.6.1. The remaining alternatives should be further refined before analyzing life cycle costs.

4.2.2 Quantitative Evaluation Based on Life Cycle Cost Analysis

Life cycle costs are analyzed for the viable alternatives identified in the high-level assessment to select the preferred alternative (or alternatives). The requirements and details regarding how to conduct a life cycle cost analysis are presented in Chapter 8.

The lowest cost alternative might not be the best option as ranked in the high-level assessment. The final selection is based on quantifiable analysis, qualitative considerations, and good judgment.

CHAPTER 5:

METHODOLOGY TO DETERMINE BAGGAGE SCREENING DEMAND

REQUIREMENTS TABLE

Section	Requirement
5.2 Generate Checked Baggage Flow	The Project Sponsor shall use GFI provided by TSA (FDRS peak daily 10-minute throughput data for the last 12 months, if available) and/or the Average Day of the Peak Month (ADPM) methodology presented in Section 5.2 to derive the existing checked baggage flows for each screening zone and determine the design day baggage rate.
5.2.1 List of Airlines	All airlines (including charter airlines) operating in each screening zone shall be identified.
5.2.2 Determination of the ADPM per Screening Zone	For each screening zone, the total number of monthly originating bags and international recheck bags for all airlines in that zone shall be obtained and the peak month identified.
5.2.2 Determination of the ADPM per Screening Zone	For each screening zone, the total number of daily originating and international recheck bags for all airlines in that zone during the peak month shall be calculated, and a mathematical average shall be derived.
5.2.3 Flight Schedule	Once the ADPM for each zone has been determined, a design-day flight schedule for each screening zone shall be provided.
5.2.3 Flight Schedule	These flight schedules shall only contain information on departing flights from the subject airport.
5.2.3 Flight Schedule	Flight schedules shall specify for each flight: destination, flight departure time, flight number, published carrier, operator, aircraft type, and number of seats.
5.2.3 Flight Schedule	To derive international recheck baggage demand, the arrival schedule of international flights whose passengers will be connecting to domestic flights shall be provided.
5.2.5 Origin/Destination and Connecting Passenger Percentages	The percentage of passengers arriving on international flights and connecting to domestic flights shall be used to derive international recheck baggage demand.
5.2.5 Origin/Destination and Connecting Passenger Percentages	The estimated number of originating passengers shall be calculated by multiplying the number of seats by the load factor, by the percentage of originating passengers assumptions for the ADPM.
5.2.5 Origin/Destination and Connecting Passenger Percentages	The estimated number of connecting passengers from international to domestic flights shall be calculated by multiplying the number of arriving seats by the load factor and by the percentage of passengers connecting assumptions for the ADPM.
5.2.7 Checked Bags per Passenger	The estimated number of originating checked bags shall be calculated by multiplying the estimated number of originating passengers by the number of checked bags per passenger assumptions for the ADPM.

Section	Requirement
5.2.7 Checked Bags per Passenger	The estimated number of international recheck bags shall be calculated by multiplying the estimated number of connecting passengers from international to domestic flights by the number of international recheck bags per passenger assumptions for the ADPM.
5.3 Project Future Baggage Flow	Baggage flows shall be projected to the Design Year before they can be used to determine screening equipment requirements.
5.3.1 Design Year for Equipment Requirements	The design year for equipment requirements shall be five years after the initial DBU for a given baggage screening system (i.e., DBU+5 years).
5.3.1 Design Year for Equipment Requirements	The EDS equipment requirements shall be listed in 1-year increments in the Basis of Design Report, from DBU through DBU+5 years.
5.3.1 Design Year for Equipment Requirements	Equipment requirements shall be revalidated 12 months prior to equipment delivery.
5.3.1 Design Year for Equipment Requirements	If the EDS equipment type changes, the construction start date is delayed, or the construction schedule is delayed more than 12 months beyond the expected DBU, then a revalidation of EDS and CBRA requirements shall be submitted.
5.3.1 Design Year for Equipment Requirements	The EDS equipment requirements for 10 additional years past DBU+5 years shall be listed in 1-year increments in a separate chart in the Basis of Design Report, from DBU+6 through DBU+15 years (including EDS units, PVS, and SVS workstations).
5.3.1 Design Year for Equipment Requirements	If, for any reason, local airport and airline staff and their consultants believe that the TAF or the Master Plan forecasts do not properly represent expected growth at the airport, the revised forecast and a detailed explanation of the reasons that the FAA-approved forecast is not acceptable shall be provided to TSA for approval.
5.3.2 Accommodating Traffic Growth after the Design Year	The EDS equipment requirements for 10 additional years past DBU+5 years shall be listed in 1-year increments in a separate chart in the Basis of Design Report, from DBU+6 through DBU+15 years (including EDS units, PVS, and SVS workstations).

This chapter documents the methodology used to determine the design demand required to size optimal screening system(s) within an airport. As explained in detail in the following paragraphs, the steps below summarize the methodology:

1. Categorize the airport into screening zones
2. Generate checked baggage flow
3. Project future baggage flow

This methodology is meant only for the Pre-Design Phase of the project when the focus is on equipment sizing, rather than on system performance. During later phases of design, simulation may be used to evaluate system performance. As such, detailed design-day flight schedules that reflect the best information available regarding future demand levels will be required.

To aid the project sponsor in determining the baggage demand through this methodology, the TSA will provide GFI, when available, for the given airport as stated in Section 2.2.1.1. This information may include data, which will assist the project sponsor in their determination of the design day baggage rate and equipment requirements (described in the subsequent chapter). The Project Sponsor may choose to use this information as a guide throughout the analysis or as a justification to shorten the required analysis.

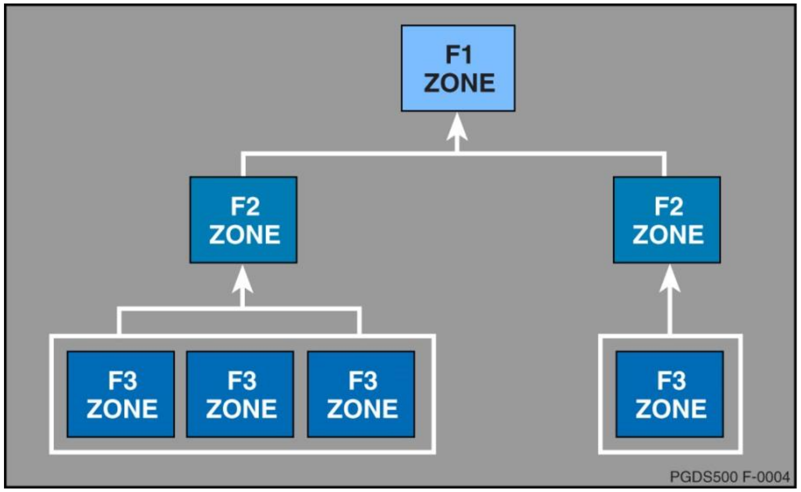
Appendix C provides a case study on how these initial steps should be conducted.

5.1 Categorize the Airport into Screening Zones

Checked baggage screening systems can be designed to combine checked baggage from several airlines into a single system. As numerous options are available for combining baggage flows, planners should use their best judgment to capture (1) high-level architectural constraints and (2) airline operational constraints. It is recommended that more than 1 screening configuration and airline grouping be considered at the outset of a project to provide realistic alternatives for comparison.

One approach that could be used to determine feasible combinations of baggage flow is a zone hierarchy scheme that represents the spatial characteristics of airport. Figure 5-1 presents a sample scheme for a tri-level hierarchy (F1, F2, and F3).

Figure 5-1: Zone Hierarchy Representation

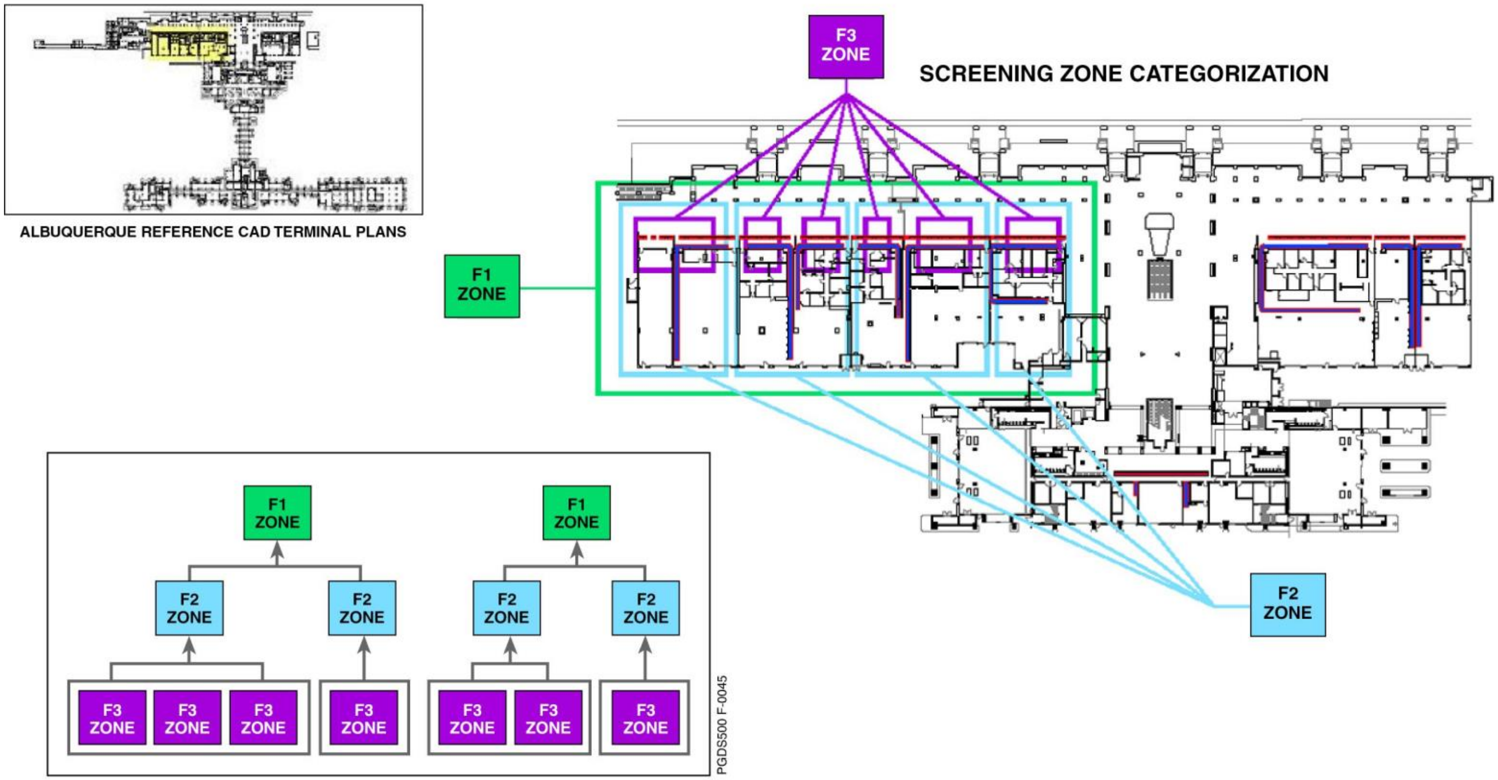


Each element in the hierarchy represents a spatially feasible zone for EDS screening, be it at a small, decentralized level or at a large, consolidated level:

- **F1 Zone** – An F1 zone is the largest feasible zone in an airport for installation of a centralized in-line system. This zone may accommodate multiple airlines that share EDS and are usually served by multiple baggage belts with sortation functionality downstream from the screening area.
- **F2 Zone** – An F2 zone represents a screening solution that fits somewhere between the F1 and F3 zones, and is usually determined by the feasibility of 2 or more adjacent airlines sharing their screening and baggage handling facilities (e.g., a common baggage make-up area).
- **F3 Zone** – On the other end of the spectrum, an F3 zone is the smallest feasible zone in a terminal wherein a highly decentralized EDS is likely to be preferred, and is usually served by a single take-away baggage belt. A dominant airline in a terminal with multiple baggage belts would have a number of F3 zones.

For example, Figure 5-2 shows the western half of the ticketing lobby and associated baggage make-up area at Albuquerque International Sunport (ABQ). The ticket lobby, airline ticket offices (ATOs), and baggage make-up areas are all located on one contiguous level.

Figure 5-2: Assumed Screening Zones at Albuquerque International Sunport



One potential method of developing a zone hierarchy for ABQ would be the following:

- **F3 Zones** – Each baggage take-away belt is assigned to an F3 zone.
- **F2 Zones** – An existing, contiguous baggage make-up area with several take-away belts is defined in this example as a single F2 zone.
- **F1 Zones** – As the ticketing lobby, the ATO, and the baggage make-up areas are physically divided by the entrance hall into the west and east sides, each side is designated as a single F1 zone. It would be impractical and expensive to screen all bags in a single centralized system for the entire airport; thus, at ABQ, 2 separate F1 zones were identified.

Because the subdivision of an airport into zones is subjective, a detailed explanation of the reasons that a particular screening zone hierarchy was selected over another hierarchy should be provided as part of the Alternatives Analysis Report (see Section 2.2.1).

Screening zone selection is fundamental in generating baggage screening demand profiles and, ultimately, in determining the required baggage screening equipment, as explained in the following paragraphs.

5.2 Generate Checked Baggage Flow

If available, and appropriate, the TSA will supply GFI to assist the ILDT in their determination of current and future baggage rate demands. This GFI data may consist of historical empirical FDRS data that has been cultivated to yield the peak 10 minutes of every day of the preceding year, individual EDS unit processing rates (by minute and/or 10 minute rolling bins), and Staff Allocation Model data (yielding some values for parameters such as bags/ passenger/ airline, hourly rates, etc.). The Project Sponsor shall use GFI provided by TSA (FDRS peak daily 10-minute throughput data for the last 12 months, if available) and/or the Average Day of the Peak Month (ADPM) methodology presented in Section 5.2 to derive the existing checked baggage flows for each screening zone and determine the design day baggage rate.

The intent of the FDRS and ADPM analysis is to ensure that systems are designed to meet the baggage demands of at least 85% of the days as expressed by the peak 10 minutes of each of days in the calendar year. Where designing for the 85th percentile does not provide sufficient capacity as determined by the TSA and Project Sponsor, alternative design days can be used with TSA approval.

The key inputs necessary to derive the checked baggage flows for the ADPM are described below.

5.2.1 List of Airlines

All airlines (including charter airlines) operating in each screening zone shall be identified.

5.2.2 Determination of the ADPM per Screening Zone

To identify the ADPM, it is necessary to first identify the peak month and then the average day in terms of originating bags as well as international recheck bags for each zone.

- For each screening zone, the total number of monthly originating bags and international recheck bags for all airlines in that zone shall be obtained and the peak month identified. The month with the maximum combined number of originating and international recheck bags is referred to as the peak month.
- For each screening zone, the total number of daily originating and international recheck bags for all airlines in that zone during the peak month shall be calculated, and a mathematical average shall be derived. The day on which the number of originating and international recheck bags is closest to the calculated mathematical average is the ADPM.

Depending on the airlines operating in each zone, the ADPM might differ from zone to zone.

Planners should include charter airline originating bags or international recheck bags if that information is relevant and available when determining the ADPM for each zone.

5.2.3 Flight Schedule

Once the ADPM for each zone has been determined, that day's flight schedule for each screening zone shall be provided. These flight schedules shall only contain information on departing flights from the subject airport. Flight schedules shall specify for each flight: destination, flight departure time, flight number, published carrier, operator, aircraft type, and number of seats.

To derive international recheck baggage demand, the arrival schedule of international flights whose passengers will be connecting to domestic flights shall be provided. Baggage arriving from international destinations where security screening protocols differ from those used by TSA are re-screened at the first United States port of entry before being loaded onto any domestic flight.

5.2.4 Load Factors

A load factor is the percentage of seats on a flight occupied by ticketed passengers. Load factors vary by flight (e.g., by airline, time of day, and destination), by day of the week, and by season. Because of the variance in load factors, it is important to obtain the most accurate data that reflect the specific conditions of the selected ADPM directly from the airlines if possible.

In addition, load factors on international arrival flights must be obtained to derive international recheck baggage demand.

5.2.5 Origin/Destination and Connecting Passenger Percentages

Originating passengers are passengers whose itinerary begins at the subject airport; an originating passenger checks in with the appropriate airline and proceeds through the security screening checkpoint to the departure gate. Similar to load factors, the percentage of originating passengers may vary by flight (e.g., by time of day, destination, and airline), by day of the week, and by season.

Domestic flights departing from the airport prior to 9 a.m. typically have significantly higher percentages of originating passengers than those departing after 9 a.m. because of the nature of connecting passenger traffic. In general, the first arrival bank of domestic flights permits very few passengers to connect with flights departing from the airport prior to 9 a.m.; therefore, most of the passengers on those flights are originating passengers. Thus, the percentage of originating passengers before 9 a.m. is close to 100%, after 9 a.m., the percentage ranges from 5% to 100%.

Because of the wide variance in originating passenger percentages, it is important to obtain the most accurate data that reflect the specific conditions of the ADPM at the subject airport directly from the airlines if possible.

The percentage of passengers arriving on international flights and connecting to domestic flights shall be used to derive international recheck baggage demand.

The estimated number of **originating passengers** shall be calculated by multiplying the number of seats by the load factor and by the percentage of originating passengers assumptions for the ADPM.

Originating Passengers = Number of Seats x Load Factor x Percentage of Originating Passengers

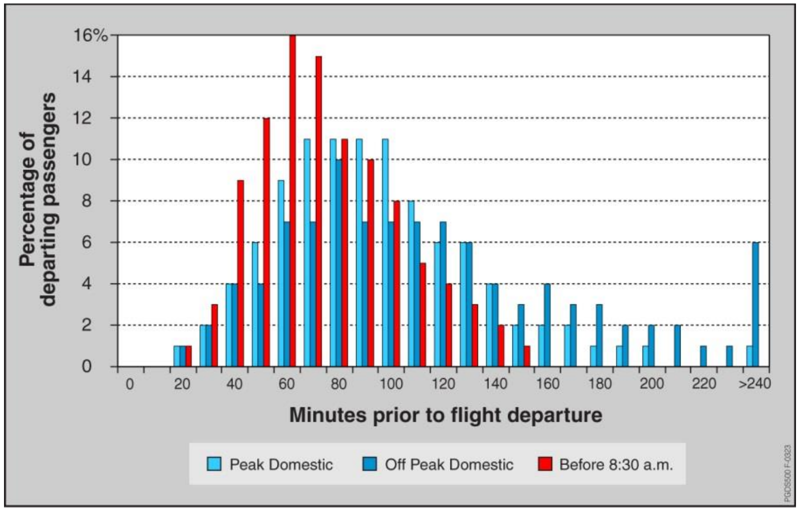
The estimated number of **connecting passengers** from international to domestic flights shall be calculated by multiplying the number of arriving seats, by the load factor, and by the percentage of connecting passengers assumptions for the ADPM.

Connecting Passengers from International to Domestic Flights = Number of Arriving Seats x Load Factor x Percentage of Connecting Passengers

5.2.6 Passenger Arrival Distributions

Where possible, and with TSA's concurrence, it is recommended that arrival distribution may be obtained directly from the airlines. The passenger arrival distributions in Figure 5-3 were taken from the latest version of the TSA ESM and should be used if airport specific data is not available.

Figure 5-3: Earliness Distributions – Domestic Carriers Peak, Off Peak, and Before 8:30 A.M.



5.2.6.1 Earliness Distributions

An earliness distribution specifies the percentages of passengers that arrive at the airport a specific number of minutes prior to their flight departure. The earliness distributions are used to determine the flow of passengers for each flight. The flows for each flight are added together to generate an overall passenger flow. Significant differences exist in the earliness distributions between:

- Passengers on domestic flights departing at peak hours (between 8:30 a.m. and 5:00 p.m.) versus off-peak hours (12:00 a.m. – 4:00 a.m. and 5:00 p.m. – 12:00 a.m.)
- Passengers on flights departing before 8:30 a.m. and after 8:30 a.m.

Earliness distributions for flights departing in the morning are generally of shorter duration and thus more peaked; therefore, it is important to use the appropriate earliness distributions to accurately derive actual baggage flows.

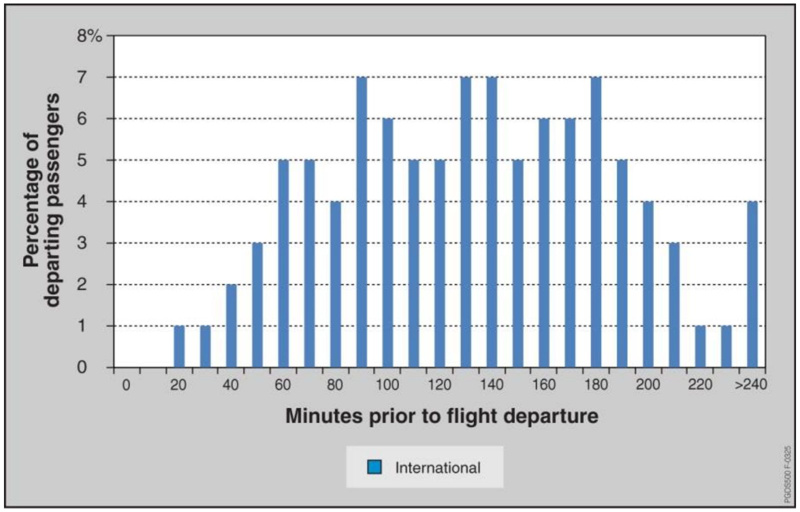
The earliness distributions shown previously in Figure 5-3 are for domestic carriers. The distribution for flights departing before 8:30 a.m. and peak hours exhibits higher peaking characteristics and has a much shorter duration than the distribution for flights departing on off-peak hours. Table 5-1 provides the specific data points shown in Figure 5-3.

Table 5-1: Earliness Distribution – TSA Study 2014

Minutes before departing flight	Before 8:30 a.m.	Peak Domestic	Off-peak Domestic	Federal Inspection Services Flight	International
0 to 10	0	0	0	0	0
10 to 20	0	0	0	0	0
20 to 30	1	1	1	0	1
30 to 40	3	2	2	2	1
40 to 50	9	4	4	3	2
50 to 60	12	6	4	19	3
60 to 70	16	9	7	27	5
70 to 80	15	11	7	25	5
80 to 90	11	11	10	20	4
90 to 100	10	11	7	4	7
100 to 110	8	11	7	0	6
110 to 120	5	8	7	0	5
120 to 130	4	6	7	0	5
130 to 140	3	6	6	0	7
140 to 150	2	4	4	0	7
150 to 160	1	2	3	0	5
160 to 170	0	2	4	0	6
170 to 180	0	2	3	0	6
180 to 190	0	1	3	0	7
190 to 200	0	1	2	0	5
200 to 210	0	1	2	0	4
210 to 220	0	0	2	0	3
220 to 230	0	0	1	0	1
230 to 240	0	0	1	0	1
>240	0	1	6	0	4
Total	100%	100%	100%	100%	100%

Figure 5-4 shows the earliness distributions for international carrier flights. The distribution variance for international carriers is higher than for domestic carriers and a larger percentage of international passengers tend to arrive at the airport earlier than for domestic flights.

Figure 5-4: Earliness Distribution – International Carriers

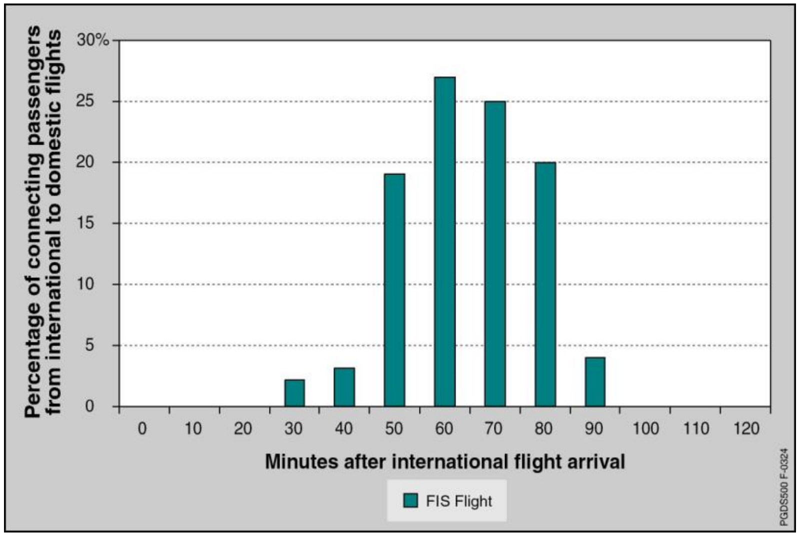


5.2.6.2 International Recheck Passenger Lateness Distributions

A lateness distribution for international recheck passengers specifies the percentage of passengers that exit the Federal Inspection Services facility a specific number of minutes after their flights have landed. Specifically, the lateness distribution is applied to international recheck passengers that need their bags screened. Passengers arriving from international destinations where security screening is not conducted according to TSA protocols and who are connecting to domestic flights need to have their bags screened at the first port of entry into the United States before they are loaded onto any domestic flight.

Lateness distributions have a much shorter duration than earliness distributions because all passengers deplane upon arrival within a relatively short period of time for any given flight. For this reason, the international recheck baggage flows show marked peaks and have very short durations, as shown in Figure 5-5.

Figure 5-5: Lateness Distribution



5.2.7 Checked Bags per Passenger

The average number of checked bags per originating passenger varies by airline, by destination, and by time of year. Extensive in-field data collection efforts and specific data provided by the airlines demonstrate that the actual numbers of checked bags per passenger are:

- Average of 0.6 checked bags per originating passenger for domestic airlines
- Average of 1.2 checked bags per originating passenger serving international markets
- Average of 1.2 recheck bags per international-to-domestic connecting passenger

These are very generic ranges, and planners should obtain and substantiate locally-collected specific values for the types of carriers and markets served. Planners should consider protocol modifications, such as the one prohibiting and subsequently limiting liquids in carry-on baggage that may also affect these ratios.

The estimated number of originating checked bags shall be calculated by multiplying the estimated number of originating passengers by the number of checked bags per passenger assumptions for the ADPM.

Originating Checked Bags = Number of Originating Passengers x Number of Checked Bags per Originating Passenger

The estimated number of international recheck bags shall be calculated by multiplying the estimated number of connecting passengers from international to domestic flights by the number of international recheck bags per passenger assumptions for the ADPM.

International Recheck Bags = Number of Connecting Passengers x Number of International Recheck Bags per Connecting Passenger

The earliness and lateness distributions are used to derive the flows of originating and international recheck bags throughout the day.

Table 5-2 summarizes several potential sources of the key input data used to derive ADPM baggage flows.

Table 5-2: Summary of Input Data Needs and Potential Data Sources

Data	Source(s)
Scheduled airline activity	Official Airline Guides, Inc. Seabury APG Database Airport sponsor Airlines
Charter airline activity	Airport sponsor Charter airlines
Airline boarding load factors	U.S. Department of Transportation Airlines
Percentage of originating passengers	U.S. Department of Transportation Airlines
Earliness and lateness distributions	Airlines In-field surveys
Checked bags per passenger	Airlines In-field surveys
Historical baggage data	TSA
ESM Data	TSA

5.2.8 Calibration of Flight Schedule-Driven Demand

It is recommended that, whenever possible, planners obtain actual baggage counts from all airlines that operate at the screening zones being considered for CBIS design. The above-mentioned methodology for generating baggage flows (using flight schedules, load factors, origin/destination percentage, earliness/lateness distributions, and ratio of bags per passenger) should be calibrated with actual baggage counts for the relevant airlines (If provided as part of the GFI package. If a significant discrepancy in peak hour baggage flow (for the ADPM) is found between the two sources, then planners should consult with the Project Sponsor (see Chapter 2) to resolve the discrepancy.

5.3 Project Future Baggage Flow

The baggage flows derived using the process explained in the previous paragraphs represent the ADPM baggage flows for a particular screening zone in the base year. Baggage flows shall be projected to the specific Design Year before they can be used to determine screening equipment requirements.

5.3.1 Design Year for Equipment Requirements

The design year for equipment requirements shall be five years after the initial DBU for a given baggage screening system (i.e., DBU+5 years). This assumption is based on current TSA policy for system approval. Thus, if a system is scheduled to become operational in 2018, the design year for that system will be 2023.

The EDS equipment requirements shall be listed in 1-year increments in the Basis of Design Report, from DBU through DBU+5 years. This is typically a chart listing EDS units, PVS and SVS workstations by yearly requirements.

Equipment requirements shall be revalidated 12 months prior to equipment delivery. If EDS equipment type changes, the construction start date is delayed, or if the construction schedule causes delays more than 12 months beyond the expected DBU, then a revalidation of EDS and CBRA requirements shall be submitted.

Baggage flow projections can be based on the FAA Terminal Area Forecast (TAF) or on the specific airport's Master Plan forecast (if the Master Plan is current). However, the use of a Master Plan for forecast growth can only be used to limit future growth and cannot exceed the TAF growth rate. In general, the FAA must approve the forecast used to determine design year baggage flows. If, for any reason, local airport and airline staff and their consultants believe that the TAF or the Master Plan forecasts do not properly represent expected growth at the airport, the revised forecast and a detailed explanation of the reasons that the FAA-approved forecast is not acceptable shall be provided to TSA for approval. The demand cannot be higher than the activity level that can be supported by the existing terminal gates for which the CBIS is designed.

The growth rate from the TAF or Master Plan forecast may be uniformly applied to the existing baggage flow, thus preserving current activity patterns, or applied differently if a detailed explanation of the reasons that the current activity pattern is expected to change is provided.

5.3.2 Accommodating Traffic Growth after the Design Year

The equipment requirements documented above are based on a design demand for five years beyond the screening system DBU (i.e., DBU+5 years). It is likely that the initial system will have some excess capacity (e.g., equipment requirements are rounded up and, therefore, equipment will not necessarily reach 100% utilization after five years). This excess capacity should be used to accommodate as much traffic growth as possible before additional costs are incurred to expand the CBIS.

For future planning, the ILDT needs to consider the space required for future growth. The EDS equipment requirements for 10 additional years past DBU+5 years shall be listed in 1-year increments in a separate chart in the Basis of Design Report, from DBU+6 through DBU+15 years (including EDS units, PVS, and SVS workstations).

While increased system utilization may accommodate some additional demand, designers should also seek to provide low-cost flexibility options in the system to incorporate one or more of the following capacity enhancements:

- Upgraded software and/or hardware to improve throughputs of installed equipment.
- Replacement of installed equipment with higher-throughput units and necessary modifications to the BHS to support these units (including providing access to and from the equipment).
- Addition of new equipment and associated BHS infrastructure.

In practice, a combination of one or more of the above approaches could be used. The choice of how additional capacity is to be provided will depend on the constraints of the terminal, the degree of certainty about future traffic growth, the overall capacity of the terminal, and the optimal system type to be installed.

Several examples of how additional capacity could be provided for specific system types are provided below:

- **In-Line CBIS** – These systems could be designed with sufficient queuing capacity, variable frequency drives, and other components to support replacement of EDS units to accommodate traffic growth. Alternatively, designs could preserve space for additional equipment or provide areas where low-cost modifications to facilities might be possible to install additional units. The choice will depend on local traffic, spatial and operational considerations, and life cycle cost projections.
- **Mini In-Line CBIS** – As this system type is based on minimal BHS modifications, it is likely that the BHS of a mini in-line system will not support significantly higher-throughput EDS equipment without significant modifications. Therefore, growth beyond DBU+5 years can be accommodated by (1) new units and associated BHS infrastructure, (2) upgrading the BHS (and possibly the EDS) to support higher throughputs, or (3) replacing the mini in-line system with an in-line system.

- **Stand-Alone CBIS** – Software and hardware improvements may increase system throughput (assuming that bags can be loaded into the EDS units at a fast enough rate to fully utilize the unit). However, it is expected that additional units will be the most likely means of enhancing capacity.

To determine when and if additional capacity will be required, baggage demand and system performance should be monitored and projected on an annual basis. Planners would then be able to anticipate the need for additional capacity and perform any necessary analyses to determine the most cost-effective approach to enhancing system capacity.

As discussed in more detail in Chapter 8, planners should conduct a 20-year life cycle cost analysis for each screening alternative identified and the preferred alternative should be spatially feasible as well as have relatively low life cycle cost. The life cycle cost analysis should include an assessment of the overall costs of different approaches for accommodating growth.

Despite the fact that EDS units are assumed to have 15 years of useful life and ETD machines 10 years of useful life, 20 years is the proper analysis period for the purposes of life cycle cost analysis. This is needed in order to properly assess economic trade-offs between the more capital intensive in-line CBIS with the more labor-intensive stand-alone CBIS. The 20-year analysis period is also the assumed useful life of the BHS equipment.

CHAPTER 6:

METHODOLOGY TO DETERMINE BAGGAGE SCREENING EQUIPMENT REQUIREMENTS

REQUIREMENTS TABLE

Section	Requirement
6.1 Pre Design Phase	In determining EDS equipment requirements, the peak 10-minute period of the design day in the design year (DBU+5) shall be used.
6.1 Pre Design Phase	OSR station and BIS requirements shall be based on the capacity of the EDS equipment.
6.1.1 EDS Equipment Requirements	Equipment requirements shall be based on surged flows obtained by multiplying the design year design day checked baggage flow by a zone-specific surge factor for each 10-minute bin.
6.1.1 EDS Equipment Requirements	The following formula shall be used to calculate the surge factor: $SF = \frac{x + 2\sqrt{x}}{x}$ Where SF = Surge Factor and x = 10-minute baggage flow
6.1.1 EDS Equipment Requirements	The number of EDS units required shall be calculated as follows: $N_{EDS} = \frac{\text{SurgedPeak10MinuteFlow} \times 6}{\text{Throughput}_{EDS}}$ Where $\mathbf{N_{EDS}}$ = Number of EDS units and $\mathbf{Throughput_{EDS}}$ = Number of EDS screened bags per hour
6.1.2 EDS Equipment Redundancy	Redundant equipment shall only be provided when no lower-cost redundancies are possible.
6.1.3 OSR Station Requirements	The number of OSR stations to be actually installed shall be derived based on the total non-redundant EDS capacity. The size of the OSR Room in terms of space allocation shall be based on the number of OSR stations derived based on the total EDS capacity including redundant units.

Section	Requirement
6.1.3 OSR Station Requirements	The number of OSR stations (N_{OSR}) required <u>shall</u> be calculated as follows: $$N_{OSR} = \frac{N_{EDS} \text{ x } Throughput_{EDS} \text{ x } FA_{EDS}}{Throughput_{OSR}}$$ Where: **N_{EDS} x $Throughput_{EDS}$** = Sum of total EDS capacity (throughput) for all EDS units connected to the remote OSR system **FA_{EDS}** = EDS false alarm rate for the EDS equipment selected (see Chapter 3) **$Throughput_{OSR}$** = 3600 / Screening Processing $Time_{OSR}$ where **Screening Processing $Time_{OSR}$** = Average screening time that the OSR operator needs for each bag (see Chapter 3)
6.1.4 Baggage Inspection Station Requirements	The number of BISs to be actually installed <u>shall</u> be derived based on the total non-redundant EDS capacity. The size of the CBRA in terms of space allocation <u>shall</u> be based on the number of BISs derived based on the total EDS capacity.
6.1.4 Baggage Inspection Station Requirements	The number of BISs (N_{BIS}) required <u>shall</u> be calculated as follows: $$N_{BIS} = N_{Alarmed/OOG} + N_{ETD\ Protocol\ OS}$$ $$N_{Alarmed/OOG} = N_{Alarmed/OOG\ Domestic} + N_{Alarmed/OOG\ International}$$ and round to the next whole integer value $$N_{Alarmed/OOG\ Domestic} = \frac{N_{EDS} \times Throughput_{EDS} \times \%\ Domestic \times [FA_{EDS} \times (1 - CR_{OSR}) + R_{LIT} + EDS_{Error}]}{Throughput_{Directed\ Search\ Domestic\ Rate}} + \frac{N_{EDS} \times Throughput_{EDS} \times \%\ Domestic\ OOG}{Throughput_{ETD\ Protocol\ Domestic\ OOG\ Rate}}$$ $$N_{Alarmed/OOG\ International} = \frac{N_{EDS} \times Throughput_{EDS} \times \%\ International \times [FA_{EDS} \times (1 - CR_{OSR}) + R_{LIT} + EDS_{Error}]}{Throughput_{Directed\ Search\ InternationalRate}} + \frac{N_{EDS} \times Throughput_{EDS} \times \%\ International\ OOG}{Throughput_{ETD\ Protocol\ International\ OOG\ Rate}}$$ $$N_{ETD\ Protocol\ OS} = N_{ETD\ Protocol\ Domestic} + N_{ETD\ Protocol\ International}$$ and round to the next whole integer value $$N_{ETD\ Protocol\ Domestic} = \frac{N_{EDS} \times Throughput_{EDS} \times \%\ Domestic\ OS}{Throughput_{ETD\ Protocol\ Domestic\ OS\ Rate}}$$ $$N_{ETD\ Protocol\ International} = \frac{N_{EDS} \times Throughput_{EDS} \times \%\ International\ OS}{Throughput_{ETD\ Protocol\ International\ OS\ Rate}}$$ Where: **N_{EDS}** = the total quantity of EDS units (non-redundant for determining equipment to be actually installed; including redundant for determining space allocation) **$Throughput_{EDS}$** = the rate of the EDS equipment selected (see Chapter 3)

Section	Requirement
	% Domestic OOG = the expected percentage of Domestic Out of Gauge baggage **% International OOG** = the expected percentage of International Out of Gauge baggage **% Domestic OS** = the expected percentage of Domestic Oversize baggage **% International OS** = the expected percentage of International Oversize baggage $\mathbf{EDS_{Error}}$ = the expected EDS error rate percentage (typically 1%) $\mathbf{N_{BIS}}$ = the minimum quantity of baggage inspection stations that are required in the CBRA $\mathbf{N_{Directed\ Search}}$ = quantity of baggage inspection tables that are allotted for the directed search of Domestic and International baggage $\mathbf{N_{Directed\ Search\ Domestic}}$ = quantity of baggage inspection tables that are allotted for the directed search of Domestic baggage $\mathbf{N_{Directed\ Search\ International}}$ = quantity of baggage inspection tables that are allotted for the directed search of International baggage $\mathbf{CR_{OSR}}$ = OSR clear rate (see Chapter 3) $\mathbf{R_{LIT}}$ = the percentage of the bags sent through the EDS units that are anticipated to be "Lost in Tracking" (i.e., to become "Unknowns") $\mathbf{Throughput_{Directed\ Search\ Domestic\ Rate}}$ = the capability of the TSO to process Domestic baggage expressed as a bags per hour rate per TSO (see Chapter 3 table 3-5) $\mathbf{Throughput_{Directed\ Search\ International\ Rate}}$ = the capability of the TSO to process International baggage expressed as a bags per hour rate per TSO (see Chapter 3 table 3-5) $\mathbf{N_{ETD\ Protocol\ OS/OOG}}$ = the quantity of baggage inspection tables that are allotted for the ETD protocol search of Out of Gauge and Oversize baggage for both Domestic and International passengers $\mathbf{N_{ETD\ Protocol\ Domestic}}$ = the quantity of baggage inspection tables that are allotted for the ETD protocol search of Out of Gauge and Oversize baggage for Domestic passengers $\mathbf{N_{ETD\ Protocol\ International}}$ = the quantity of baggage inspection table that are allotted for the ETD protocol search of Out of Gauge and Oversize baggage for International passengers $\mathbf{Throughput_{ETD\ Protocol\ Domestic\ OS/OOG\ Rate}}$ = the capability of the TSO to process Domestic Oversize and Out of Gauge baggage expressed as a bags per hour rate per TSO (see Chapter 3 table 3-5) $\mathbf{Throughput_{ETD\ Protocol\ International\ OS/OOG\ Rate}}$ = the capability of the TSO to process International Oversize and Out of Gauge baggage expressed as a bags per hour rate per TSO (see Chapter 3 table 3-5) $\mathbf{FA_{EDS}}$ = EDS false alarm rate for the EDS equipment selected (see Chapter 3)
6.1.5 ETD Machine Requirements	The number of ETD machines required <u>shall</u> be calculated as follows: $N_{ETD Machines} = \frac{N_{BIS}}{2}$ (Round up to the next ETD)

Section	Requirement
6.2 Schematic and Detailed Design Phases	At the Schematic Design Phase, high-level flow-based modeling shall be used to determine maximum baggage time in system by calculating the shortest and longest times a bag will travel through the system as measured from the natural point(s) of bag induction through an EDS, into and out of the CBRA and for the shortest and longest time for OOG bag travel from natural induction into and out of the CBRA.
6.2 Schematic and Detailed Design Phases	The path(s) used for the high-level flow-based modeling calculations shall also be submitted on plan view drawings.
6.2 Schematic and Detailed Design Phases	At the Detailed Design Phase, once the preferred CBIS has been identified, one of the following means shall be used to further refine the Bag Time in System calculations: The high-level flow-based modeling calculations will be updated based on refined system designs Dynamic simulation will be used
6.2 Schematic and Detailed Design Phases	If dynamic simulation is used the simulation provider shall submit to the Project Sponsor and the TSA Project Coordinator all programming parameters that may be used to adjust the model including but not limited to: Bag distribution methodology Belt speeds Merge windows Spacer/bag gap timers Jam timer Space programmed between bags for diverting Bag spacing at vertical sortation units All statistical distribution used (see Section 6.2.3)

This chapter provides a high-level methodology to determine EDS equipment requirements, OSR station requirements, and BIS requirements in the Pre-Design Phase, as well as an overview of the approach recommended during later design phases to finalize equipment requirements.

During the Pre-Design Phase, the focus is on determining how many EDS units, OSR stations, and BISs are required, given a certain airline grouping, CBIS type, and EDS equipment type. Once all feasible screening zones (airline groupings) have been determined and the baggage flow for each screening zone has been projected for the design year, it is possible to determine the high-level equipment requirements for each screening zone.

6: METHODOLOGY TO DETERMINE BAGGAGE SCREENING EQUIPMENT REQUIREMENTS

6.1 Pre-Design Phase

During the Pre-Design Phase, EDS equipment requirements, EDS equipment redundancy, OSR station requirements, and BIS requirements need to be determined. In determining EDS equipment requirements, the peak 10-minute period of the design day in the design year (DBU+5) shall be used. OSR station and BIS requirements shall be based on the capacity of the EDS equipment.

6.1.1 EDS Equipment Requirements

The following key steps must be completed to determine EDS equipment requirements:

1. Group airlines into screening zones (as discussed in Chapter 5).
2. Project design year baggage demand for each screening zone (as discussed in Chapter 5).
3. Surge design year baggage demand for each screening zone (an explanation of how to surge demand is provided below).
4. Select CBIS type and EDS equipment type (a list of system types, including EDS equipment types and their throughputs, is provided in Chapter 3).

Equipment requirements shall be based on surged flows obtained by multiplying the design year design day checked baggage flow by a zone-specific surge factor* for each 10-minute bin. The use of a surge factor is recommended to capture the intrinsic variance of baggage demand and to ensure that equipment requirements are not undersized. For mini in-line systems the application of a surge factor may not be required. This will be at TSA's discretion. The following formula shall be used to calculate the surge factor:

$$SF = \frac{x + 2\sqrt{x}}{x}$$

where:

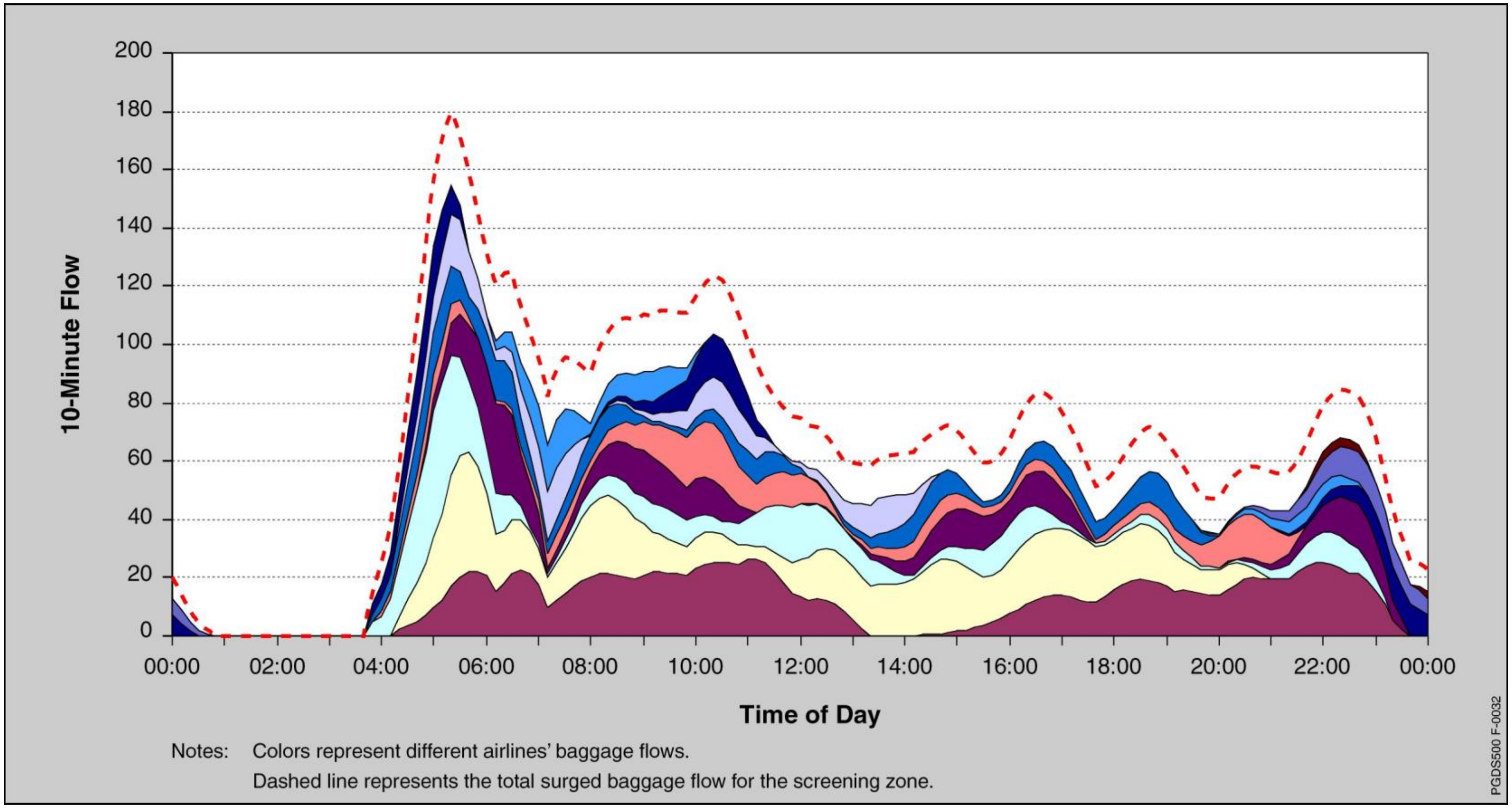
SF = Surge Factor, and

x = 10-minute baggage flow.

* To account for random variability in the expected average flow rate, a surge factor derived from an assumed Poisson arrival process distribution is applied to the peak 10-minute baggage flow. The surged peak 10-minute rate is then normalized to an hourly equivalent load to obtain a design-hour flow rate.

Figure 6-1 shows the 10-minute ADPM checked baggage flow by airline for an example airport; the surged flow is shown by the red dashed line. Each airline is represented by a different color in this figure.

Figure 6-1: 10-Minute Surged ADPM Checked Baggage Flow



To calculate EDS equipment requirements, the surged peak 10-minute design year baggage flow is first converted to surged peak-hour design year baggage flow and then divided by the EDS unit throughput (95% throughput presented in Table 3-1 for in-line systems or appropriate Option and Variant combination for Mini In-line systems).

The number of EDS units required shall be calculated as follows:

$$N_{EDS} = \frac{SurgedPeak10MinuteFlow \times 6}{Throughput_{EDS}}$$

where:

N_{EDS} = Number of EDS units, and

$Throughput_{EDS}$ = Number of EDS screened bags per hour (see Chapter 3).

Example: The peak 10-minute flow shown in Figure 6-1 is 157 bags per 10-minute period. The surge factor applied to this flow is approximately 1.14, which yields a surged flow of 179 bags per 10-minute period, or 1,074 bags per hour. To calculate EDS equipment requirements for a In-line CBIS using L-3 eXaminer 3DX 6700 equipment (Type I) at a throughput of 505 bags per hour, 1,074 bags per hour would be divided by 505 bags per hour, which results in 2.13. Rounding up to the nearest whole number of EDS units required implies that a CBIS with three EDS units would be necessary, without considering redundancy (as discussed later in this chapter).

As screening systems are sized using the ADPM, screening demand will, at times, exceed capacity over the course of the year. Depending on the duration of the over-capacity conditions, specific contingency measures should be implemented, as described in Chapter 11.

6.1.2 EDS Equipment Redundancy

Estimating EDS equipment requirements based on surged peak-hour baggage flow will result in adequate capacity during typical operating conditions. However, EDS equipment cannot be assumed to be 100% reliable. Given the central role of EDS as the primary screening technology for checked baggage inspection, redundancy must be provided to account for the potential that EDS equipment will be inoperable during certain peak periods. For mini in-line systems redundant EDS equipment is not allowed.

To attain the best possible values for operational availability, an additional EDS unit will be supplied per EDS unit grouping. A grouping is defined as a quantity of EDS units situated together and fed from a single mainline.

The quantity of mainlines, as well as the quantity of EDS units in a CBIS should be minimized. This increases efficiency, operational availability, and reduces cost.

The redundant EDS units are intended to provide replacement capacity in the event that some of the nonredundant EDS units are out-of-service for a period of time.

Redundant equipment shall only be provided when no lower-cost redundancies are possible. For instance, for decentralized systems (such as mini in-line or stand-alone systems), redundancy can be provided through the use of other nearby systems. It is expected that redundant equipment will only be cost-effective for In-line CBIS types, where unit downtime can have a significant effect on system performance.

TSA will endorse the CBIS right of way for future growth but reserves the right to delay providing all screening equipment beyond those necessary to accommodate DBU+5 years until growth projections are met.

6.1.3 OSR Station Requirements

For certain system types, the OSR can be centralized and remotely located.

The degree of centralization can also vary from totally centralized OSR systems that serve the entire airport to OSR systems dedicated to each CBIS. If the system type supports a remotely located OSR system, several considerations should guide the selection of the appropriate degree of system centralization, including TSA staffing, space requirements, and IT infrastructure requirements.

Thus, to select the best OSR system type and location, it is recommended that OSR options be evaluated by assessing OSR staffing needs, capital costs of IT infrastructure and building modifications, and O&M costs associated with each option.

The number of OSR stations to be actually installed shall be derived based on the total non-redundant EDS capacity. The size of the OSR Room in terms of space allocation shall be based on the number of OSR stations derived based on the total EDS capacity including redundant units.

The number of OSR stations (N_{OSR}) required shall be calculated as follows:

$$N_{OSR} = \frac{N_{EDS} \times Throughput_{EDS} \times FA_{EDS}}{Throughput_{OSR}}$$

where:

N_{EDS} x $Throughput_{EDS}$ = Sum of total EDS capacity (throughput) for all EDS units connected to the remote OSR system;

FA_{EDS} = EDS false alarm rate for the EDS equipment selected (see Chapter 3); and

$Throughput_{OSR}$ = 3600 / Screening Processing $Time_{OSR}$

where:

Screening Processing Time = Average screening time that the OSR operator needs for each bag (see Chapter 3).

Example: Continuing the example earlier in this section, a CBIS with 3 L-3 eXaminer 3DX 6700 EDS units would need a total of 2 OSR stations [(3 EDS units x 505 bags per hour x 20%) / (180 bag images per hour) = 1.7 OSR operators], rounded up to 2 OSR operators or 2 stations].

The false alarm rate shown in the above example is used for illustrative purposes only. Official planning values for EDS false alarm rates are considered Sensitive Security Information. Please contact TSA to obtain this information.

6.1.4 Baggage Inspection Station Requirements

BISs are accommodated in CBRAs. In general, an ETD machine is shared between two TSOs because the amount of time the ETD machine is used during the total screening process for a bag is relatively short. Thus, the ratio of BISs to ETD equipment is typically two to one.

The following key inputs are necessary to calculate BIS requirements:

- Total sum of EDS capacity (throughput) for all EDS units connected to the CBRA (sum of Throughput_{EDS})
- EDS false alarm (FA) rate for the EDS equipment selected (FA_{EDS}) (see Chapter 3)
- OSR clear rate (CR_{OSR}) (see Chapter 3)
- Average ETD screening time per TSO, from which it is possible to derive the average ETD throughput per TSO (Throughput_{ETD}) (see Chapter 3)
- Average rate of OS and OOG bags (Domestic and International)
  - Average rate of Lost-in-Tracking bags
  - BIS Requirements with Remote OSR

<u>The number of BISs to be actually installed shall be derived based on the total non-redundant EDS capacity. The size of the CBRA in terms of space allocation shall be based on the number of BISs derived based on the total EDS capacity.</u>

The number of BISs (N_{BIS}) required shall be calculated as follows:

$$N_{BIS} = N_{Alarmed/OOG} + N_{ETD\ Protocol\ OS}$$

$$N_{Alarmed/OOG} = N_{Alarmed/OOG\ Domestic} + N_{Alarmed/OOG\ International} \text{ and round to the next whole integer value}$$

$$N_{Alarmed/OOG\ Domestic} = \frac{N_{EDS} \times Throughput_{EDS} \times \%\ Domestic \times [FA_{EDS} \times (1 - CR_{OSR}) + R_{LIT} + EDS_{Error}]}{Throughput_{Directed\ Search\ Domestic\ Rate}} + \frac{N_{EDS} \times Throughput_{EDS} \times \%\ Domestic\ OOG}{Throughput_{ETD\ Protocol\ Domestic\ OOG\ Rate}}$$

$$N_{Alarmed/OOG\ International} = \frac{N_{EDS} \times Throughput_{EDS} \times \%\ International \times [FA_{EDS} \times (1 - CR_{OSR}) + R_{LIT} + EDS_{Error}]}{Throughput_{Directed\ Search\ InternationalRate}} + \frac{N_{EDS} \times Throughput_{EDS} \times \%\ International\ OOG}{Throughput_{ETD\ Protocol\ International\ OOG\ Rate}}$$

$$N_{ETD\ Protocol\ OS} = N_{ETD\ Protocol\ Domestic} + N_{ETD\ Protocol\ International} \text{ and round to the next whole integer value}$$

$$N_{ETD\ Protocol\ Domestic} = \frac{N_{EDS} \times Throughput_{EDS} \times \%\ Domestic\ OS}{Throughput_{ETD\ Protocol\ Domestic\ OS\ Rate}}$$

$$N_{ETD\ Protocol\ International} = \frac{N_{EDS} \times Throughput_{EDS} \times \%\ International\ OS}{Throughput_{ETD\ Protocol\ International\ OS\ Rate}}$$

Where:

N_{EDS} = the total quantity of EDS units (non-redundant for determining equipment to be actually installed; including redundant for determining space allocation).

$Throughput_{EDS}$ = the rate of the EDS equipment selected (see Chapter 3)

% Domestic OOG = the expected percentage of Domestic Out of Gauge baggage

% International OOG = the expected percentage of International Out of Gauge baggage

% Domestic OS = the expected percentage of Domestic Oversize baggage

% International OS = the expected percentage of International Oversize baggage

EDS_{Error} = the expected EDS error rate percentage (typically 1%)

N_{BIS} = the minimum quantity of baggage inspection stations that are required in the CBRA

$N_{Directed\ Search}$ = quantity of baggage inspection tables that are allotted for the directed search of Domestic and International baggage

$N_{Directed\ Search\ Domestic}$ = quantity of baggage inspection tables that are allotted for the directed search of Domestic baggage

$N_{Directed\ Search\ International}$ = quantity of baggage inspection tables that are allotted for the directed search of International baggage

CR_{OSR} = OSR clear rate (see Chapter 3)

R_{LIT} = the percentage of the bags sent through the EDS units that are anticipated to be “Lost in Tracking” (i.e., to become “Unknowns”).

$Throughput_{Directed\ Search\ Domestic\ Rate}$ = the capability of the TSO to process Domestic baggage expressed as a bags per hour rate per TSO (see Chapter 3 Table 3-3).

$Throughput_{Directed\ Search\ International\ Rate}$ = the capability of the TSO to process International baggage expressed as a bags per hour rate per TSO (see Chapter 3 Table 3-3).

$N_{ETD\ Protocol\ OS/OOG}$ = the quantity of baggage inspection tables that are allotted for the ETD protocol search of Out of Gauge and Oversize baggage for both Domestic and International passengers.

$N_{ETD\ Protocol\ Domestic}$ = the quantity of baggage inspection tables that are allotted for the ETD protocol search of Out of Gauge and Oversize baggage for Domestic passengers.

$N_{ETD\ Protocol\ International}$ = the quantity of baggage inspection table that are allotted for the ETD protocol search of Out of Gauge and Oversize baggage for International passengers.

$Throughput_{ETD\ Protocol\ Domestic\ OS/OOG\ Rate}$ = the capability of the TSO to process Domestic Oversize and Out of Gauge baggage expressed as a bags per hour rate per TSO (see Chapter 3 Table 3-3).

$Throughput_{ETD\ Protocol\ International\ OS/OOG\ Rate}$ = the capability of the TSO to process International Oversize and Out of Gauge baggage expressed as a bags per hour rate per TSO (see Chapter 3 Table 3-3).

FA_{EDS} = EDS false alarm rate for the EDS equipment selected (see Chapter 3).

6.1.5 ETD Machine Requirements

<u>The number of ETD machines required shall be calculated as follows:</u>

$$N_{ETD}\ Machines = \frac{N_{BIT}}{2} \quad \text{(Round up to the next ETD)}$$

Example: Continuing the example used earlier in this section, a CBIS with 3 L-3 eXaminer 3DX 6700 EDS units would need a total of 9 BISs [(3 EDS units x 513 bags per hour x 20% x 40%+4%+1%) / (24.2 bags per hour) = 8.86 ETD stations, rounded up to 9 stations]. The total number of ETD machines required would be 5 (9/2 = 4.5 rounded up to 5 ETD machines).

NOTES:

- In determining ETD TSO throughput rates for remote OSR, it is assumed that each TSO has a dedicated viewing station.
- The false alarm rate and OSR clear rate shown in the above example are used for illustrative purposes only. Official planning values for EDS false alarm rates are considered SSI. Please contact TSA to obtain this information.

CBRA design requirements are addressed in Chapter 9.

6.2 Schematic and Detailed Design Phases

During the Pre-Design Phase, several conceptual screening alternatives should be evaluated. Thus, the methodology used during that phase is intended to provide quick estimates of EDS, OSR, and ETD screening requirements for each alternative concept. As explained in more detail earlier in this chapter, this methodology is based on baggage flow estimates and assumptions regarding average throughputs and false alarm rates.

Once the number of feasible alternatives has been reduced and those remaining feasible alternatives compared based on the life cycle cost methodologies described in Chapter 8, detailed simulation modeling can be used to further evaluate the alternatives, refine equipment requirements, and evaluate CBIS performance. Simulation modeling helps planners, architects, and CBIS designers transition from high-level concepts to more detailed design. It can also serve as a feedback loop between designers and the BHSC regarding the system parameters needed for effective operation of the CBIS.

<u>At the **Schematic Design Phase**, high-level flow-based modeling shall be used to determine maximum baggage time in system by calculating the shortest and longest times a bag will travel through the system as measured from the natural point(s) of bag induction through an EDS, into and out of the CBRA and for the shortest and longest time for OOG bag travel from natural induction into and out of the CBRA. The path(s) used for the high-level flow-based modeling calculations shall also be submitted to TSA on plan view drawings.</u>

For the purpose of these calculations, assume constant bag flow based on the design speeds from induction to CBRA with no provision for jams, faults, or halting for merging or diverting. For complicated system designs, nonvisual simulation modeling may prove beneficial and can be performed at the Project Sponsor's discretion.

<u>At the **Detailed Design Phase**, once the preferred CBIS has been identified, one of the following means shall be used to further refine the Bag Time in System calculations:</u>

- The high-level flow-based modeling calculations will be updated based on refined system designs
- Dynamic simulation will be used

Dynamic simulation can provide designers with the ability to:

- Finalize the detailed components of the baggage handling and screening system (e.g., number of queuing belts, conveyor speeds, exact location of merge and diversion points, exact amount of buffering required)
- Assist baggage designers with PLC specifications and requirements
- Refine the evaluation of system performance
- Visualize the final design to assist with stakeholder review and approval

If dynamic simulation is used the simulation provider shall submit to the Project Sponsor and the TSA Project Coordinator all programming parameters that may be used to adjust the model including but not limited to:

- Bag distribution methodology
- Belt speeds
- Merge windows
- Spacer/bag gap timers
- Jam timer
- Space programmed between bags for diverting
- Bag spacing at vertical sortation units
- All statistical distributions used (see Section 6.3.2)

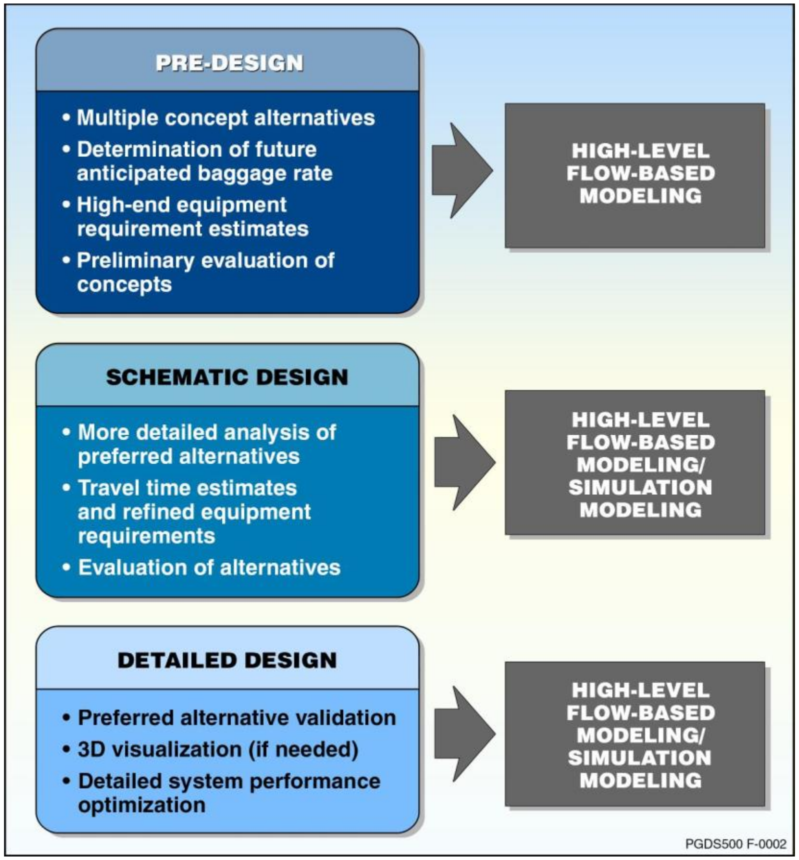
The Project Sponsor should share all dynamic simulation parameters used with the BHSC once contracted to ensure that the BHSC is using the same programming parameters used in the simulation and the CBIS will perform as shown in the simulation.

If any parameters are changed as a result of the construction process, an updated simulation should be performed and the results submitted to the TSA Project Coordinator to confirm CBIS performance sill meets the established requirements.

Commercially available simulation packages, as well as proprietary packages, can be used for the Detailed Design Phase.

Figure 6-2 summarizes the key elements of each phase and the analytical modeling approach used to assess requirements.

Figure 6-2: Approach to Modeling CBIS Requirements



6.3 Recommended Simulation Approach

When developing CBIS simulations, it is recommended that the following approach be used to verify the performance of CBIS designs and to ensure standardization of simulation development. Using a commonly accepted approach during simulation development will enable more efficient use of the simulation results and improve the screening solutions.

The CBIS simulation should include CBRA operations (i.e., conveyors leading to CBRA, bags queuing within CBRA, screening process, and bag reinsertion into the CBIS).

6.3.1 General Approach

As shown previously in Figure 6-2, the following standards and methodology should be used during the development of any simulation:

1. Begin with a layout of the CBIS, including accurate conveyor lengths, equipment used, and conveyor belt speeds.
2. Program system control logic, including transfers, merges, belt speeds, and bag spacing designed for the EDS equipment being used.
3. Use the design day flight schedule and other assumptions (load factors, earliness distributions, etc.) developed during the Pre-Design phase regarding the flight schedule to determine baggage demand input to the simulation model for the specific airport.
4. In a simulation effort, if the baggage rate is sampled in 1-minute intervals, the surge factor should not be applied. (The Surge factor is a correction to offset the averaging incurred – in 10 minute intervals – during the ADPM process, and is not relevant if the sampling is done in 1-minute increments).
5. Assume that the redundant EDS unit (see Section 6.1.2) is operational for the entire simulation period.
6. Multiple simulations should be performed for the design day, to explore the sensitivity of the simulation to variables which may change randomly.
7. For systems using laser scanners, assume a no-read or misread rate of 8.0%. For systems using RFID scanners, assume a no-read or misread rate of 1.5%.
8. Identify potential locations for jams throughout the system and program realistic jam rates. If historical data is available on jam rates by system location, then that information should be used. For new systems, an overall 0.5% jam rate can be applied to occur randomly at baggage transition points within the system

6.3.2 Statistical Distributions

Whenever possible, planners should obtain specific and updated ETD and OSR processing distributions from TSA. However, if these distributions are not available, the following distributions can be used:

- **Time to clear bag jams** – Use a triangular probability distribution to simulate the clearing of jams, with a minimum time value of 0.5 minute, most likely time value of 1.5 minutes, and maximum time value of 5.0 minutes.
- **OSR** protocol for EDS alarmed bags – Use a gamma distribution where the mean is 30.0 seconds, the standard deviation is 7.5 seconds, the minimum value is 5.0 seconds, and the maximum value is 45.0 seconds.

- **ETD** protocol for oversize bags – Use a gamma distribution. Distribution parameters are considered Sensitive Security Information. Please contact TSA to obtain required information.
- **ETD** directed search of EDS alarmed bag – Use a gamma distribution. Distribution parameters are considered Sensitive Security Information. Please contact TSA to obtain required information.
- If possible, **baggage size** (length, width, height, and weight) should be distributed based on data collection at the airport or data provided by the airport operator or airlines. When actual data are unavailable, the distribution of bags listed in Appendix D should be used with an average bag length of 28 inches (a conservative average for domestic baggage length) and bag spacing of 12 inches at the entrance of the EDS units. For international operations, an average bag length of 32" should be used.
- The **baggage weight** distribution will assist TSA in selecting the type of lift-assist devices to reduce or eliminate manual baggage lifting and handling in the CBRA.

CHAPTER 7:

CBIS DESIGN PRINCIPLES

REQUIREMENTS TABLE

Section	Requirement	Testing	Design	Process
7.2 Specific Design Principles	Legacy baggage handling systems shall not affect the performance of the CBIS.		X	
7.2 Specific Design Principles	The Project Sponsor shall ensure compliance with the EDS OEM's site planning and installation guidelines.		X	
7.2.1 BHS Capacity	For new systems, no component of the CBIS shall constrain the maximum qualified capacity of each EDS unit. For recapitalization projects the existing CBIS capacity shall not be reduced.	X	X	
7.2.1.1 Mainline Requirements	Mainlines shall be capable of delivering bags to the EDS units to equal the capacity of the total non-redundant EDS units.		X	
7.2.1.1 Mainline Requirements	Mainlines taking bags away from the EDS unit shall be capable of transporting bags equal to or greater than the capacity of the non-redundant EDS units.		X	
7.2.1.2 Tail-to-Head Bag Spacing Requirement	For slider bed conveyors, the space between bags as measured from the trailing edge of leading bag to the leading edge of the trailing bag, or "tail-to-head spacing," shall be no less than 12 inches as bags enter the EDS unit.	X	X	
7.2.1.2 Tail-to-Head Bag Spacing Requirement	The speed of the queue belt immediately before and after the EDS unit as bags transition into and out of the EDS shall comply with the EDS Integration manual.	X	X	
7.2.1.2 Tail-to-Head Bag Spacing Requirement	For ICS the space between carriers shall be as determined by the EDS manufacturer and their ability to clearly delineate between carriers. The BHS must also be able to maintain positive tracking.	X	X	
7.2.2 Screening Throughput Capacity Requirement	The actual screening throughput capacity as tested in accordance with the information presented in Appendix D shall meet or exceed the TSA-identified 95% screening throughput capacity as defined in Table 3-1 which is calculated as the product of: (a) the number of EDS units provided (excluding any redundant units) and (b) the 95% screening throughput capacity per EDS unit.	X		
7.2.4.1 OSR Decision Time Requirements, In-Line Systems	For in-line systems, the CBIS shall allow a minimum of 45 seconds of BTT between the exit from the EDS and the final diversion trigger point to the CBRA without holding bags.	X	X	
7.2.4.2 OSR Decision Time Requirements, Mini In-Line Systems	For mini in-line systems, the minimum BTT shall be 60 seconds.	X	X	

Section	Requirement	Testing	Design	Process
7.2.4.2 OSR Decision Time Requirements, Mini In-Line Systems	For mini in-line systems, the minimum design OVT shall be 25 seconds for each alarm bag, for up to 3 consecutives alarm bags.	X	X	
7.2.5.1 CBIS Positive Bag Tracking Requirements	The CBIS shall be capable of maintaining positive bag tracking in the STZ during events (e.g., diebacks, merging, decision point transitions, etc.) that are typical of situations which may occur in baggage handling systems.	X		
7.2.5.1.1 Pre-EDS Requirements	The BHS shall assign a unique tracking ID (BHS Bag ID Pseudo) to each bag once the bag enters the STZ within the CBIS for the purposes of positive bag tracking.	X		
7.2.5.1.1 Pre-EDS Requirements	The CBIS shall incorporate an ATR upstream of the EDS matrix.		X	
7.2.5.1.1 Pre-EDS Requirements	ATR read rates shall be no less than 98% for laser arrays and 99% for RFID applications for valid reads for that system during controlled testing.	X		
7.2.5.1.1 Pre-EDS Requirements	The BHS Bag ID (pseudo) shall be used for tracking purposes.	X		
7.2.5.1.1 Pre-EDS Requirements	All systems utilizing an ATR shall maintain a relation between the BHS tracking ID and the 10-digit IATA bag tag ID for all bags that are successfully read.	X		
7.2.5.1.1 Pre-EDS Requirements	The BHS Bag ID (pseudo) shall be used as the Primary ID passed from the BHS to the EDS. In all systems where an ATR is present, the 10-digit IATA bag tag data shall also be passed from the BHS to the EDS. CBIS tracking shall in no way be controlled or constrained by a sort controller where the relation is maintained within the PLC.	X		
7.2.5.1.1 Pre-EDS Requirements	The BHS Bag ID (pseudo) and, if available, the 10-digit IATA bag tag data shall be transferred between BHS and EDS equipment as defined by each EDS manufacturer's interface requirements document or integration guide. If the EDS does not accept both a BHS Bag ID (pseudo) and an 10-digit IATA bag tag ID, then the 10-digit IATA bag tag ID shall be transferred to the EDS.	X		
7.2.5.1.1 Pre-EDS Requirements	The upstream IATA tracking accuracy shall be calculated and reported in the Daily CBIS Summary Report, Figure A-6 by summing the quantity of the 10-digit IATA bag tags that are successfully handed off to the EDS units, R_{EDS}, with the quantity of 10-digit IATA bag tags that are seen by the photo eye (PE) just past the OOG divert location, $R_{OOG\,@\,PE}$, all divided by the quantity of 10-digit IATA bag tags that are successfully read by the ATR and supplied to the BHS, R. This value shall be displayed as a percentage and shall be at least 97%.	X		
7.2.5.1.1 Pre-EDS Requirements	The BHS OEM shall ensure EDS Bag ID overlap does not occur between any EDS unit within any matrix.			X

Section	Requirement	Testing	Design	Process
7.2.5.1.1 Pre-EDS Requirements	BHS Bag IDs (pseudo) and/or EDS Bag IDs shall not overlap with IATA requirements for Bag Tag IDs or repeat themselves within 24 hours in a calendar day (i.e., unique BHS/EDS Bag IDs are required for a duration of 24 hours).	X		
7.2.5.1.1 Pre-EDS Requirements	The OOG tracking accuracy (absolute) shall be calculated by dividing the quantity of successfully tracked OOG bags just after the OOG divert location by the total OOG bags detected at the BMA. This value shall be displayed as a percentage in the Daily CBIS Summary Report (Figure A-6) and shall be at least 97%.	X		
7.2.5.1.1 Pre-EDS Requirements	The Invalid OOG Arrival percentage shall be measured just after the OOG divert location and calculated by subtracting the known OOG bags, $R_{OOG\ @\ PE} + R_{NR,\ OOG\ @\ PE}$, from the total quantity of bags at the same location, all divided by the total quantity of bags at the same location. This value shall be displayed as a percentage in the Daily CBIS Summary Report (Figure A-6).	X		
7.2.5.1.2 Post-EDS Requirements	When the EDS passes a decision to the BHS, the BHS shall retain this status throughout the tracking process for each bag and never override the EDS decision.	X		
7.2.5.1.2 Post-EDS Requirements	If a decision is not received from the EDS, the BHS shall assign a Communication Error status for tracking purposes.	X		
7.2.5.1.2 Post-EDS Requirements	At no time shall the system swap or transfer BHS tracking IDs on or between bags nor swap or transfer security screening decisions on or between bags.	X		
7.2.5.1.2 Post-EDS Requirements	Invalid arrivals at CBRA shall be monitored and logged via the BHS reporting system.	X		
7.2.5.1.2 Post-EDS Requirements	Appropriately displayed Timeout and EDS Error arrival status bags are considered Invalid, but are excluded from the Invalid CBRA Arrival rate. These are not included in the Invalid CBRA Arrival rate calculation, but shall be separately tracked, as any of these arrivals represent a system deficiency as follows: Timeouts – any during controlled testing not caused by testing and any in live operations, and EDS Errors - any during controlled testing and a rate above 1% during live operations.	X		
7.2.5.1.2 Post-EDS Requirements	The Invalid CBRA Arrival rate allowed for controlled testing and live operations shall not exceed 3% in a CBRA designed with a bag reinsertion line (BRL), and not exceed 2% in a CBRA designed without a BRL.	X		
7.2.5.1.2 Post-EDS Requirements	In the event of a BHS or EDS emergency stop (e-stop) activation, the system shall maintain tracking of all bags screened by the EDS.	X		
7.2.5.1.2 Post-EDS Requirements	In the event of a BHS or EDS emergency stop (e-stop) activation, the system shall maintain the security status of all bags that have been screened by the EDS.	X		

Section	Requirement	Testing	Design	Process
7.2.5.1.2 Post-EDS Requirements	In the event of a BHS or EDS emergency stop (e-stop) activation, the system shall maintain the security decision transmitted from the EDS to the BHS prior to or after activation of either a BHS or EDS e-stop.	X		
7.2.5.1.2 Post-EDS Requirements	The EDS shall recover from the e-stop condition in accordance with published criteria from the EDS vendor and the BHS shall recover per established e-stop recovery procedures defined in the BHS specifications and in accordance with the OEM's Integration Guidelines.	X		
7.2.5.1.3 CBIS Detection Requirements	The CBIS shall be capable of detecting when any bag infringes on the tracking window of any other bag as long as the bags are at or above the minimum conveyance size and the bag is not on top of, underneath, or directly beside another bag: Any bag with a conveyable dimension less than 12 inches should be placed in a tub. The minimum conveyable bag should measure at least 12 inches in any dimension.	X		
7.2.5.1.3 CBIS Detection Requirements	The CBIS shall be capable of detecting when a bag has been delayed or accelerated in accordance with Appendix D, Section D.3.2 and Section D.3.3.	X		
7.2.5.1.3 CBIS Detection Requirements	Delaying or accelerating a bag beyond the configured tracking tolerance shall result in application of one of the following solutions: Upstream of EDS (single bag): The CBIS shall reacquire the bag and continue tracking. Downstream of EDS (single bag): If the bag has already been screened and traveled downstream of the EDS, any security status assigned to the bag will no longer be considered valid and the bag shall be routed to the CBRA. Downstream of EDS (multiple bags): If multiple bags are involved and tracking windows have been infringed upon, then the CBIS shall be capable of detecting this condition and route all bags involved to the CBRA.	X		
7.2.5.1.3 CBIS Detection Requirements	The CBIS shall be capable of detecting when a bag has been added within the tracking zone as long as that bag is added anywhere other than on top of, underneath, or directly beside another bag. Upstream of EDS (single bag): The CBIS shall acquire the bag and continue tracking. Downstream of EDS (single bag): If the addition occurs downstream of the EDS and only the added bag itself is affected (added bag does not infringe on the tracking window of another bag), then the added bag shall be routed to the CBRA.	X		
7.2.6.1 Divert and Merge Requirements	Bags exiting each EDS unit shall be separated by their clear or non-clear screening status prior to merging onto the post-EDS mainline or OSR line. ICS carriers shall be separated by their clear or non-clear status at the first opportunity but may travel on the OSR line.		X	

Section	Requirement	Testing	Design	Process
7.2.6.1 Divert and Merge Requirements	After clear and non-clear bags have been separated, they shall not be commingled.	X	X	
7.2.6.1 Divert and Merge Requirements	Only clear bags shall be diverted at horizontal diverters; non-clear bags shall pass through. At vertical diverters, clear bags shall divert up and non-clear bags shall divert down.	X	X	
7.2.6.1 Divert and Merge Requirements	The following requirements apply to diverters in the security tracking zone downstream of the EDS units: For systems with two decision point diverters, at the first decision point diverter, if the system is unable to divert a clear bag, the bag shall bypass the diverter on the Alarm Line. For systems with a single decision point diverter and at second chance diverters, if the system is unable to divert a clear bag, the bag shall cascade stop and NOT bypass the diverter on the Alarm Line. The CBIS may have a bypass feature to allow clear bags to bypass all diverters during fault conditions and be sent to the CBRA. The bypass feature shall be enabled and disabled via an operator's workstation in the BHS control room. Bypass features that send non-clear bags to the outbound system shall not be allowed.	X	X	
7.2.6.2 Bag Allocation Methodology	All new CBIS designs shall incorporate a round-robin BAM, in which bags are routed singularly and consecutively to each available SS line. Deviations from round-robin BAM shall be submitted through an RFV for review and approval by TSA.	X	X	
7.2.7.2 Out-Of-Gauge Bag Requirement	The CBIS shall transport OOG bags directly to the CBRA.	X		
7.2.7.2 Out-Of-Gauge Bag Requirement	To minimize bags on the OOG line, bags that do not have dimension information or that may have been lost in tracking after the BMA shall be transported to an EDS shunt, not the OOG line. Additionally, an over-height protective device shall be installed two queues in front of each EDS unit, e.g. an over-height photo eye, light curtain, headache bar or other similar device to ensure over height bags are stopped prior to the EDS unit.	X	X	
7.2.8.1 Fail-Safe Operation General Requirements	In the event of a fail-safe activation, the default path for any non-clear bag shall be to a secure location. Non-clear bags shall never be sent to an airside location.	X		
7.2.8.1 Fail-Safe Operation General Requirements	Fail-safe activations shall not exceed 0.5% of bag volume for each system test in controlled testing as measured by dividing the number of Fail-Safe activations at all Decision Diversion Points by Total Bags Inducted.	X		

Section	Requirement	Testing	Design	Process
7.2.8.1 Fail-Safe Operation General Requirements	Fail-safe activations shall not exceed 0.5% of bag volume during the Daily Peak Hour and 24-Hour Calendar Day as measured using by dividing the # of Fail-Safe activations at all Decision Diversion Points by Total Bags Inducted the Daily CBIS Summary Report defined in Appendix A.	X		
7.2.8.1 Fail-Safe Operation General Requirements	The sidewalls of all conveyors or portions of conveyors associated with the fail-safe zone shall be clearly marked or identified to support appropriate bag removal.	X		
7.2.8.1 Fail-Safe Operation General Requirements	Fail-safe alarms shall be distinct from all other types of system event alarms.	X		
7.2.8.2 Fail-Safe Operation Requirements for In-Line CBIS	Bag length shall be measured at a photo eye no more than two queue conveyors upstream of the EDS unit. This measurement shall be established as the bag's baseline length. The use of a dual speed conveyor shall not negatively affect this measurement in any way.	X		
7.2.8.2 Fail-Safe Operation Requirements for In-Line CBIS	Bags shall be tracked though each diverter downstream of the EDS unit(s) prior to the CBRA. A single bag failing to track from the decision photo eye upstream of the diverter to the fail-safe photo eye on the Alarm Line downstream of the diverter shall activate a fail-safe condition.	X		
7.2.8.2 Fail-Safe Operation Requirements for In-Line CBIS	Upon activation of a fail-safe: The appropriate number of conveyors on the clear bag line, as calculated in Item 4 below, shall stop; and, Activate audible and visible fail-safe alarms in locations(s) designated by TSA.	X		
7.2.8.2 Fail-Safe Operation Requirements for In-Line CBIS	The length of clear bag line conveyors to stop shall be calculated as follows: 1. Measure the amount of time for a bag to travel from the tracking/decision point photo eye before the diverter to the fail-safe photo eye after the diverter. 2. Measure the distance a bag travels in the amount of time measured above from the tracking/decision point photo eye before the diverter down the Clear Line. 3. Add an additional five feet to the measured distance above. 4. All conveyors on the Clear Line within the distance measured above shall be identified and stopped as the fail-safe zone. 5. To account for unique project requirements, additional conveyor(s) may be identified and stopped as a part of the fail-safe zone. However, under no circumstances shall fewer conveyor(s) be identified and stopped as the fail-safe zone.	X		

Section	Requirement	Testing	Design	Process
7.2.8.2 Fail-Safe Operation Requirements for In-Line CBIS	For systems with more than one diverter between the EDS unit(s) and the CBRA, during a fail-safe activation at the first chance diverter, clear bags shall pass the diverter on the Alarm Line to be diverted at the second chance diverter.	X		
7.2.8.2 Fail-Safe Operation Requirements for In-Line CBIS	For systems with a single diverter and at the second-chance diverter, during a fail-safe activation at this diverter, clear bags shall not pass the diverter and shall cascade stop upstream of the diverter.	X		
7.2.8.2 Fail-Safe Operation Requirements for In-Line CBIS	Bag length shall be re-measured at the decision photo eye immediately upstream of the diverter. This measurement shall be compared to the bag's baseline length. Any bag that has increased in length by 12 inches or more at the decision photo eye upstream of the diverter shall be conveyed to the CBRA with a status of 'Length Change'.	X		
7.2.8.3 Fail-Safe Operation Requirements for a Manually Operated In-Line Decision Point CBIS	In case of a fail-safe event, the BHS shall identify non-clear bags and perform one of the following actions: Recognize the condition as a non-clear bag on the Clear Line; or, Maintain a halt condition on the Clear Line beyond the manually operated in-line decision point except when a clear bag has been successfully transported through the in-line decision point (i.e., bag information for any non-clear bags has been cleared and a clear bag is either approaching the in-line point or a bag has been processed manually at the CBRA and is reinserted at the reinsertion point through the use of local BHS controls); and, Activate audible and visible fail-safe alarms in location(s) designated by TSA	X		
7.2.9.1 OTK Test Requirements	Specific OTK Test controls shall be built into the CBIS in coordination with the EDS and BHS vendors and their integration documentation.		X	
7.2.9.1 OTK Test Requirements	The OTK testing controls shall be appropriately located to control the OTK Test with minimal walking between the controls, OTK load point and OTK unload point, and between adjacent units so that two units can be tested from one location.	X	X	
7.2.9.1 OTK Test Requirements	The conveyors immediately before and after each EDS shall be straight with a maximum angle of 0 degrees.		X	

Section	Requirement	Testing	Design	Process
7.2.9.1 OTK Test Requirements	OTK testing controls shall enable an operator to: Stop the normal flow of bags into the EDS without losing track of bags already in the system Allow the OTK bag to be placed safely and properly onto the EDS entrance conveyor; the sideguard height at this interface point shall not exceed 4 inches and have no protrusions or sharp edges Restart the EDS entrance conveyor to feed the OTK bag into the EDS Stop the OTK bag on the EDS exit conveyor to allow removal of the IQT bag; the sideguard height at this removal point shall not exceed 4 inches and have no protrusions or sharp edges Allow for repeat of OTK Tests as necessary Return the system to normal screening operation	X		
7.2.9.1 OTK Test Requirements	All of the OTK processes shall be supported without requiring a shutdown and restart of the CBIS from a MCP or other location. The OTK control station shall consist of a keyless, selector type switch to enable the OTK test mode. The OTK test activation signal shall be annunciated in the BHS control room	X		
7.2.10.1 Bag Jam Requirements	The bag jam rate is calculated by dividing the number of jam events (hard and missing) from the ATRs on the SF line through all the EDS shunt lines to the entrance of the EDS by the total bags inducted. The Jam Rate shall be less than 1%. During controlled testing, the bag jam rate for each system test shall be less than 1% of inducted bag volume is calculated by dividing the number of jam events (hard and missing) from the ATRs on the SF line through all the EDS shunt lines to the entrance of the EDS by the total bags inducted during the test. During live bag operations, the bag jam rate shall be less than 1% of bag volume during the Daily Peak Hour and 24-hour Calendar Day as measured using the CBIS Executive Summary Report defined in Appendix A, Section A.8.	X		
7.2.11.1 Recirculation Loop Requirement	The automatic recirculation of bags shall not be designed, either pre-EDS screening or post-EDS screening, except for automated reinsertion lines in the CBRA as shown in Chapter 9.	X	X	
7.2.11.12 Reinsertion Line Requirement	Non-cleared bags shall only be reinserted upstream of the STZ.	X	X	
7.2.11.3 Draft Curtains Requirement	All PECs shall be clear of obstructions including draft curtains.	X	X	
7.2.11.4 EDS Maintainability Requirements	Designers shall use the EDS PGDS Maintainability Standards Exhibit (Environment Checklist) displayed in Figure 7-5 to ensure that the required environmental standards described in this chapter are met.			X

Section	Requirement	Testing	Design	Process
7.2.11.4 EDS Maintainability Requirements	The Project Sponsor shall ensure that all operating environmental and maintenance requirements as set in the OEM's integration guidelines are met.			X
7.2.11.4 EDS Maintainability Requirements	Secure storage space shall be provided for spare parts and tools. This space should be approximately 150 square feet and shall be located close to the EDS unit.		X	
7.2.11.4 EDS Maintainability Requirements	CBIS designers shall identify the appropriate number of conveyor components in the Detailed Design Phase immediately before and after the EDS unit that will be readily removable using commonly available hand or power tools. Designers shall also identify the methodology for removal of any ancillary equipment before or after the EDS units to allow for easy access to the EDS units for maintenance, removal or replacement.		X	
7.2.11.5 EDS Replacement Planning Requirement	The Project Sponsor shall include access routes for EDS equipment replacement in the CBIS design.		X	
7.2.12.3 Specific STIP Design Requirements	All ETDs and stand-alone EDSs shall have one "dual telecommunications outlet".	X	X	
7.2.12.3 Specific STIP Design Requirements	When a multiplex server is present, connectivity to TSANet shall terminate at the multiplex server cabinet, therefore connectivity to TSANet for each EDS is not required.		X	
7.2.12.3 Specific STIP Design Requirements	All core drilling shall support a minimum of 4 "modular jacks".		X	
7.2.12.3 Specific STIP Design Requirements	All new fiber installations shall be multimode fibers, either multimode fiber, either 50/125 or 62.5/125 micron fibers r 50/125 or 62.5/125 micron fibers, 6-strand bundles enclosed in inner duct.		X	
7.2.12.3 Specific STIP Design Requirements	All cabinet installations shall have 2 110v 20A service.		X	
7.2.12.3 Specific STIP Design Requirements	All cabinet installations shall meet the local seismic rating requirements and can be floor/bracket mounted.		X	
7.2.12.3 Specific STIP Design Requirements	All newly installed and existing data jacks and associated patch panels shall comply with TSA's approved scheme [see TSA Structured Cabling System Guidelines dated July 2012].		X	
7.2.12.3 Specific STIP Design Requirements	Completed Data Capture Sheet and cable certification paperwork shall be provided to TSA prior to established ISAT date.		X	

Section	Requirement	Testing	Design	Process
7.2.12.3 Specific STIP Design Requirements	All IT cabinet installations shall include a temperature and humidity gauge for monitoring purposes.		X	
7.2.13.1 Reporting Frequency Requirement	The CBIS reporting system shall be capable of providing data in real time (±1 minute) and in hourly, daily, weekly, monthly, quarterly, annual, and manually entered time periods.	X		
7.2.13.2 Reporting Detail Requirement	The CBIS reporting system shall be capable of providing detailed data by Bag ID number and EDS unit, and will be provided by the BHS Vendor.	X		
7.2.13.2 Reporting Detail Requirement	At a minimum, the reporting system shall be capable of providing the following features in reports: Bag Data Bag tag number (with ATR/RFID installed) Time stamped at BMA BHS tracking ID number for each bag (shared by BHS and EDS unit) Bag type (OS, OOG, in-spec) Time stamped when bag enters the EDS unit or time stamped when OOG bags are diverted to OOG Line SSI – Level 1 screening status SSI – Level 2 screening status	X		
7.2.13.2 Reporting Detail Requirement	At a minimum, the reporting system shall be capable of providing the following features in reports: Critical Tracking PEC Immediately upstream and downstream of each EDS, prior to and after each tracked divert point, and at the last tracked PEC entering the CBRA, the BHS shall report the following for each activation of the PEC: Bag ID SSI - Bag screening status NOTE: This is not a report for a given PE, but rather the status of a given bag at critical PEs in the system.			
7.2.13.2 Reporting Detail Requirement	At a minimum, the reporting system shall be capable of providing the following features in reports: BHS Faults Fault type (NOTE: A "fault" is defined as a “cause” such as lost in track, motor overload, PEC failure, encoder failure) Fault location Fault time Fault time cleared Total fault time	X		

Section	Requirement	Testing	Design	Process
7.2.13.2 Reporting Detail Requirement	At a minimum, the reporting system shall be capable of providing the following features in reports: BHS Events Event type (NOTE: An "event" is defined as the "effect" of a fault, such as re-establish tracking, fail-safe, or jams, or the "effect" of human interaction on the system, such as via Human Machine Interface (HMI) or control station – e.g., pushing an e-stop, or OTK Activation) Event location Event time Total event time	X		
7.2.13.2 Reporting Detail Requirement	At a minimum, the reporting system shall be capable of providing the following features in reports: EDS Statistics (if data to support these statistics is available from the EDS OEM being installed) SSI – Number of bags alarmed by specific EDS unit SSI – Number of bags cleared by specific EDS unit EDS unit faults (if known) Start time of fault End time of fault	X		
7.2.13.2 Reporting Detail Requirement	At a minimum, the reporting system shall be capable of providing the following features in reports: ATR Performance ATR Name ATR Description (i.e., Tracking or Sortation) Total number of bags seen Total number of tags read Number of problem tag reads (this can be provided as a single total count or ideally as a set of constituent counts plus a total count and should be representative of the number of unreadable/missing tags, number of invalid tag reads, number of conflict/multi-tag reads, etc.) Number of associated tag reads (i.e., the number of 10-digit IATA bag tag IDs read and associated with the bag as the bag's BHS tracking ID) Total number of 10-digit bag tags that are read at the ATR and passed to the EDS Total number of 10-digit IATA bag tags sent to the EDS and how many were sent back at the EDS exit IATA Tracking Accuracy	X		

Section	Requirement	Testing	Design	Process
7.2.13.2 Reporting Detail Requirement	At a minimum, the reporting system shall be capable of providing the following features in reports: BMA Statistics Total number of bags through the BMA Total number of OS bags Total number of OOG bags OOG (absolute) tracking accuracy	X		
7.2.13.2 Reporting Detail Requirement	At a minimum, the reporting system shall be capable of providing the following features in reports: Baggage System Volumes By input conveyors (ticket counter conveyors, curbside conveyors, oversize conveyors) By screening area (including EDS unit and CBRA)	X		
7.2.13.2 Reporting Detail Requirement	At a minimum, the reporting system shall be capable of providing the following features in reports: CBRA Statistics – CBRA statistics shall be presented and considered SSI Cleared Cleared (CLR) PRE-Clear (P-CLR) SEL Clear (S-CLR) Alarmed (ALM) PRE-Alarm (P-ALM) SEL-Alarm (S-ALM) No Decision Purged Queue Time Out (Q-TimeOut) Operator Time Out (O-TimeOut) Lost inTracking Mistracked Bag Length Tracking Following Lost Bag Too Close Security Re-route Unscreened OS OOG Invalid arrivals at the OOG line Reinsert Line Reinserted bags	X		

Section	Requirement	Testing	Design	Process
7.2.13.2 Reporting Detail Requirement	At a minimum, the reporting system shall be capable of providing the following features in reports: PEC Tracking Statistics Total number of bags seen at each PEC Total number of purged bags at each PEC Total number of missing bags at each PEC Total number of unknown bags at each PEC Total number of "hard" jams at each PEC Total number of missing bag jams at each PEC	X		
7.2.13.2 Reporting Detail Requirement	At a minimum, the reporting system shall be capable of providing the following features in reports: Baggage Process Timer (BPT) Statistics Total number of bags seen Average processing time for each bag By BIS position	X		
7.2.13.2 Reporting Detail Requirement	The reporting system shall provide BHS Reports which should be within 5% difference or accuracy compared to the EDS Counts per screening line.	X		
7.2.13.2 Reporting Detail Requirement	For MITs, all CBRA reports shall be generated based on bag status upon arrival at the inspection station location.	X		
7.2.13.3 Daily Reporting Requirements	At a minimum, the following daily reports in the format shown in Appendix A, Section A.8 shall be provided to the local TSA representative: Daily CBIS Summary Report (Figure A-6) Daily CBIS Summary Report – Peak Hour Daily CBIS Bag Volume Report (Figure A-7) CBIS Executive Summary Report (Figure A-8) – SSI CBRA Executive Summary Report (Figure A-9) – SSI PEC Tracking Reports for all PECs within a tracking zone (Figure A-10) BPT Summary Report (Figure A-11) CBRA Bag Report (Figure A-12)	X		

Section	Requirement	Testing	Design	Process
7.2.13.4 BHS ID Log Report Requirement	A report of the last 1000 BHS ID's shall be provided as defined below: The BHS_ID_LOG shall be considered a First-In-First-Out (FIFO). The FIFO shall capture the last 1,000 Pseudo IDs, associated decisions and a flag indicating whether the bag has been processed by a TSO (including re-inserted for screening) for each EDS. This data shall consist of three elements: Pseudo_ID Decision Processed	X		
7.2.13.4 BHS ID Log Report Requirement	The report shall be provided in both a PDF format and an importable CSV file.	X		
7.3.2.7 BHS Reporting During Maintenance	BHS Reporting capabilities shall be designed such that logging of photo eye activity (i.e., total, missing, unknown, etc.) is disabled on conveyors not running or operating in a manual override mode. The BHS shall only log PE activity when conveyors are running in a fully automated mode.	X		

A properly designed CBIS will meet TSA's security, supportability, maintainability and safety standards as defined in this chapter while maximizing efficiency, customer service level, and cost effectiveness. This chapter presents a discussion of:

- Overall CBIS design principles related to security, efficiency, customer service level, cost-effectiveness, and safety.
- Specific design best practices and standards to assist designers and planners in developing CBIS designs in accordance with the PGDS.

The design performance to be achieved by the CBIS designs are described in detail in this chapter. The requirements will be used by the CBIS designers in developing CBIS plans and specifications.

7.1 Summary of Overall CBIS Design Principles

7.1.1 Security

When designing a CBIS, security is a priority. The following CBIS design principles describe key security-related requirements and best practices to be met in planning and designing a CBIS.

7.1.2 Efficiency

Efficient operation is another priority of every CBIS design. To operate efficiently, CBIS designs must minimize the frequency of errors and faults. In particular, the frequency or rate at which non-alarmed bags are sent to the CBRA because of tracking or misread errors must be minimized. Manually inspecting these error bags at the CBRA can increase system operating costs, as well as the time a bag is in the system.

7.1.3 Customer Service Level

Customer service is also a priority of every CBIS design. A CBIS must meet TSA security requirements without compromising the level of service that airlines provide to their passengers. The delay incurred by the baggage screening process must be kept within acceptable limits to ensure that bags do not miss their intended flights and airline operations are not unduly affected.

7.1.4 Cost Effectiveness

Alternative system types, if properly sized, will offer equivalent levels of security, efficiency, and customer service. Therefore, selection of the preferred alternative will be based on cost effectiveness. When evaluating cost effectiveness, it is essential to consider not only the upfront capital costs involved, but also the recurring costs associated with operating, maintaining, and staffing the system. The methodology for evaluating cost-effectiveness is discussed in Chapter 8.

7.1.5 Concept of Operation

A CBIS is designed to accommodate a particular screening process or concept of operation. When planning and designing a CBIS, the process should begin with a thorough understanding of the concept of operation. Planners and designers must document a concept of operation tailored to the specific CBIS and CBRA which must accompany the 30% design submission to TSA. A generic CBIS concept of operation is described in Chapter 3, but a specific CBIS concept of operation pertaining to the CBIS design for a specific airport should be developed by the designers or planners of that system as stated in the requirements for Chapter 2. A set of generic CBIS types and related concepts of operation are described in Appendix B and can be used as a starting point for further development of airport-specific CBIS concepts of operation.

7.1.6 Proper System Selection and Sizing

In planning a CBIS, proper system selection and sizing are essential to ensuring that the system provides the required level of security. An undersized system that cannot accommodate the demand routinely experienced presents not only a security issue but can also negatively affect the customer service level. Separate chapters of this PGDS are devoted to the key steps involved in proper system selection and sizing:

- Chapter 3 describes the range of system types and screening equipment to be considered.
- Chapter 4 describes the process used in developing and evaluating alternatives.

- Chapter 5 describes the process for determining baggage screening demand.
- Chapter 6 describes the methodology for determining baggage screening equipment requirements.

7.1.7 Safety

In planning and throughout the construction of a CBIS, safety standards and ergonomic design principles will be applied as early as possible to reduce the potential for injuries caused by improper ergonomic designs. Applicable safety standards and ergonomic design principles will be applied in conjunction with other security parameters during the planning phase to avoid future costly retro-fitting solutions to reduce injuries.

7.2 Specific Design Principles

Performance requirements specify key operational objectives that a CBIS must meet or exceed. This section describes those requirements to assist Project Sponsors to successfully pass the design review process and the commissioning of the system.

A CBIS will be evaluated during the design, construction, testing, and commissioning phases to ensure compliance with specific design standards:

- **Design Phases** – Before receiving approval from TSA, proposed in-line CBIS designs will be evaluated to demonstrate compliance with the requirements described in this chapter.
- **Construction, Testing, and Commissioning Phases** – Before final TSA acceptance, a number of system and component tests will be performed on an installed CBIS as part of the commissioning process. See Appendix D for a description of how the Integrated Site Acceptance Test and Site Specific Test Plan will be developed.

Legacy baggage handling systems shall not affect the performance of the CBIS. To ensure the legacy BHS does not affect the new system's ability to deliver bags to or convey bags from the CBIS at the designed throughput, TSA will consider reimbursement of the costs for specific replacement and upgrade of the conveyor system necessary to support integration of the EDS units. Please contact the TSA Project Coordinator or go to http://www.tsa.gov/research-center/airport-checked-baggage-guidance-materials to obtain a copy of the EBSP Policy Memo – TSA Funding for Checked Baggage Inspection System Project Costs.

The Project Sponsor shall ensure compliance with the EDS OEM's site planning and installation guidelines.

7.2.1 BHS Capacity

For new systems, no component of the CBIS shall constrain the maximum qualified capacity of each EDS unit. For recapitalization projects, the existing capacity of the CBIS shall not be reduced.

7.2.1.1 Mainline Requirements

Mainlines shall be capable of delivering bags to the EDS units to equal the capacity of the total non-redundant EDS units. Mainlines taking bags away from the EDS unit shall be capable of transporting bags equal to or greater than the capacity of the non-redundant EDS units.

A redundant mainline will not be allowed when:

- It will defeat the purpose of redundant EDS unit(s)
- Or it will reduce the efficiency of the CBIS
- Or it will add unnecessary cost
- Or it will impose unnecessary spatial constraints
- Or when it will add unnecessary complexity to the system

7.2.1.2 Tail-to-Head Bag Spacing Requirement

For slider bed conveyors, the space between bags as measured from the trailing edge of leading bag to the leading edge of the trailing bag, or "tail-to-head spacing" shall be no less than 12 inches as bags enter the EDS unit. The speed of the queue belt immediately before and after the EDS unit (as bags transition into and out of the EDS) shall comply with the EDS Integration manual. For ICS the space between carriers shall be as determined by the EDS manufacturer and their ability to clearly delineate between carriers. The BHS must also be able to maintain positive tracking.

7.2.2 Screening Throughput Capacity Requirement

Designed and installed CBIS need to provide adequate screening throughput capacity and meet the throughput and capacity standards set in this chapter. The following are the corresponding screening throughput capacity standards.

The actual screening throughput capacity as tested in accordance with the information presented in Appendix D shall meet or exceed the TSA-identified 95% screening throughput capacity as defined in Table 3-1 which is calculated as the product of: (a) the number of EDS units provided (excluding any redundant units) and (b) the 95% screening throughput capacity per EDS unit.

Note: The actual EDS screening throughput is the overall baggage rate with the OS and OOG percentages subtracted.

- As part of the pre-ISAT testing described in Section 2.2.6, the average screening throughput capacity per EDS unit will be confirmed by the Project Sponsor.

- If the design cannot meet the required screening throughput capacity, the Project Sponsor must justify the designed screening throughput capacity to TSA.

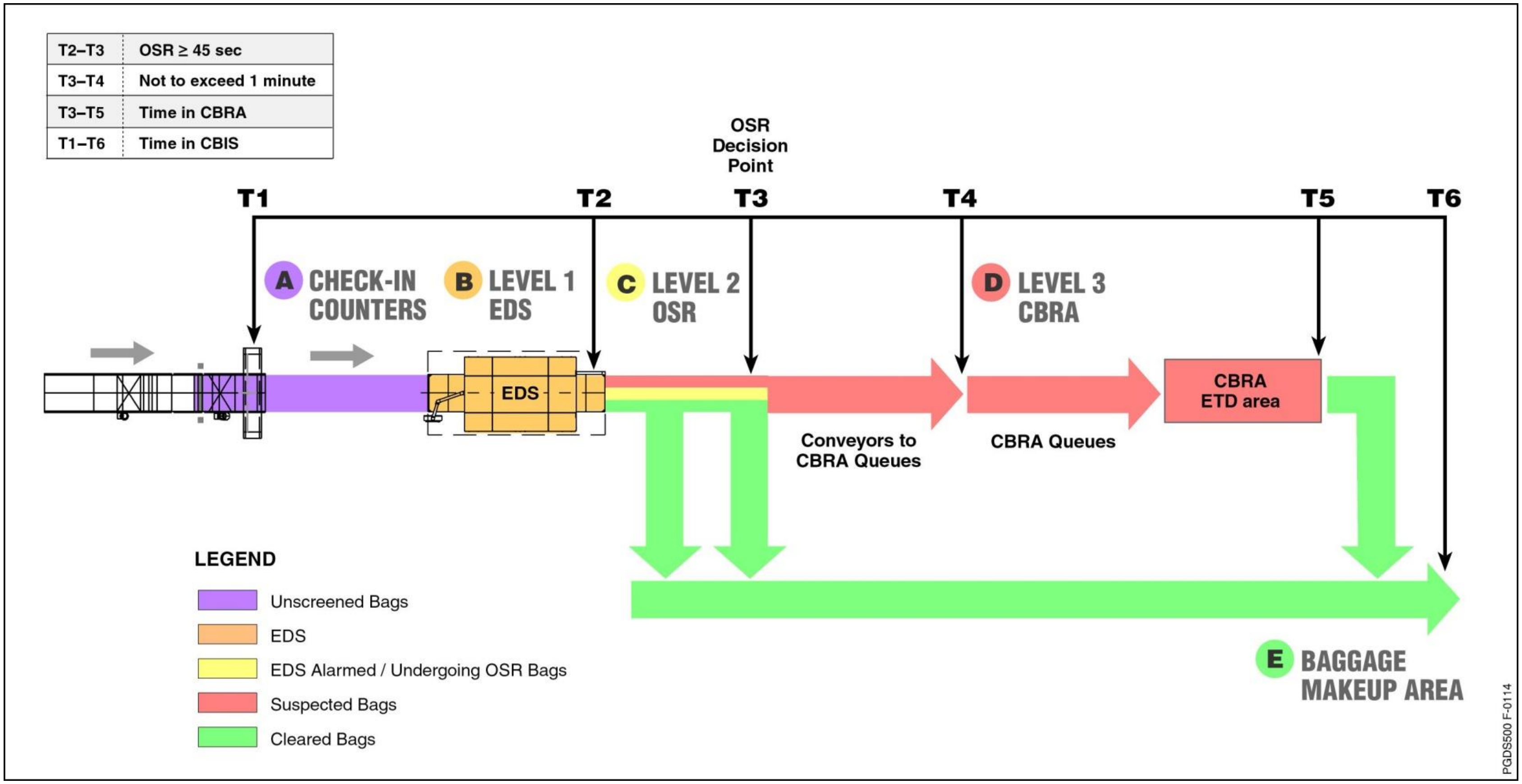
7.2.3 Bag Time-in-System Best Practices

When designing the CBIS, the amount of time a bag is in the system needs to be considered. The proposed CBIS will not cause unacceptable levels of delay to bags processed during normal operations.

7.2.3.1 Time-in-System Static Calculations

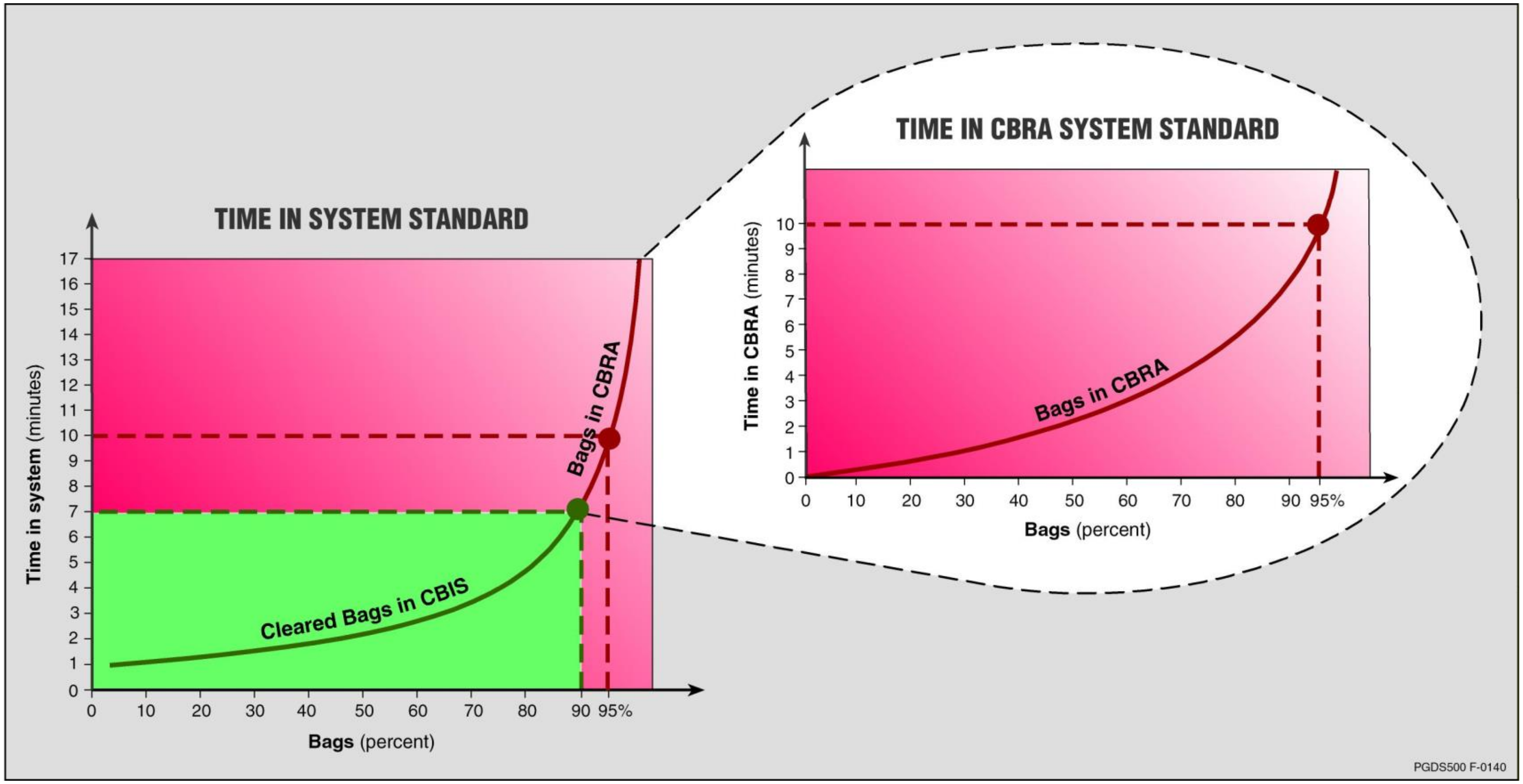
Industry best practice is that the bag time-in -system from insertion at the furthest load point, through the CBIS, to arrival at the sortation system mainlines which feed the baggage makeup area should be no more than 10 minutes for 95% of peak hour bags during normal operations (shown as T1-T6 in Figure 7-1).

Figure 7-1: Bag Time In System and Bag Time In CBRA



The time includes all screening time (i.e., including alarm resolution in the CBRA). Since the vast majority of bags bypass the CBRA area by being cleared by the EDS or the OSR operator, only a small percentage of bags should ever exceed the 10-minute threshold as shown in Figure 7-2.

Figure 7-2: Time In System and Time In CBRA Standards



The travel time calculations will be provided as part of the Schematic and Detailed Design Phases as referenced in Chapter 2 and Chapter 6.

7.2.3.2 Time-in-System Simulation Calculations

If simulation analysis of the CBIS is performed, the time-in-system calculations should be verified by averaging across a sufficient number of simulation runs to provide reliable results (industry best practice is commonly 10 or more). See Chapter 6 for additional best practice language regarding dynamic simulation programming parameters.

However, for specific CBISs with especially long delivery lines from check-in areas to a centralized CBIS or CBIS with legacy EDS units that typically have higher false alarms rates, bag time-in-system calculations could result in values longer than 10 minutes for 95% of the bags. In these cases, the Project Sponsor should engage with the project stakeholders to determine what an acceptable solution is.

7.2.4 OSR Decision Time Requirements

The Bag Travel Time (BTT) is the time it takes a bag to travel from the exit of the EDS to the last decision point.

7.2.4.1 In-line Systems

For in-line systems, the CBIS shall allow a minimum of 45 seconds of BTT between the exit from the EDS and the final diversion trigger point to the CBRA without holding bags.

7.2.4.2 Mini In-Line Systems

For mini in-line systems, the minimum BTT shall be 60 seconds, but designers are encouraged to maximize it further whenever possible. This higher BTT can be achieved without impacting EDS rates, using a combination of:

- Slower belt speeds downstream of the EDS
- Additional queues downstream of the EDS
- Holding of alarm bags downstream of the EDS to take advantage of lag times in between the bags (due to bag flow control upstream of the EDS)

The OVT is the minimum time an operator has to conduct OSR protocols at Level 2. It is critical to ensure adequate OVT when dealing with consecutive alarm bags to minimize timed out bags going into the CBRA. For mini in-line systems, the minimum design OVT shall be 25 seconds for each alarm bag, for up to 3 consecutives alarm bags.

7.2.5 BHS Tracking

This section defines the BHS baggage tracking requirements and corresponding best practices to achieve optimal performance. A key requirement is using positive bag tracking, which is a method where the BHS maintains a known position for all bags within the CBIS at all times. Bag positions can be tracked by such methods as monitoring the conveyor belt speeds, distances, routing events, bag length, and other information associated with its travel path through the tracking zones. Positive tracking is essential to monitoring the threat status of each bag as it passes through the CBIS.

7.2.5.1 CBIS Positive Bag Tracking Requirements

- The CBIS shall be capable of maintaining positive bag tracking in the STZ during events (e.g., diebacks, merging, decision point transitions, etc.) that are typical of situations which may occur in baggage handling systems.
- The STZ starts at the point at which the BHS acquires positive tracking of a bag prior to the EDS (normally at a BMA, an ATR, or a Photocell where the BHS Tracking ID is assigned). The STZ extends to the Clear Line diversion point(s) and to the BRPs (Baggage Removal Points) in the CBRA.
- The CBIS will be designed with sufficient control functions so that bags stop on the appropriate conveyor and do not allow any part of the bag to drift onto the next downstream conveyor.

7.2.5.1.1 Pre-EDS Requirements

- The BHS shall assign a unique tracking ID (BHS Bag ID-Pseudo) to each bag once the bag enters the STZ within the CBIS for the purposes of positive bag tracking.
- The CBIS shall incorporate an ATR upstream of the EDS matrix. This may require an ATR upstream of each EDS unit and will minimize lost Bag Tag IDs due to tracking through diverters.
- ATR read rates shall be no less than 98% for laser arrays and 99% for RFID applications for valid reads for that system during controlled testing.
- The BHS Bag ID (pseudo) shall be used for tracking purposes.
- All systems utilizing an ATR shall maintain a relation between the BHS tracking ID and the 10-digit IATA bag tag ID for all bags that are successfully read.
- The BHS Bag ID (pseudo) shall be used as the Primary ID passed from the BHS to the EDS. In all systems where an ATR is present, the 10-digit IATA bag tag data shall also be passed from the BHS to the EDS. CBIS tracking shall in no way be controlled or constrained by a sort controller where the relation is maintained within the PLC.
- The BHS Bag ID (pseudo) and, if available, the 10-digit IATA bag tag data shall be transferred between BHS and EDS equipment as defined by each EDS manufacturer's interface requirements document or integration guide. If the EDS does not accept both a BHS Bag ID (pseudo) and a 10-digit IATA bag tag ID, then the 10-digit IATA bag tag ID shall be transferred to the EDS.
- IATA tracking accuracy: The upstream IATA tracking accuracy shall be calculated and reported in the Daily CBIS Summary Report, Figure A-6 by summing the quantity of the 10-digit IATA bag tags that are successfully handed off to the EDS units, R_{EDS}, with the quantity of 10-digit IATA bag tags that are seen by the photo eye (PE) just past the OOG divert location, $R_{OOG\ @\ PE}$, all divided by the quantity of 10-digit IATA bag tags that are successfully read by the ATR and supplied to the BHS, R. This value shall be displayed as a percentage and shall be at least 97%. The formula used to calculate Upstream IATA Tracking Accuracy is shown below:

$$\left[\frac{R_{OOG\ @\ PE} + R_{EDS}}{R}\right] x\ 100$$

- If the BHS Bag ID (pseudo) becomes unknown or unavailable, the BHS will generate a new BHS Bag ID (pseudo ID) or the EDS will generate an EDS Bag ID (pseudo ID) for tracking purposes. This format and EDS Bag ID range is specified in the OEM's integration guide. The BHS OEM shall ensure EDS Bag ID overlap does not occur between any EDS unit within any matrix.
- BHS Bag IDs (Pseudo) and/or EDS Bag IDs shall not overlap with IATA requirements for bag tag IDs or repeat themselves within 24 hours in a calendar day (i.e., unique BHS/EDS Bag IDs are required for a duration of 24 hours).
- OOG tracking accuracy (absolute): The OOG tracking accuracy (absolute) shall be calculated by dividing the quantity of successfully tracked OOG bags just after the OOG divert location by the total OOG bags detected at the BMA. This value shall be displayed as a percentage in the Daily CBIS Summary Report (Figure A-6) and shall be at least 97%. The equation used to calculate this value is shown below, where $R_{OOG\ @\ PE}$ is the quantity of positively read, OOG bags at the OOG divert point; $R_{NR,\ OOG\ @\ PE}$ is the no-reads at the OOG divert; R_{OOG} is the positively read OOG bags at the BMA; and $R_{NR,\ OOG}$ is the OOG no-reads at the BMA.

$$\left[\frac{R_{OOG\ @\ PE} + R_{NR,\ OOG\ @\ PE}}{R_{OOG} + R_{NR,\ OOG}}\right] x\ 100$$

- Invalid Arrivals at the OOG Line: The Invalid OOG Arrival percentage shall be measured just after the OOG divert location and calculated by subtracting the known OOG bags, $R_{OOG\ @\ PE} + R_{NR,\ OOG\ @\ PE}$, from the total quantity of bags at the same location, all divided by the total quantity of bags at the same location. This value shall be displayed as a percentage in the Daily CBIS Summary Report (Figure A-6). The equation used to calculate the percentage is shown below:

$$\left[\frac{Total\ Bags\ at\ OOG\ PE - (R_{OOG\ @\ PE} + R_{NR,\ OOG\ @\ PE})}{Total\ Bags\ at\ OOG\ PE}\right] x\ 100$$

7.2.5.1.2 Post-EDS Requirements

- When the EDS passes a decision to the BHS, the BHS shall retain this status throughout the tracking process for each bag and never override the EDS decision.
- If a decision is not received from the EDS, the BHS shall assign a Communication Error status for tracking purposes.
- At no time shall the system swap or transfer BHS tracking IDs on or between bags, nor swap or transfer security screening decisions on or between bags.
- If the EDS is controlling the conveyors immediately before and after the EDS, the CBIS/EDS is still required to meet the same criteria for tracking as in any other tracking zone.

- Invalid arrivals at CBRA shall be monitored and logged via the BHS reporting system. Whether or not a bag arrival is considered Valid at CBRA will be based on the status displayed at the BIS BSD as the bag initially arrives to the BRP (i.e., not following secondary retrieval methods that may be available, such as hand scanners).
  - The ONLY valid bag arrival statuses displayed in CBRA during controlled testing or live operations, provided the status appropriately conveys the bag disposition as defined in Section 9.6.2, are:
    - Alarmed bags
    - OOG bags
    - OS bags (if applicable)

    Note: An exception to this is that Timeout bags may be considered valid for systems where OSR is conducted in CBRA.
  - In addition to inappropriately displayed statuses per Section 9.6.2, Invalid bag arrival statuses displayed in CBRA during controlled testing and live operations include:
    - Cleared
    - Timeout (except per the above caveat, **see note below**)
    - EDS Error (**see note below**)
    - Communication Error
    - Unknown

    Note: Appropriately displayed Timeout and EDS Error arrival status bags are considered Invalid, but are excluded from the Invalid CBRA Arrival rate. These are not included in the Invalid CBRA Arrival rate calculation, but shall be separately tracked, as any of these arrivals represent a system deficiency as follows: Timeouts – any during controlled testing not caused by testing and any in live operations, and EDS Errors - any during controlled testing and a rate above 1% during live operations.
  - Reported statuses should either match the displayed status or further delineate the reason for, and uniquely represent, the displayed CBRA arrival status (e.g., Unknown bags may be displayed for lost bags as well as security re-reroute conditions detected such as bags too close or bag length change; EDS errors may be the result of bag spacing errors as presented by the BHS, if delineated by the EDS disposition code, or due to various EDS fault conditions; Timeout bags can be queue or screen timeouts, provided this distinction is provided by the EDS disposition code).
- The Invalid CBRA Arrival rate during controlled testing is measured by dividing the Number of Invalid CBRA Arrivals (per above) by Total Bags Inducted. The Invalid CBRA Arrival rate during live operations is measured by dividing the Number of Invalid CBRA Arrivals (per above) by Total Bags Inducted during both the Daily Peak Hour and 24-hour Calendar Day. The Daily CBIS Summary Report defined in Appendix A may be used to determine the Invalid CBRA Arrival rate during live operations. The Invalid CBRA Arrival rate allowed for controlled testing and live operations shall not exceed 3% in a CBRA designed with a bag reinsertion line (BRL), and not exceed 2% in a CBRA designed without a BRL.
- In the event of a BHS or EDS emergency stop (e-stop) activation, the system shall:

- Maintain tracking of all bags screened by the EDS and
- Maintain the security status of all bags that have been screened by the EDS and
- Maintain the security decision transmitted from the EDS to the BHS prior to or after activation of either a BHS or EDS e-stop.

- The EDS shall recover from the e-stop condition in accordance with published criteria from the EDS vendor and the BHS shall recover per established e-stop recovery procedures defined in the BHS specifications and in accordance with the OEM's integration guidelines.

7.2.5.1.3 CBIS Detection Requirements

- The CBIS shall be capable of detecting when any bag infringes on the tracking window of any other bag as long as the bags are at or above the minimum conveyance size and the bag is not on top of, underneath, or directly beside another bag:
  - Any bag with a conveyable dimension less than 12 inches should be placed in a tub.
  - The minimum conveyable bag should measure at least 12 inches in any dimension.
- The CBIS shall be capable of detecting when a bag has been delayed or accelerated in accordance with Appendix D, Section D.3.2 and D.3.3. Delaying or accelerating a bag beyond the configured tracking tolerance shall result in application of one of the following solutions:
  - Upstream of EDS (single bag): The CBIS shall reacquire the bag and continue tracking.
  - Downstream of EDS (single bag): If the bag has already been screened and traveled downstream of the EDS, any security status assigned to the bag will no longer be considered valid and the bag shall be routed to the CBRA. For ICS, if the identification of the carrier can be reacquired prior to the last divert point and the status of the bag is clear, the carrier can be rerouted to the sortation area.
  - Downstream of EDS (multiple bags): If multiple bags are involved and tracking windows have been infringed upon, then the CBIS shall be capable of detecting this condition and route all bags involved to the CBRA. For ICS, if the identification of the carrier can be reacquired prior to the last divert point and the status of the bag is clear, the carrier can be rerouted to the sortation area.
- The CBIS shall be capable of detecting when a bag has been added within the tracking zone as long as that bag is added anywhere other than on top of, underneath, or directly beside another bag.
  - Upstream of EDS (single bag): The CBIS shall acquire the bag and continue tracking.
  - Downstream of EDS (single bag): If the addition occurs downstream of the EDS and only the added bag itself is affected (added bag does not infringe on the tracking window of another bag), then the added bag shall be routed to the CBRA.

See Section D.3.4 for testing standards related to added bags.

7.2.5.2 Bag Tag Identification Best Practices

Bag tag identification is a method in which a tag or chip with a unique readable Bag Tag ID number is physically attached to each bag and linked to the passenger name record (PNR). The bag tag is positively identified by scanning or reading the attached tag or chip.

The technology used for positive identification may be based on either optical (laser array) or RFID, as long as the technology does not affect CBIS throughput performance.

Best practices that can critically influence the read rate of ATRs and therefore, the association rate of ATR ID to bag image in live stream of commerce operations include:

- ATR maintenance and adjustments should be performed periodically and/or as needed to ensure optimal reader performance. This includes periodically cleaning ATR reader heads, realigning and calibrating reader heads, and ensuring ATR to BHS communication performance occurs reliably. The need for periodic maintenance and adjustments may be planned in accordance with ATR OEM guidelines and historical operational need. Recognizing the need for unplanned maintenance and adjustments may be determined by periodic physical inspection and review of ATR performance as reported via ATR or CBIS reports.
- Airline bag tag print quality should be maintained to ensure optimal read performance. Airlines should periodically inspect printed 10-digit IATA bag tags for print quality and readability (i.e., misalignment, inadequate contrast, streaking, bleed), and maintain tag printers accordingly. Bag tag printer OEM documentation should be reviewed for performing maintenance procedures properly.
- Bag induction procedures and practice should be inclusive of tactics for optimizing bag tag read performance, including:
  - Bag tag placement relative to bag orientation should be considered (i.e., tags should not be placed on a part of a bag that will challenge readability such as under an extendable handle or on the underside of a bag in its induction orientation, and if the bag will be inducted within a tub tags should not be positioned on bag such that the tag will be hidden from the reader by the tub sides or bottom).
  - Previously used bag tags and bingo tags should be removed prior to bag tag placement to avoid multi-tag reads.
  - Care should be taken not to bend, wrinkle, smudge, or otherwise distort bag tags and their printed bar codes during tag application.
  - Bag tags should be applied such that bar code information on each side of the applied tag has a reasonable opportunity to be read.
  - Stickers should not be placed on bag tags and, occluding markers or pens, should not be used to write on bag tags, such that the bar code is in any way covered. Only highlight markers should be used to mark bag tags before reinserting bags on re-induction lines.

7.2.6 Conveyor System Design

To properly maintain baggage tracking, CBIS designs must provide for sufficient conveyor control through the use of the components/design requirements and best practices listed below.

7.2.6.1 Divert and Merge Requirements

- Bags exiting each EDS unit shall be separated by their clear or non-clear screening status prior to merging onto the post-EDS mainline or OSR line. ICS carriers shall be separated by their clear or non-clear status at the first opportunity but may travel on the OSR line.
- After clear and non-clear bags have been separated, they shall not be commingled. OOG bags should be routed to the CBRA on the Alarm Line. If space or design limitations exist and routing OOG bags on the Alarm Line is not cost-effective or feasible, then OOG bags should be routed directly to the CBRA on separate conveyors.
- Only clear bags shall be diverted at horizontal diverters; non-clear bags shall pass through. At vertical diverters, clear bags shall divert up and non-clear bags shall divert down.
- The following requirements apply to diverters in the security tracking zone downstream of the EDS units:
  - For systems with two decision point diverters, at the first decision point diverter, if the system is unable to divert a clear bag, the bag shall bypass the diverter on the Alarm Line.
  - For systems with a single decision point diverter and at second chance diverters, if the system is unable to divert a clear bag, the bag shall cascade stop and NOT bypass the diverter on the Alarm Line.
  - The CBIS may have a bypass feature to allow clear bags to bypass all diverters during fault conditions and be sent to the CBRA. The bypass feature shall be enabled and disabled via an operator's workstation in the BHS control room. Enabling the bypass feature is to be coordinated with local TSA. Bypass features that send non-clear bags to the outbound system shall not be allowed.

7.2.6.2 Baggage Allocation Methodology

Bag allocation methodology (BAM) refers to the logic used to distribute bags between the EDS units. All new CBIS designs shall incorporate a round-robin BAM, in which bags are routed singularly and consecutively to each available SS line. Deviations from round-robin BAM shall be submitted through an RFV for review and approval by TSA.

Round-robin allocation is typically accomplished by assigning an ID for each SS line to bags upstream of the screening matrix. For example, if a matrix has four SS lines, as bags leave the upstream scanning array, SS_1 is assigned to bag 1, SS_2 to bag 2, SS_3 to bag 3, SS_4 and so on. Under normal conditions, bags are diverted to the corresponding SS lines. If the corresponding SS line cannot accept the bag (shunt or EDS unavailable), the PLC logic dynamically adjusts to allow another SS line to accept the bag. In the case where an SS line is not available, the system is expected to maintain that ID in the round-robin count.

7.2.6.3 Conveyor System Design Best Practices

A CBIS that does not follow the following industry best practices may introduce a high risk of testing failure which could delay the project and incur additional cost. Historical testing has shown that tracking failures can often be correlated to tracking issues caused by non-adherence to the below best practices.

7.2.6.3.1 Gradual Conveyor Speed Transitions Best Practices

The transitions in conveyor belt speeds between any two consecutive conveyor belts should not exceed 30 feet per minute or a 50% difference of belt speeds, whichever is less, so as not to affect the stability, orientation, or spacing of bags while still maintaining accurate bag tracking.

CBIS designers must match adjacent conveyor speeds at the juncture between BHS and EDS conveyors at both the entrance and exit of the EDS.

7.2.6.3.2 Avoidance of Steep Conveyor Slopes Best Practices

The CBIS should be designed with incline and decline angles no greater than 18 degrees in non-tracking zones (i.e., zones where bags are not positively tracked) and no greater than 12 degrees in tracking zones (i.e., zones where bags are positively tracked).

A key best practice for conveyor design is avoidance of steep slopes which lead to baggage rolling and sliding on the conveyor, which often results in tracking losses, bag jams, and bags doubling up. Double bags inducted into the EDS are likely to result in machine faults, reduced throughput, equipment down time, increased maintenance, and a reduced level of security.

NOTE: Acute turns in the BHS with adjacent inclines or declines may also cause avoidable tracking errors and bag jams. Consult with EDS and BHS manufacturers to ensure such configurations are acceptable, when indicated due to space constraints.

7.2.6.3.3 Divert and Merge Best Practices

The proper use of diverters and merges is essential to reducing tracking errors and bag jams. Improper merging/diverting and the use of multiple conveyor merge/divert points on an individual line increases the number of mistracked bags and reduces the overall CBIS throughput.

- Static ploughs and roller diverters should not be used.
- Directly opposing diverters should not be used.
- Pushers should not be used in the CBIS until the bags have been cleared, and are being pushed to a Clear Line or are on a post-EDS mainline proceeding to bag makeup areas for sortation.

Designers should consider incorporating separate conveyors when system throughput and/or bag tracking would be negatively affected by excessive merges/diverts on any given line.

7.2.6.3.4 Bag Orientation Best Practices

CBIS designers should strive to ensure proper bag orientation is maintained throughout the system, and especially into the EDS, to prevent unnecessary EDS error bags, unnecessary losses in tracking through the EDS, and jam events.

The effective application of bag orientation/positioning devices is achieved through proper application of static deflectors and belt type to guide bags or tubs off of side walls to improve system throughput prior to baggage induction to EDS equipment, ATRs, or BMAs.

For static deflectors to work efficiently and effectively, a low coefficient of friction belt under the static deflectors should be used. The EDS in-feed and exit conveyors are typically high coefficient of friction belting.

7.2.6.3.5 Non-Powered Rollers Best Practices

Non-powered rollers should be avoided as much as possible when designing the CBIS, as they can cause bag jams and tracking losses as bags slow, hang, and get caught on the rollers. Frequent cleaning is also required, as bag tags and other stickers get caught and adhere to the rollers.

Non-powered rollers should not be used in tracking zones in the CBIS. The only exception is non-powered rollers that are an integral part of the transition plates for High Speed Diverters (HSD).

7.2.7 System Conveyable Items

Items that are conveyable in a CBIS vary from system to system. Variables that determine whether or not items are conveyable include: BHS equipment used, EDS equipment used, legacy system constraints, and cost versus operational advantages, among other variables. Typically OS and OOG items in the CBIS create excessive jam conditions.

7.2.7.1 Oversize Bag Requirement

The dimensions of OS items exceed the conveyance limitations of any CBIS conveyor belts. Therefore, if automated conveyance of oversize bags is needed, OS conveyors must be used to transport OS items.

7.2.7.2 Out-Of-Gauge Bag Requirement

<u>The CBIS shall transport OOG bags directly to the CBRA.</u> OOG bags are those bags that can be transported by the BHS, but are too large to be screened by the EDS units deployed for that CBIS. The most effective way to filter OOG is to locate BMAs queues upstream of the EDS lines. <u>To minimize bags on the OOG line, bags that do not have dimension information or that may have been lost in tracking after the BMA shall be transported to an EDS shunt, not the OOG line. Additionally, an over-height protective device shall be installed two queues in front of each EDS unit, e.g., an over-height photo eye, light curtain, headache bar or other similar device to ensure over height bags are stopped prior to the EDS unit.</u>

7.2.8 Fail-Safe Operation

A fail-safe operation is one that prevents the conveyance of any non-clear bag to airside locations where they would be loaded onto a flight. The following requirements correspond to fail-safe operation. The requirements for the documentation of fail-safe recognition and resolution procedures will be provided in the system description of operation as noted in Chapter 2.

7.2.8.1 Fail-Safe Operation General Requirements

- In the event of a fail-safe activation, the default path for any non-clear bag shall be to a secure location. Non-clear bags shall never be sent to an airside location.
- Fail-safe activations shall not exceed 0.5% of bag volume for each system test in controlled testing as measured by dividing the number of fail-safe activations at all Decision Diversion Points by Total Bags Inducted.
- Fail-safe activations shall not exceed 0.5% of bag volume during the Daily Peak Hour and 24-Hour Calendar Day as measured by dividing the number of fail-safe activations at all Decision Points by Total Bags Inducted using the Daily CBIS Summary Report defined in Appendix A, Section A.8.
- The sidewalls of all conveyors or portions of conveyors associated with the fail-safe zone shall be clearly marked or identified to support appropriate bag removal.
- Fail-safe alarms shall be distinct from all other types of system event alarms.

7.2.8.2 Fail-Safe Operation Requirements for In-Line CBIS

The following fail-safe requirements shall apply to in-line CBISs:

- Bag length shall be measured at a photo eye no more than two queue conveyors upstream of the EDS unit. This measurement shall be established as the bag's baseline length. The use of a dual belt speed conveyor shall not negatively affect this measurement in any way.
- Bags shall be tracked though each diverter downstream of the EDS unit(s) prior to the CBRA. A single bag failing to track from the decision photo eye upstream of the diverter to the fail-safe photo eye on the Alarm Line downstream of the diverter shall activate a fail-safe condition.
- Upon activation of a fail-safe:
  - The appropriate number of conveyors on the clear bag line, as calculated in Item 4 below, shall stop; and,
  - Activate audible and visible fail-safe alarms in locations(s) designated by TSA.
- The length of clear bag line conveyors to stop shall be calculated as follows:

1. Measure the amount of time for a bag to travel from the tracking/decision point photo eye before the diverter to the fail-safe photo eye after the diverter.
2. Measure the distance a bag travels in the amount of time measured above from the tracking/decision point photo eye before the diverter down the Clear Line.
3. Add an additional five feet to the measured distance above.
4. All conveyors on the Clear Line within the distance measured above shall be identified and stopped as the fail-safe zone.
5. To account for unique project requirements, additional conveyor(s) may be identified and stopped as a part of the fail-safe zone. However, under no circumstances shall fewer conveyor(s) be identified and stopped as the fail-safe zone.

- For systems with more than one diverter between the EDS unit(s) and the CBRA, during a fail-safe activation at the first chance diverter, clear bags shall pass the diverter on the Alarm Line to be diverted at the second chance diverter.
- For systems with a single diverter and at the second-chance diverter, during a fail-safe activation at this diverter, clear bags shall not pass the diverter and shall cascade stop upstream of the diverter.
- Bag length shall be re-measured at the decision photo eye immediately upstream of the diverter. This measurement shall be compared to the bag's baseline length. Any bag that has increased in length by 12 inches or more at the decision photo eye upstream of the diverter shall be conveyed to the CBRA with a status of 'Length Change'.

Figure 7-3 illustrates a typical In-line fail-safe CBIS design.

Figure 7-3: In-Line Fail-Safe Designs

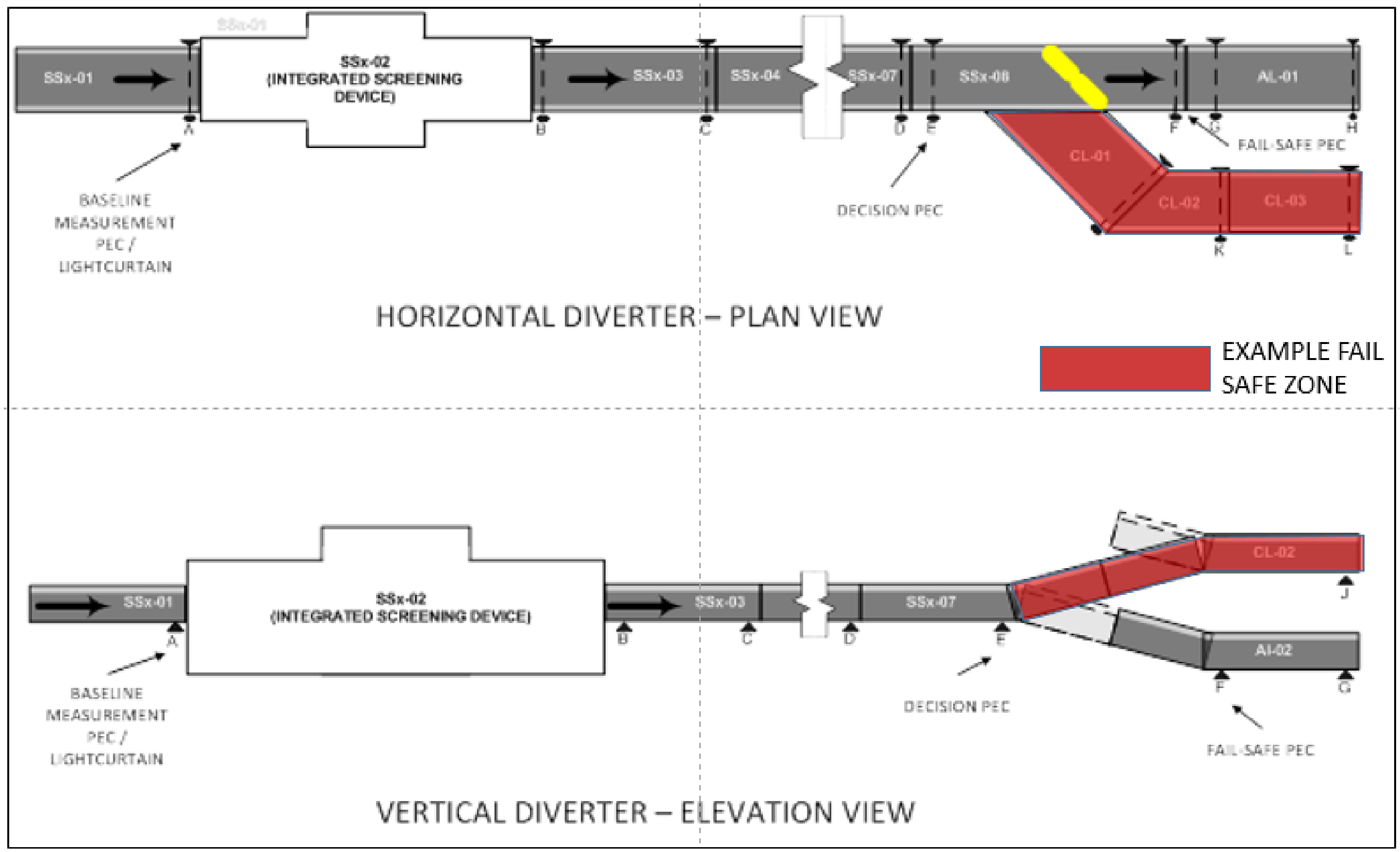
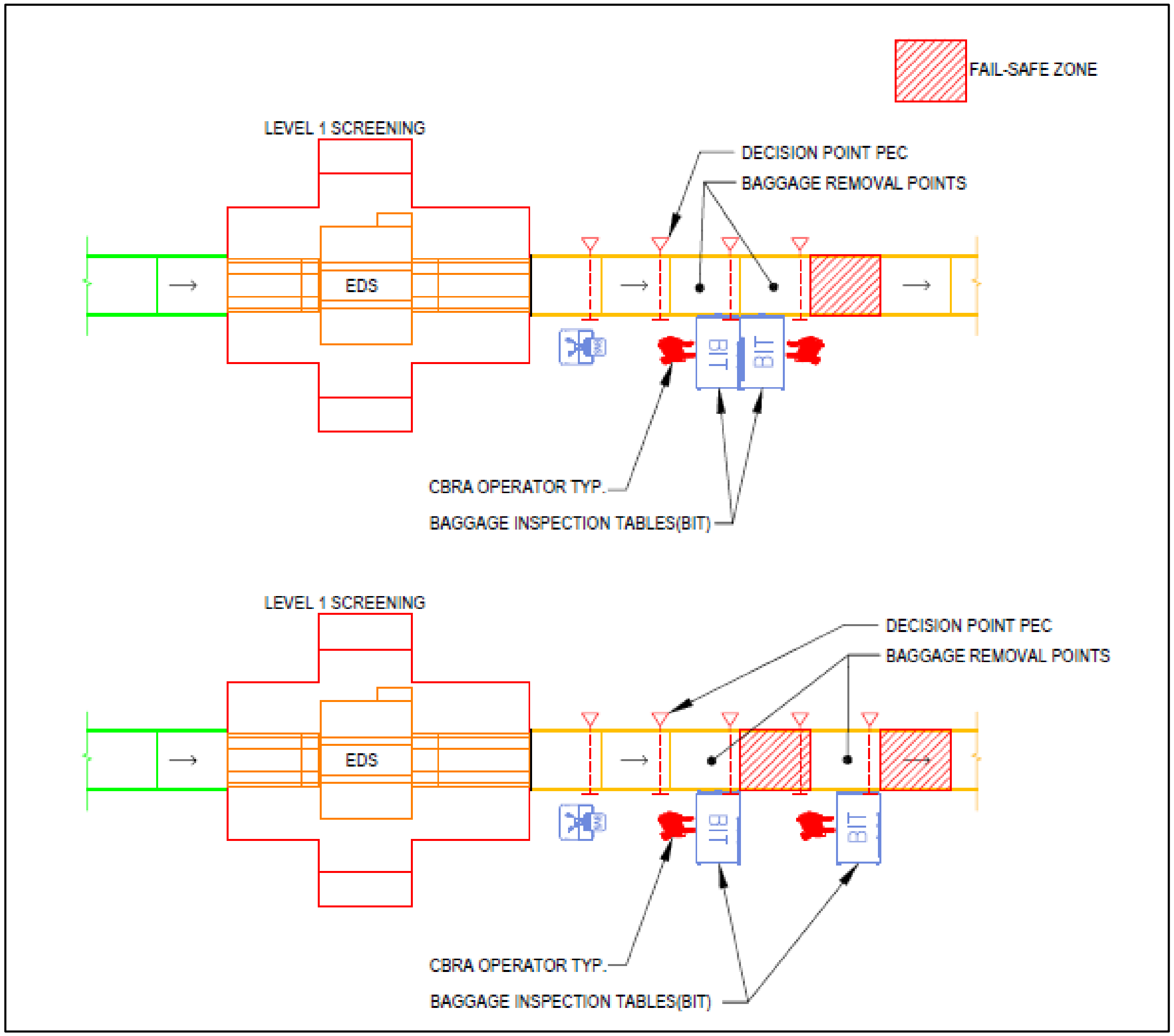


Figure 7-4 illustrates typical fail-safe designs for a Mini In-Line CBIS.

Figure 7-4: Mini In-Line Fail-Safe Designs



7.2.8.3 Fail-Safe Operation Requirements for a Manually Operated In-Line Decision Point CBIS

In case of a fail-safe event, the BHS shall identify non-clear bags and perform one of the following actions:

- Recognize the condition as a non-clear bag on the Clear Line; **or**,
- Maintain a halt condition on the Clear Line beyond the manually operated in-line decision point except when a clear bag has been successfully transported through the in-line decision point (i.e., bag information for any non-clear bags has been cleared and a clear bag is either approaching the in-line point or a bag has been processed manually at the CBRA and is reinserted at the reinsertion point through the use of local BHS controls); **and**,
- Activate audible and visible fail-safe alarms in location(s) designated by TSA.

7.2.9 Operational Test Kit

Design of Operational Test Kit (OTK) bag insertion and removal locations (such as conveyor sideguards, EDS and BHS e-stops) need to properly address applicable safety standards and ergonomic design principles. The following are design requirements for the OTK test.

7.2.9.1 OTK Test Requirements

Specific OTK Test controls shall be built into the CBIS in coordination with the EDS and BHS vendors and their integration documentation. The OTK testing controls shall be appropriately located to control the OTK Test with minimal walking between the controls, OTK load point and OTK unload point, and between adjacent units so that two units can be tested from one location. The conveyors immediately before and after each EDS shall be straight with a maximum angle of 0 degrees. Emphasis should be on coordinating in advance with the BHS vendors to optimize the layout for quick and efficient conduct of the daily OTK Test. These controls shall enable an operator to:

- Stop the normal flow of bags into the EDS without losing track of bags already in the system.
- Allow the OTK bag to be placed safely and properly onto the EDS entrance conveyor. The sideguard height at this interface point shall not exceed 4 inches and have no protrusions or sharp edges.
- Restart the EDS entrance conveyor to feed the OTK bag into the EDS.
- Stop the OTK bag on the EDS exit conveyor to allow removal of the IQT bag. The sideguard height at this removal point shall not exceed 4 inches and have no protrusions or shape edges.
- Allow for repeat of OTK Tests as necessary.
- Return the system to normal screening operation.

All of the OTK processes shall be supported without requiring a shutdown and restart of the CBIS from a MCP or other location. The OTK control station shall consist of a keyless, selector type switch or HMI graphics to enable the OTK test mode. The OTK test activation signal shall be annunciated in the BHS control room.

7.2.10 Bag Jam Rate

- A hard bag jam is defined as an event during which a PEC is blocked for an inordinate amount of time while the associated conveyor belt is running.
- A missing bag jam occurs when three sequentially tracked bags are sensed at any tracking PEC and not sensed at the next downstream tracking PEC.
- The BHSC may utilize the option of setting the missing bag jam counter to a value of one at the clear-bag line divert point.
- CBIS designs will allow for safe, quick, and effective clearing of any bag jam.
- When a bag jam does occur, adequate and proper bag jam clearing procedures are required to ensure safe and secure operations throughout the CBIS.

7.2.10.1 Bag Jam Requirements

The bag jam rate is calculated by dividing the number of jam events (hard and missing) from the ATRs of the SF line through all EDS shunt lines to the entrance of the EDS by the total bags inducted. The Jam Rate shall be less than 1%.

- During controlled testing, the bag jam rate for each system test shall be less than 1% of inducted bag volume is calculated by dividing the number of jam events (hard and missing) from the ATRs of the SF line through all EDS shunts to the entrance of the EDS by the total bags inducted during the test.
- During live bag operations, the bag jam rate shall be less than 1% of bag volume during the Daily Peak Hour and 24-hour Calendar Day as measured using the Daily CBIS Summary Report defined in Appendix A, Section A.8. The bag jam rate is calculated by dividing the number of jam events (hard and missing) from the ATRs of the SF line through all EDS shunt lines to the entrance of the EDS by the total bags inducted during the peak hour and averaging across each daily peak hour measured during the 30-day run-in.

Written bag jam resolution procedures will be developed for all areas within the CBIS, including tracked, non-tracked, and fail-safe zones as referenced in the requirements listed in Chapter 2 for CBIS Use and Logistics Training. In the case of fail-safe zone jam events, the procedures must include notification of the event to local TSA personnel for witnessing of the jam removal procedures to ensure proper routing and resolution of cleared, non-cleared, and unknown baggage.

Please refer to Appendix A, Section A.4 for an outline of the Bag jam resolution procedures that should be provided.

7.2.11 CBIS Layout

The following section describes CBIS layout-related requirements and their corresponding best practices.

7.2.11.1 Recirculation Loop Requirement

The automatic recirculation of bags shall not be designed, either pre-EDS screening or post-EDS screening, except for automated reinsertion lines in the CBRA as shown in Section 7.2.11.2.

7.2.11.2 Reinsertion Line Requirement

Non-cleared bags shall only be reinserted upstream of the STZ.

7.2.11.3 Draft Curtains Requirement

All PECs shall be clear of obstructions including draft curtains.

7.2.11.4 EDS Maintainability Requirements

CBIS designers will provide sufficient access to the EDS units for the following purposes:

- TSA operations (e.g., TSOs conducting regular tests, preventive maintenance (PM) or operation of EDS)
- Corrective Maintenance (CM)
- Equipment removal and equipment replacement
- Equipment upgrades

Designers shall use the EDS PGDS Maintainability Standards Exhibit (Environment Checklist) displayed in Figure 7-5 to ensure that the required environmental standards described in this chapter are met.

Figure 7-5: EDS PGDS Maintainability Standards Exhibit (Environment Checklist)

EDS PGDS Maintainability Standards Exhibit (Environment Checklist)

Airport: ______ **Date:** ______

Location/Terminal: ______

Completed by: ______

Service Access	***Yes***	***No***
Does the EDS area provide 3 feet or more around all four sides of the unit(s) and a clearance of 9 feet or more above the unit(s)?	☐	☐
Measured area around all four sides, and overhead clearance, of EDS **(please provide):**		
Environment		
Heating, Ventilation, and Air Conditioning (HVAC) Systems	***Yes***	***No***
Does the EDS area provide for consistent warmed, cooled and dehumidified air flows?	☐	☐
Model and make of the HVAC system in place **(please provide):**		
Temperature	***Yes***	***No***
Does the temperature of the EDS area maintain a consistent range between 50°F and 80°F?	☐	☐
Measured temperature range in the EDS area **(please provide):**		
Humidity	***Yes***	***No***
Does the humidity of the EDS area maintain a consistent range between 10% and 60% non-condensing?	☐	☐
Measured humidity range in the EDS area **(please provide):**		
Storage and Space Parts Access		
Secure Storage Space	***Yes***	***No***
Is there a secure storage space for spare parts and tools with an area of 150 square feet or more, and within close proximity of the EDS?	☐	☐
Describe secure storage space **(please provide):**		
Distance from EDS to secure storage area **(please provide):**		
Heavy Equipment Lifting	***Forklift***	***Overhead trolley hoist***
Is their heavy equipment lifting equipment and/or systems are in place for use in maintaining the EDS unit(s)?	☐	☐
Specify heavy equipment lifting equipment or system that is in place **(please provide):**		
Quick Disconnect Standard	***Yes***	***No***
Are the EDS conveyor components readily removable through the use of available hand or power tools?	☐	☐

Note/Comments:

Service Access. A required minimum service area of 3 feet around all 4 sides of the equipment along with a minimum clearance of 9 feet above the EDS is required. Unimpeded access to the equipment for maintenance by engineers and technicians should be planned to the maximum extent possible. If it is not possible, or if the units are installed on a mezzanine or in other inaccessible areas, provisions should be made for hoisting or transporting heavy items to the installation site (i.e., trap doors, removable conveyor sections, and overhead lifting equipment). It is recommended that a winch or chain lift from an overhead beam that is rated and approved for such lifting purposes is available for the movement of heavy and large parts for maintenance purposes. Failure to provide access or lifting equipment will result in longer repair times.

Environment. The Project Sponsor shall ensure that all operating environmental and maintenance requirements as set in the OEM's integration guidelines are met. Within the facility the temperature range in the operating environment must be between 50°F and 80°F. The relative humidity must range between 10% and 60% non-condensing. There should also be adequate illumination and sufficient dedicated power source outlets to perform maintenance activities. Adequate heating, ventilation, and air conditioning (HVAC) systems are necessary to ensure acceptable performance of the CBIS.

Storage and Spare Parts Access. Secure storage space shall be provided for spare parts and tools. This space should be approximately 150 square feet and shall be located close to the EDS unit.

Quick Disconnect Standard. CBIS designers shall identify the appropriate number of conveyor components in the Detailed Design phase immediately before and after the EDS unit that will be readily removable using commonly available hand or power tools. Designers shall also identify the methodology for removal of any ancillary equipment before or after the EDS units to allow for easy access to the EDS units for maintenance, removal or replacement.

7.2.11.5 EDS Replacement Planning Requirement

The Project Sponsor shall include access routes for EDS equipment replacement in the CBIS design.

7.2.12 STIP Data Requirements for Checked Baggage Systems

The TSA HQ Office of Information Technology (OIT) and Security Technology Integrated Program (STIP) require STIP-enabled transportation security equipment to have specific connections to securely and reliably network the equipment. Multiple parties play a role in this portion of CBIS specification and execution.

The TSA Project Coordinator will provide the Project Sponsor with the latest copy of the STIP data requirements.

7.2.12.1 Roles and Responsibilities for Implementing STIP

As a CBIS is modified as part of a TSA-funded project, the Project Sponsor's contractor will provide new telecommunications outlets and cables as needed to support new technology. If a CBIS reconfiguration is initiated as part of a recapitalization/optimization, safety effort, new technology deployment or any other CBIS redesign initiative, the CBIS contractor will be responsible for restoring the previous state of connectivity ("make whole"), including development of the scope of work (SOW). Implementation in the field will occur via the CBIS contractor. A working group, must be formed by the Project Sponsor consisting of representatives from the Airport Authority, FSD staff, OAPM, OIT and STIP. The group should meet immediately via conference call once it has been determined that a CBIS is going to be recapitalized or optimized. This action will ensure that ALL aspects of the CBIS redesign have been identified and assigned to a specific group for action and funding. The Project Sponsor will organize the working group members, develop, review and approve the SOW. The OIT Field Regional Manager (FRM) will always be consulted when a CBIS redesign is initiated and will provide the necessary routing information to ensure the checked baggage systems are appropriately cabled to a networked TSA IT cabinet.

7.2.12.2 The IMAC Process

The Installation, Move, Add and Change (IMAC) Process is the mechanism by which TSA OIT will procure and install IT hardware (e.g., network switch) following the IT infrastructure build-out of a CBIS contractor. The TSA Project Coordinator will be responsible for engaging OIT at project initiation and including the respective regional FRM throughout the construction process.

The IMAC process takes between 30 and 45 days and needs to be initiated to complete the following tasks:

- Procurement, configuration and shipment of IT hardware
- Installation of IT hardware
- Patch cabling of checked baggage equipment
- Validation of network connectivity for checked baggage equipment
- Validations of STIP Enterprise Manager server registration for checked baggage equipment.

It is imperative to engage each team member as early as possible in order to avoid any gaps in IT services.

7.2.12.3 Specific STIP Design Requirements

Two modular jacks consisting of a flush-mounted telecommunications outlet box plus/minus 10 feet from the equipment are required. Even though one is redundant, both terminations should be connected using Cat5e or Cat6 4-pair 100 ohm unshielded twisted pair (UTP) or screened twisted pair (ScTP) cable and terminated on the patch panel in the closest TSA IT cabinet. The data cable type should be based on the existing conditions at the CBIS. The purpose of this connectivity is so that TSA HQ can review statistical data over the network from screening equipment for a particular airport and time period without having to go to the site.

Installation and/or relocation of Cat5e/Cat6 data cabling will meet or exceed the specifications listed in the TSA Structured Cabling System Guidelines dated July 2012. This document will be provided by the TSA to the Project Sponsor.

The following STIP requirements shall be met:

- All ETDs and stand-alone EDSs shall have one "dual telecommunications outlet".
- When a multiplex server is present, connectivity to TSANet shall terminate at the multiplex server cabinet, therefore connectivity to TSANet for each EDS is not required.
- All core drilling shall support a minimum of four "modular jacks".
- All new fiber installations shall be multimode fibers, either multimode fiber, either 50/125 or 62.5/125 micron fibers r 50/125 or 62.5/125 micron fibers, 6-strand bundles enclosed in inner duct.
- All cabinet installations shall have 2 110v 20A service.
- All cabinet installations shall meet the local seismic rating requirements and can be floor/bracket mounted.
- All newly installed and existing data jacks and associated patch panels shall comply with TSA's approved scheme [see TSA Structured Cabling System Guidelines dated July 2012].
- Completed Data Capture Sheet and cable certification paperwork shall be provided to TSA prior to established ISAT date.
- All IT cabinet installations shall include a temperature and humidity gauge for monitoring purposes.

Figure 7-6 illustrates all of the equipment that must be connected to the Main Distribution Frame/Intermediate Distribution Frame IT cabinet for a stand-alone CBIS configuration. When the EDS are in a stand-alone configuration, each EDS must be connected to the patch panel.

Figure 7-6: Stand-Alone CBIS Configuration

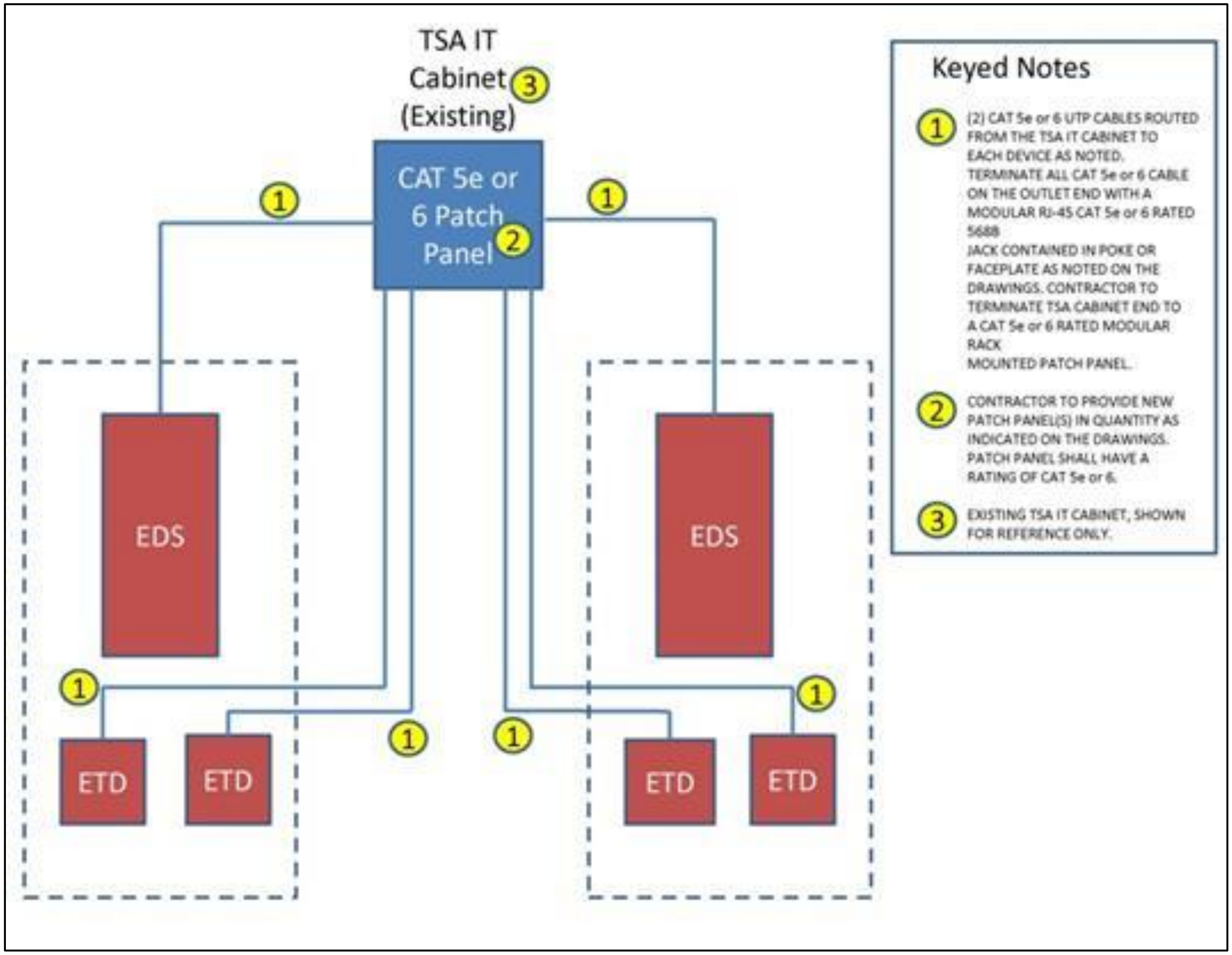
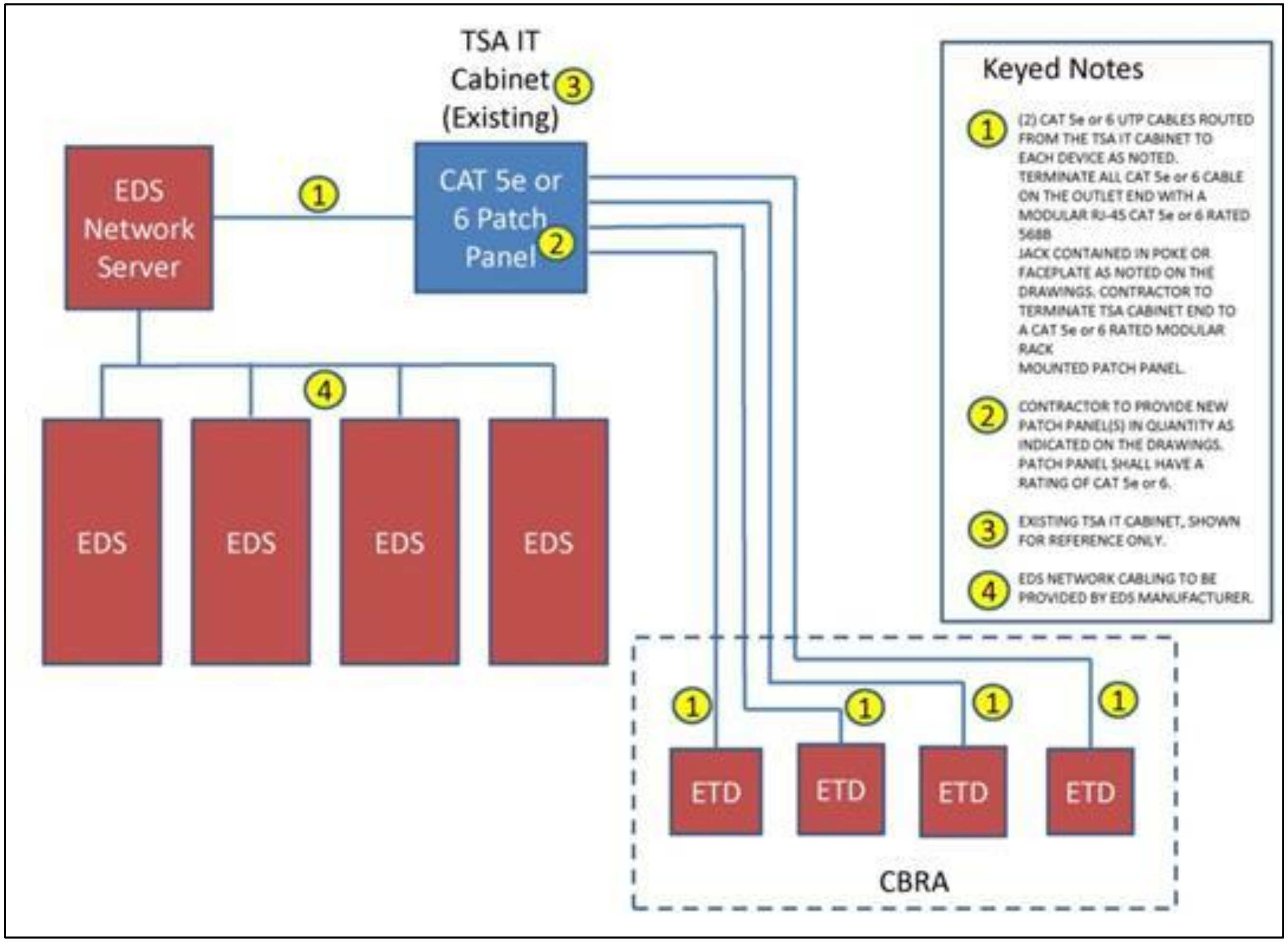


Figure 7-7 illustrates all of the equipment that must be connected to the Intermediate Distribution Frame IT cabinet for a CBIS where the EDS units are already networked together. When the EDS units are networked together (e.g., MUX and NEDS), the connection only needs to be made to the EDS Network Server(s).

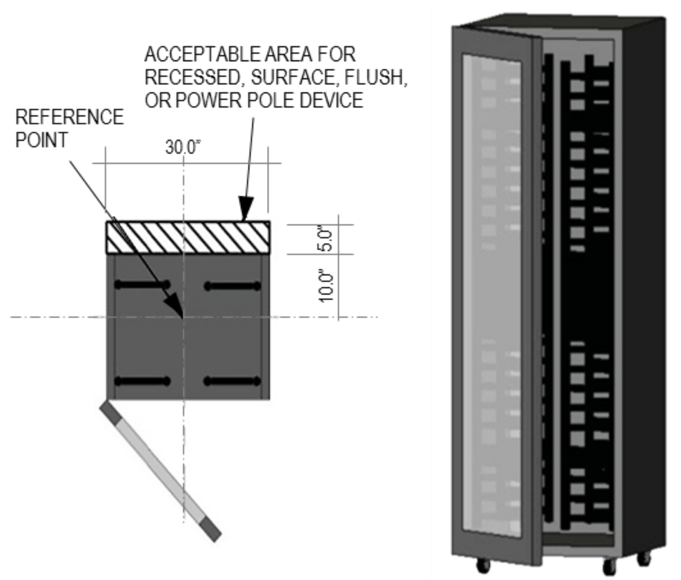
Figure 7-7: Networked CBIS Configuration



At a minimum, the following guidelines should be considered when designing a new CBIS or reconfiguring an existing CBIS.

- If an existing TSA IT cabinet is within 295 feet of the CBIS:
  - Verify that the existing switches have sufficient open ports to accommodate the required number of drops.
  - Notify TSA OIT FRM if the existing switch capacity will not accommodate the required number of drops so that additional equipment can be procured.
  - Punch down cabling from the individual CBIS devices in the patch panel of the IT cabinet.
- If there is no IT cabinet within 295 feet of the CBIS:
  - Install an appropriate IT cabinet. Refer to for the IT cabinet specifications below.
  - Run fiber optic cable from the IT cabinet to an existing TSA IT cabinet.
  - Punch down cabling from the individual CBIS devices in the patch panel of the IT cabinet.
  - Initiate IMAC group to install jumper cables from the patch panel to the switch and activate port.

Figure 7-8: IT Cabinet



Height	Width	Depth	Weight
24”	27.3”	30.0”	97 lbs
36”	27.3”	30.0”	124 lbs
48”	27.3”	30.0”	151 lbs
60”	27.3”	30.0”	246 lbs
72”	27.3”	30.0”	274 lbs

IT Cabinet Specifications:

- Cabinet size: See Figure 7-8.
- Quantity: One or more per checkpoint, depending on size
- Power requirements
  - For 24H, 36H and 48H:
    - Dedicated
    - 20A, 125V, 3KVA/Cabinet
    - 2-Pole, 3-Wire Grounding
    - NEMA L5-30R Receptacle
    - 3KVA UPS
    - 6’ power cord from the IT cabinet to the receptacle
  - For 60H and 72H:
    - Dedicated
    - 30A, 208V, 6KVA/Cabinet
    - 2-Pole, 3-Wire Grounding
    - NEMA L6-30R Receptacle
    - 6KVA UPS
    - 8’ power cord from the IT cabinet to the receptacle
- IT Requirements
  - Size patch panels to accommodate all TSA data outlets at the checkpoint plus 100% spares, minimum.
  - Size giga bit network switch to accommodate all data outlets in checkpoint plus 10%.
  - Provide a minimum of four pair single mode fiber optic cable from IT cabinet to the TSA main distribution frame.
- Additional information
  - 30” front and rear access is required.
  - These cabinets will receive all data communication lines from the SSCP, so the cabinet should be located as close to the SSCP as possible, but in a secure location. Careful consideration needs to be given to the IT cabinet location because the exhaust fan for cooling can be loud when located in a confined space with TSA or airport personnel.

- Equipment racks can be loaded into the cabinet from the front or the back at the location where the cabinet is installed. Although not required, side access would improve rack accessibility and TSA personnel mobility around the cabinet.
- Refer to Program of Requirements dated July 2005, Section III-D for labeling, cable management and administration of IT cabinet.
- Refer to Program of Requirements dated July 2005, Section III-D for acceptance testing of IT circuits.
- Wall-mounted cabinets are an option in some instances, but must adhere to all applicable local codes and standards. Recommend consultation with the Field Regional Manager when considering a wall-mounted alternative.

7.2.12.4 Advanced Surveillance Program Video Surveillance

TSA's Advanced Surveillance Program (ASP) recommends the following best practices for all video surveillance systems:

- The system installed should be configurable, expandable, and have a hierarchy of access levels, user IDs and passwords.
- All recorded video should be able to be stored for a minimum of 30 days; airports may choose to increase the length of storage based on local considerations.
- Cameras and displays should be positioned to minimize any impact on the quality or performance of the video displayed due to light glare.
- Video data should be in a format suitable for use by all airport stake holders (e.g. local TSA, local law enforcement, airport authority, etc.).
- Video surveillance workstations should be provided at reasonable locations.

Table 7-1 shows the recommended minimum Field of Views (FOV) be captured using any number of devices.

Table 7-1: ASP Recommended Field of Views

Field of View	Summary	Capability
1. Explosive Detection System (EDS) Entrance	FOV is the baggage entering the EDS unit.	FOV enables effective situational monitoring of this area; specifically, the view enables identification of baggage by shape ,color, and - if applicable - identification of the EDS operator.
2. Explosive Detection System (EDS) Exit	FOV is baggage exiting the EDS unit.	FOV enables effective situational monitoring of this area; specifically, the view enables identification of baggage by shape, color, and - if applicable - identification of the EDS operator.
3. On Screen Resolution (OSR) Room	FOV is OSR alarm resolution area.	FOV enables effective situational monitoring of this area; specifically, the view enables identification of personnel performing screening and monitoring of primary viewing station in OSR.

Field of View	Summary	Capability
4. Overhead View of Checked Baggage Resolution Area (CBRA)	FOV is overhead view of CBRA.	FOV enables effective situational monitoring of this area; specifically, the view enables monitoring of the baggage as it is taken to the bag inspection table.
5. CBRA Baggage Entrance	FOV is baggage entering CBRA.	FOV enables effective situational monitoring of this area; specifically, the view enables identification of baggage by shape and color.
6. CBRA Baggage Inspection Tables	FOV is bag contents screening and ETD Sampling.	FOV enables effective situational monitoring of this area; specifically, the view enables identification of baggage by shape and color; view includes screeners handling any items from the passenger property; identification of individual items removed from and returned to baggage should also be included in the view.
7. CBRA Explosive Trace Detection (ETD) Machine	FOV is screener collecting sample to be placed into ETD, screener placing sample into ETD machine, and results from ETD machine.	FOV enables effective situational monitoring of this area; specifically, the view enables identification of screener and identifies if ETD machine alarmed.
8. CBRA Exit to Reintroduction / Reinsertion Belt	FOV is baggage exiting CBRA for EDS re-screening.	FOV enables effective situational monitoring of this area; specifically, the view enables identification of baggage by shape and color; view also enables identification of personnel placing baggage onto belt.
9. CBRA Exit to Cleared Belt	FOV is baggage exiting CBRA for entry into Cleared Belt.	FOV enables effective situational monitoring of this area; specifically, the view includes belt and enables identification of baggage by shape and color and identification of personnel placing baggage onto Cleared Belt.
10. Personnel Entrance to CBRA	FOV is personnel entrance to CBRA area.	FOV enables effective situational monitoring of this area; specifically, the view enables identification of any persons entering the CBRA area along with identification of baggage entering CBRA in their possession.
11. CBRA Personnel Exit	FOV is personnel exit from CBRA area.	FOV enables effective situational monitoring of this area; specifically, the view enables identification of any persons exiting the CBRA area along with identification of baggage leaving the area in their possession.
12. Oversize / Out of Gauge Belt (OOG)	FOV is baggage entering Oversize / OOG belt and then entering the CBRA.	FOV enables effective situational monitoring of this area; specifically, it enables identification of baggage by shape and color; if applicable, allows the identification of the EDS operator. View enables monitoring of the baggage as it is transferred to CBRA. Coverage is sufficient to enable review of baggage screening procedures.

7.2.13 CBIS Reporting

Investment in CBIS error logging and reporting (or some other form of system diagnostic capability) is valuable in CBIS operation. Such capability allows for monitoring of the CBIS performance so that developing problems can be spotted early, directing predictive or preventive maintenance efforts. Following are the minimum CBIS reporting requirements.

7.2.13.1 Reporting Frequency Requirement

The CBIS reporting system shall be capable of providing data in real time (±1 minute) and in hourly, daily, weekly, monthly, quarterly, annual, and manually entered time periods.

7.2.13.2 Reporting Detail Requirements

- The CBIS reporting system shall be capable of providing detailed data by Bag ID number and EDS unit and will be provided by the BHS Vendor.
- At a minimum, the reporting system shall be capable of providing the following features in reports:
  - Bag Data
    - Bag Tag number (with ATR/RFID installed)
    - Time stamped at BMA
    - BHS tracking ID number for each bag (shared by BHS and EDS unit)
    - Bag type (OS, OOG, in-spec)
    - Time stamped when bag enters the EDS unit or time stamped when OOG bags are diverted to OOG Line
    - SSI - Level 1 screening status
    - SSI - Level 2 screening status
  - Critical Tracking PEC

    Immediately upstream and downstream of each EDS, prior to and after each tracked divert point, and at the last tracked PEC entering the CBRA, the BHS shall report the following for each activation of the PEC:
    - Bag ID
    - SSI - Bag screening status

    NOTE: This is not a report for a given PE, but rather the status of a given bag at critical PEs in the system.
  - BHS Faults
    - Fault type (NOTE: A "fault" is defined as a “cause” such as lost in track, motor overload, PEC failure, encoder failure)
    - Fault location
    - Fault time
    - Fault time cleared

- Total fault time

– BHS Events
  - Event type (NOTE: An "event" is defined as the "effect" of a fault, such as re-establish tracking, fail-safe, or jams, or the "effect" of human interaction on the system, such as via HMI or control station, e.g., pushing an e-stop or OTK activation)
  - Event location
  - Event time
  - Total event time

– EDS Statistics (if data to support these statistics is available from the EDS OEM being installed)
  - SSI – Number of bags alarmed by specific EDS unit
  - SSI – Number of bags cleared by specific EDS unit
  - EDS unit faults (if known)
  - Start time of fault
  - End time of fault

– ATR Performance
  - ATR Name
  - ATR Description (i.e., Tracking or Sortation)
  - Total number of bags seen
  - Total number of tags read
  - Number of problem tag reads (this can be provided as a single total count or ideally as a set of constituent counts plus a total count and should be representative of the number of unreadable/missing tags, number of invalid tag reads, number of conflict/multi-tag reads, etc.)
  - Number of associated tag reads (i.e., the number of 10-digit IATA bag tag IDs read and associated with the bag's BHS tracking ID)
  - Total number of 10-digit IATA bag tags that are read at the ATR and passed to the EDS
  - Total number of 10-digit IATA bag tags sent to the EDS and how many were sent back at the EDS exit
  - IATA Tracking Accuracy

– BMA Statistics
  - Total number of bags through the BMA

    - Total number of OS bags
    - Total number of OOG bags
    - OOG (absolute) tracking accuracy

- System Baggage Volumes
    - By input conveyors (ticket counter conveyors, curbside conveyors, oversize conveyors)
    - By screening area (including EDS unit and CBRA)

- CBRA Statistics – CBRA statistics shall be presented and considered SSI.
    - Cleared
        - Cleared (CLR)
        - PRE-Clear (P-CLR)
        - SEL-Clear (S-CLR)
    - Alarmed
        - Alarmed (ALM)
        - PRE-Alarmed (P-ALM)
        - SEL-Alarmed (S-ALM)
        - No Decision
        - Purged
        - Queue Time Out (Q-TimeOut)
        - Operator Time Out (O-TimeOut)
    - Lost in Tracking
        - Mistracked
        - Bag Length Tracking
        - Following Lost Bag
        - Too Close
        - Security Re-route
    - Unscreened
        - OS
        - OOG
        - Invalid arrivals at the OOG line

  - Reinsert Line
    - Reinserted bags
- PEC Tracking Statistics
  - Total number of bags seen at each PEC
  - Total number of purged bags at each PEC
  - Total number of missing bags at each PEC
  - Total number of unknown bags at each PEC
  - Total number of “hard” jams at each PEC
  - Total number of missing bag jams at each PEC
- Baggage Process Timer (BPT) Statistics – see Section 9.5.5
  - Total number of bags seen
  - Average processing time for each bag
  - By BIS position

- At the Project Sponsor’s discretion, the reporting system may contain the capability to perform database queries.
- The reporting system shall provide BHS Reports which should be within 5% difference or accuracy compared to the EDS Counts per screening line. (When analyzing this data, the point of Bag ID acquisition at the EDS must be taken into consideration, i.e., if the ID is generated at the in-feed and passed to the EDS, the ID may be processed and logged in the FDRS. However, if the unit faults, that ID and decision may not be passed back to the BHS for logging.)
- For MITs, all CBRA reports shall be generated based on bag status upon arrival at the inspection station location.

7.2.13.3 Daily Reporting Requirements

At a minimum, the following daily reports in the format shown in Appendix A, Section A.8 shall be available to the local TSA representative:

- Daily CBIS Summary Report (Figure A-6)
- Daily CBIS Summary Report – Peak Hour
- Daily CBIS Bag Volume Report (Figure A-7)
- CBIS Executive Summary Report (Figure A-8) – SSI

- CBRA Executive Summary Report (Figure A-9) – SSI
- PEC Tracking Reports for all PECs within a tracking zone (Figure A-10)
- BPT Summary Report (Figure A-11)
- CBRA Bag Report (Figure A-12)

7.2.13.4 BHS ID Log Report Requirements

A report of the last 1000 BHS ID's shall be provided as defined below:

The BHS_ID_LOG shall be considered a First-In-First-Out (FIFO). The FIFO shall capture the last 1,000 Pseudo IDs, associated decisions and a flag indicating whether the bag has been processed by a TSO (including re-inserted for screening) for each EDS.

This data shall consist of three elements:

- Pseudo_ID
- Decision
- Processed

Refer to OEM integration manuals for additional guidance.

The report shall be provided in both a PDF format and an importable CSV file.

7.3 CBIS Operating and Maintenance Best Practices

Designing an optimal CBIS should also include implementation of design practices that will ensure optimal CBIS Operation and Maintenance (O&M). High quality and cost-effective operation and maintenance of CBISs can help maintain good performance of the CBIS and prevent unnecessary performance degradation. CBIS performance monitoring can be used to help identify corrective maintenance and schedule preventive maintenance actions to improve the overall operations.

The paragraphs below discuss CBIS O&M best practices that designers should be cognizant of during the CBIS design phase to ensure that optimal CBIS design allows for implementation of such O&M best practices when the CBIS is operational.

7.3.1 CBIS Operating Best Practices

When designing CBISs, designers should allow for the following best practices to ensure a high-quality and cost-effective CBIS operation.

7.3.1.1 CBIS Reporting Tools

A CBIS dashboard (a real-time display of key CBIS statistics and data) in the BHS control room is important to allow for cost-effective monitoring and quick detection of any CBIS performance degradation or malfunction.

In compliance with the current TSA Interface Requirement Document (IRD) for BHS and CBIS and to facilitate such reporting tools, designers should aim to design a common database for EDS and BHS reporting data. A common database would enable the provision of a dashboard report in the BHS monitoring system during CBIS operation, which can show simple trend indicators.

One recommended method of designing and implementing a CBIS dashboard is to use a separate Internet-based system from the BHS control system to combine the output into one user-friendly dashboard. Output information is displayed on screen and also allows for audible and visible alarms when required. New CBIS dashboards could communicate the status of EDS units (CBIS in compliance with IRD). For a legacy CBIS, a TSA EDS control slave monitor would need to be used and placed close to the dashboard. In both cases, as more information becomes available because of wider compliance with the TSA IRD, the reporting system will become more robust.

7.3.1.2 CBIS Reporting Trends

One of the most effective tools used to monitor CBIS performance, ensure seamless operations, and quickly identify and addres s problems is to be able to review CBIS operating trends. The following are key trends that provide important information about CBIS performance and are vital to detecting CBIS performance degradation:

- Increase in CBRA error percentages – The error rate established when the system was commissioned should remain within a relatively constant range. An increase trend can signal that more bags are labeled as unknown or error bags, which may be due to CBIS performance degradation or malfunction (e.g., bag tracking system).
- EDS false alarm rates – EDS false alarm rates should remain relatively constant over time (assuming no changes in protocol). An increasing or decreasing trend may indicate degradation in the CBIS or EDS performance.

7.3.1.3 CBIS Testing

The most valuable CBIS tests are often the most difficult, and costly, to perform. A complete battery of tests cannot be completed on a live CBIS without a severe interruption of regular operations. Therefore, in addition to the above-mentioned improved diagnostics and monitoring CBIS trends through the use of reports, spot checks (subsets of the ISAT) are the best way to ensure that the system is efficient, secure, and not deteriorating.

Ensuring that EDS-required detection levels are maintained can be achieved through the periodic use of test bags, such as the TSA-qualified OTK kit or other TSA-qualified test bags. Designers should allow for the conduct of such periodic testing as seamlessly as possible with regular operation of the CBIS. An example of such design principles is: communications system between TSO testing at the EDS and TSO testing at the CBIS control room (TSOs need to switch the EDS to test mode and switch back to regular screening mode after the test is complete).

7.3.1.4 BHS O&M Contracts

System monitoring should be used to avoid "break-fix" contracts, which allow for the slow deterioration of the system. Performance metrics should be used to monitor system performance for maintenance contracts.

7.3.1.5 Communications

An important key element to ensuring efficient and high-quality CBIS operations is effective communications between all relevant stakeholders. Communication is vital to quickly identify and address problems that will inevitably arise during the course of operation. Considerations related to communications between stakeholders should include the following:

- Ensuring that the proper communication can occur between EDS units and the BHS control room.
- Improved communications between TSA and the BHS operator (e.g., BHS operators should be notified by TSA of any EDS failure).
- Review of data by all stakeholders (airport operators, airlines, airport engineers, TSA, BHS operators) and the scheduling of biweekly (or at least monthly) meetings to review both non-SSI and SSI CBIS reports.

While Project Sponsors and/or airlines are usually responsible for BHS maintenance, TSA is responsible for the maintenance of EDS units, which are owned by TSA. As such, non-TSA personnel clearing bag jams from EDS units may create contractually challenging situations. Therefore, only authorized TSA personnel or other TSA designees are allowed to clear bag jams from EDS units.

7.3.2 Maintenance Best Practices

Effective CBIS maintenance is an important element in ensuring that the CBIS is operating as required and is efficiently remediated during malfunctioning. The following is a list of recommended preventive and corrective maintenance best practices.

7.3.2.1 Maintenance Responsibility Matrix

TSA and the BHS operator (and the contracted maintenance providers) must have a clear picture of their responsibilities. A responsibility matrix should be created once the core team is established. An OTA or Memorandum of Understanding document between TSA and the Project Sponsor should be created outlining all responsibilities and include technical upgrades to the CBIS.

7.3.2.2 Operator Training

Operator training is an important element in preventive maintenance, which, if conducted well, can improve CBIS operating time and Mean Time Between Critical Failure (MTBCF). Training should include items such as what the operator sees, hears, and smells to determine the correct operation of the CBIS. Operators should report anything unusual that can be an indication of required maintenance. For example, oil stains or smell of burning rubber/ plastic can be important indicators of a CBIS malfunction or an imminent malfunction and, if reported promptly and accurately, can be addressed with preventive maintenance. Training should also include Level 1 preventive and corrective maintenance requirements as identified by the equipment manufacturer (see Section 7.3.2.5).

7.3.2.3 Frequency of Preventive Maintenance

The operator should conduct Level 1 preventive maintenance on the EDS as identified by the equipment manufacturer. Level 1 PM are normally required every shift, daily, or weekly without the need to open the CBIS that will help improve the reliability of the CBIS (e.g., inspect/clean filters or replace paper). Level 2 PMs on the EDS are normally performed every month, quarter or year and require a trained maintenance technician to perform the action (e.g., replace gaskets or clean exhaust port). These actions are conducted by the equipment manufacturer during the warranty period or under the Contractor Logistics Support contract. BHS preventive maintenance should be performed daily, weekly, monthly, and semi-annually in accordance with the airport Project Sponsor maintenance contract.

7.3.2.4 CBIS Environment

The cleanliness of the overall CBIS environment can significantly affect the overall performance of the BHS and EDS units, as dust and dirt can cause computers to malfunction. An adequate HVAC system often helps improve the performance of a CBIS over time and is, therefore, a worthy investment.

7.3.2.5 Aligning BHS and EDS Preventive Maintenance

Contractually, aligning BHS and EDS maintenance would be difficult; however, face-to-face communication can greatly improve this alignment and create good O&M synergy. This successful alignment typically varies from airport to airport. Best practices to allow for such successful alignment include:

- Routine maintenance
- Onsite teams
- Well-trained people
- Audit teams

Safety EDS maintenance best practices, that when implemented, have led to significant improvements in operating time and MTBCF of EDS units include:

- Ensuring that work environments are safe for all personnel who work in the area.
- Providing and using appropriately personal protective equipment to service personnel
- Immediately reporting any injuries that occur on site

7.3.2.6 BHS Maintenance Best Practice

BHS maintenance such as the cleaning of photo eyes should not be performed during live bag operations.

7.3.2.7 BHS Reporting During Maintenance

BHS Reporting capabilities shall be designed such that logging of photo eye activity (i.e., total, missing, unknown, etc.) is disabled on conveyors not running or operating in a manual override mode. The BHS shall only log PE activity when conveyors are running in a fully automated mode. Analysis of operational run-in data has been thrown off and skewed when maintenance activities occur while the system was live or logging events.

CHAPTER 8:

LIFE CYCLE COSTS

REQUIREMENTS TABLE

Section	Requirement
8 Life Cycle Costs	To establish the lowest-cost alternative, planners shall calculate the life cycle costs of developing, maintaining, and replacing the CBIS.
8.1.1 Life cycle Cost Analysis Period	To provide a standardized period for assessing life cycle costs, a 20-year total life cycle shall be assumed based on an EBSP Acquisition Decision Memo to fully capture the upfront capital costs, as well as recurring costs for staffing, O&M, and life cycle replacements.
8.1.4 Real Dollar Cost	Real values are used to provide a consistent comparison of costs over time and shall be used to estimate all costs considered in the life cycle analysis.
8.2.1.6 Required Building and BHS Infrastructure Modification Costs	Planners shall develop a detailed, bottom-up cost estimate for facility modification and infrastructure costs for all alternatives being considered.
8.2.1.6 Required Building and BHS Infrastructure Modification Costs	Facility modification costs shall be adjusted to account for regional differences in construction costs based on the latest RS Means Construction Cost Data Indexes published by Reed Construction Data or by other industry-standard cost adjustment practices.
8.2.2.3 Incremental BHS Maintenance Costs	For the purposes of the life cycle cost analysis of screening alternatives, planners shall only consider the incremental cost of BHS maintenance which is calculated by subtracting the existing maintenance cost of the current BHS (with or without a CBIS) from the total estimated maintenance cost of the new BHS with the proposed CBIS.
8.2.2.3 Incremental BHS Maintenance Costs	The overall annual cost of O&M for the full CBIS shall be estimated at 10% of the initial overall cost of the system.
8.2.2.4 Incremental BHS Operating Costs	Planners shall compare utility costs for the BHS on an incremental basis.
8.2.2.4 Incremental BHS Operating Costs	To calculate the incremental BHS operating costs, planners shall subtract the existing operating cost of the current BHS (with or without a CBIS) from the total estimated operating cost of the BHS with CBIS.
8.2.3.1 TSA Personnel Costs	Planners shall request staffing cost estimates for the screening alternative(s) under consideration upon submittal of the Preliminary Alternatives Analysis Report (see Chapter 2).
8.2.3.2 Incremental Costs for Baggage Porters and Other Airport/Airline Staff	Any increase or decrease in costs for baggage porters or other airport/airline staff shall be included in the life cycle cost analysis.

Section	Requirement
8.2.3.2 Incremental Costs for Baggage Porters and Other Airport/Airline Staff	Planners shall include only incremental costs for baggage porters or other airport/airline staff.
8.3 Cost Estimating	To ensure that TSA is only funding that portion of a project that is necessary to implement a CBIS, airport sponsors requesting funding support from TSA shall provide a detailed cost estimate summary as included in Figure 8-1 at each phase of design.
8.3.1 Basis of Estimate	Estimates submitted for funding request purposes shall include a Basis of Estimate (BOE) document, developed from the perspective of the prime contractor for construction, which includes, at a minimum, the following elements: Purpose Executive Summary Project Scope Description Methodology Used to Prepare the Estimate Work Breakdown Structure Tools and Data Sources Major Cost Components: Labor, Equipment, and Material Subcontractor and Prime Contractor Markups and Fees Allowances Other Factors Schedule Requirements Assumptions, Exclusions, and Exemptions Areas of Risks
8.3.1.2 Executive Summary	The Executive Summary shall provide a brief (no more than one page) overview of the project for which the independent cost estimate, cost estimate validation, or cost to complete report is being prepared.
8.3.1.2 Executive Summary	The Executive Summary section shall include, not necessarily in this order, discussions of: • Where the project sponsor is in the bid and construction contract award process, if applicable • Whether construction has already begun and, if so, how much of the construction has been completed, if applicable • If the airport sponsor has awarded the construction contract, the type of construction contract instrument (firm fixed price, time and materials, design-build, etc.), if applicable • Name of the general contractor and BHS contractor, if available • Name and telephone number of the airport representative that provided the cost information • Brief statement of the design level the estimate was based on and statement as to whether the Current Working Estimate (CWE) is authored by a single entity or is a reconciliation of two or more estimates • Statement of the escalation that has been used, based on a project schedule and a summary of the CWE at a high level to show BHS costs, other construction-related costs, and soft costs • Discussion of any known areas of risk • Total estimated cost

Section	Requirement
	• Statement regarding whether the airport sponsor's estimate is reflective of current market conditions. This statement should address: • Description of current bidding climate relative to number of bidders responding to requests for proposals • Use of Davis Bacon Act wage rates, where applicable • List of current construction projects, including project name, type, approximate construction value, and schedule • Use of union versus nonunion labor • Narrative of labor availability • Narrative of material and equipment availability • Review of typical contracting methods used in location • Statement of the currency (i.e., age) of the airport sponsor estimates. Estimates for projects constantly change. In order to maximize use of limited funding cost estimates for projects must be current and validated for funding to be approved.
8.3.1.4.1 Work Breakdown Structure	A generic description of the estimate format and relationships of detailed cost items to their hierarchy shall be presented.
8.3.1.4.2 Tools and Data Sources	The BOE shall indicate the primary estimating methodology used in preparing the cost estimate, including that used for cost resources, historical data, and estimating tools and documents.
8.3.1.4.3 Major Cost Components: Labor, Equipment, Material	Sources for labor, equipment and material cost elements used in preparing the estimate shall be described, thereby further demonstrating the estimator's level of effort and knowledge of the project requirements.
8.3.1.4.5 Allowances	Allowances used in the estimate and the reason they were used shall be clearly stated.
8.3.1.4.8 Assumptions, Exclusions, and Exemptions	The BOE shall include three separate and distinct bulleted listings that concisely identify the assumptions, exclusions, and exemptions used in developing the estimate.
8.3.3.1 Design Contingencies	Design contingencies shall be noted as separate and distinct items apart from direct construction costs and other associated markups.
8.3.3.2 Construction Contingencies	Construction contingencies shall be noted as separate and distinct items apart from direct construction costs and other associated markups.
8.3.4.1 Current Escalation	The body/details of the estimate shall have all cost items in current year dollars.
8.3.4.1 Current Escalation	The historical escalation rate used to make data current shall be based on the RSMeans Building Construction Cost Index (CCI) or another comparable industry standard from the relevant source date to the current date.
8.3.4.2 Forward Escalation	Escalation shall be based on the average annual rate of cost escalation for the three years prior to the estimate development date, as established by the most current quarterly published RSMeans Building CCI.

Section	Requirement
8.3.4.2 Forward Escalation	The escalation rate used shall be based on data for the nearest city provided in the CCI.
8.3.4.2 Forward Escalation	Escalation shall be noted as a separate and distinct item apart from direct construction costs and other associated markups.
8.3.4.2 Forward Escalation	Escalation shall be calculated from the scheduled construction start date to the midpoint of construction on a compounding basis.
8.3.4.2 Forward Escalation	Escalation shall be applied to the sum total of direct construction costs, general conditions, overhead, and profit.
8.3.4.2 Forward Escalation	Should a construction schedule not be available, the CWE shall be presented in nonescalated dollars and clearly noted as such.
8.3.4.3 Cost Estimate Currency/Age	All CWE pricing shall be effective as of the date of the submittal.
8.3.4.3 Cost Estimate Currency/Age	Estimates submitted for funding request purposes shall be accompanied by a market analysis specific to the airport location and timeframe during which proposed improvements will be implemented.
8.3.4.5 Estimate Trending	Any changes to scope or design shall be identified, documented, and submitted to the TSA Project Coordinator for approval prior to initiation of the next design phase.
8.3.5 TSA Funding	The Project Sponsor shall include both allowable/allocable and non-allowable/allocable costs in the appropriate CWE column.
8.4 Selecting the Preferred Alternative	Alternatives shall be evaluated on the basis of the present value of total life cycle costs, defined as the present value of the annual sum of capital, O&M, and staffing costs.
8.4 Selecting the Preferred Alternative	For the purposes of estimating the present value of these costs, planners shall use the 20-year Real Interest Rate on Treasury Notes and Bonds of Specified Maturities found in the latest version of OMB Circular No. A-94 Appendix C at http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c as the real discount rate.
8.4 Selecting the Preferred Alternative	Once the costs of all concept-level alternatives have been developed to include the full present value life cycle costs, alternatives shall be ranked based on present value life cycle costs and the lowest-cost alternative that meets all other requirements shall be selected as the preferred alternative.

The design principles prescribed in the PGDS emphasize the need to define and implement the most cost efficient screening alternative for the particular airport or terminal. To establish the lowest-cost alternative, planners shall calculate the life cycle costs of developing, maintaining, and replacing the CBIS. These costs will include those to be borne by TSA as well as airport operators and airlines. Life cycle cost is estimated early in the design process and is refined as the design process progresses. These costs establish the basis for return on investment analysis.

The analysis assumptions, life cycle costs to consider including capital costs, O&M costs, and staffing costs, and how to select the preferred alternative are discussed below.

It is expected that the life cycle cost will initially be completed as part of the pre-design phase to help identify a preferred alternative and then continually refined during the rest of the design phases. The estimated cost of the project is reviewed by TSA during the design review.

8.1 Analysis Assumptions

Life cycle cost analysis assumptions include the following:

- Life cycle cost analysis period
- Equipment life cycle
- Construction period
- Constant dollar cost

8.1.1 Life Cycle Cost Analysis Period

To provide a standardized period for assessing life cycle costs, a 20-year total timeframe shall be assumed based on an EBSP Acquisition Decision Memorandum to fully capture the upfront capital costs, as well as recurring costs for staffing, O&M, and life cycle replacements. The 20-year analysis period allows planners to account for: (1) screening equipment refurbishment and replacement and (2) accommodating traffic growth beyond the initial project design year (DBU+5 years).

8.1.2 Equipment Life Cycle

For the purposes of this analysis, equipment life cycle assumptions are as follows (see Chapter 3 for details by equipment model):

- **EDS Equipment**. The useful life of an EDS unit is assumed to be 15 years.
- **ETD Equipment**. The useful life of an ETD unit is assumed to be 10 years.
- **Baggage Handling System**. The useful life of a Baggage Handling System is assumed to be 20 years. Mechanical and Control modifications to systems may be required to accommodate the latest technology and EDS unit throughput rates.

8.1.3 Construction Period

It is expected that the construction period will be, on average, about two years for in-line systems and one year or less for mini in-line and stand-alone systems. The exact construction period will be project-specific and depend on the complexity of design and contracting requirements. Therefore, planners should estimate appropriate construction periods for the particular project in question.

8.1.4 Real Dollar Cost

Cash flows can be expressed in real or nominal dollars. Nominal (or current) values represent the expected price that will be paid when a cost is due to be paid. These values include inflation. For instance, if a unit costs $1.0 million today and is expected to cost $1.1 million in 2015, $1.1 million is the nominal cost of the unit in 2015. Real (or constant) values are adjusted to eliminate the effect of inflation. In the example above, the real value of the unit is $1.0 million, whether purchased today or in the future. Real values are used to provide a consistent comparison of costs over time and shall be used to estimate all costs considered in the life cycle analysis. These costs are based on the year in which the analysis is conducted. Therefore, no assumptions regarding cost escalation or inflation are necessary for this analysis. For an estimate of the present day value of project costs, a discount rate will be applied (see Section 8.3).

8.2 Life Cycle Costs to Consider

At a minimum, planners should assess the following costs in determining the overall cost of each screening alternative:

- Capital costs
- O&M costs
- Staffing costs

Planners should calculate overall life cycle costs for all alternatives based (as much as possible) on actual costs. Cost assumptions, averages, and estimates provided in this chapter should serve as a baseline to verify that actual costs are within a reasonable range. Details regarding estimation of the above costs are described in the paragraphs below.

8.2.1 Capital Costs

Capital costs to be considered include:

- Screening equipment acquisition costs
- Screening equipment direct installation costs
- Screening equipment upgrade costs
- Screening equipment replacement costs
- EDS removal costs

- EDS residual value and disposal costs
- Required building and BHS infrastructure modification costs

8.2.1.1 Screening Equipment Acquisition Costs

The cost to acquire screening equipment should be obtained from the TSA Project Coordinator.

8.2.1.2 Screening Equipment Direct Installation Costs

Direct installation costs relate to the set up and preparation of equipment for use. The components of direct installation costs are summarized in Table 8-1.

Table 8-1: Components of Direct Installation Costs

Equipment	Labor	Logistics	Onsite Installation
Auxiliary equipment (including hardware and software) Initial spares/repair parts and consumables	Program management (on-site and TSA Headquarters), including technical contracts Systems engineering personnel Initial training	Warehousing Shipping and handling Data (training manuals, maintenance manuals, operations manuals) Travel Other	Site preparation Facility modifications (construction) and design[1] Integration and multiplexing Testing and evaluation

1 Includes any onsite modifications required to install screening equipment. Does not cover expenses related to baggage handling system design and associated facility modifications. Facility modifications, construction and design are part of the overall project by the project sponsor. Electrical for screening equipment should also be included by the project sponsor. Integration, testing and evaluation are activities that will have both direct and project-sponsored costs.

Direct installation costs vary significantly among configurations of the same model of EDS unit. For example, the installation of a Reveal CT-80DR in a stand-alone configuration will cost significantly less than the same unit installed in an integrated configuration. Similarly, a higher installation cost for a mini in-line system using Reveal CT-80DR equipment compared to one using Reveal CT-80DRXL equipment should be assumed, as the Reveal CT-80DR EDS is capable of operating at higher throughput rates. Table 8-2 details the installation cost assumptions for each system type.

Table 8-2: Direct Screening Equipment Installation Cost

System Type	Installation Cost per Unit	Source
In-line	$340,000	(a)
Mini in-line	$50,000	(a)
Stand-alone EDS	$50,000	(a)
Stand-alone ETD	$0	(a)

Note: Stand-alone EDS installations using light-weight units do not require the same floor reinforcement as installations of heavier stand-alone equipment.

(a) TSA Federal Fiscal Year 2015 Notional Spend Plan.

8.2.1.3 Screening Equipment Upgrade Costs

Planners should consult with TSA about upgrade options, as well as the costs of those options that are available for the screening equipment being considered in the CBIS design for the particular airport.

8.2.1.4 Similar Screening Equipment Replacement Costs

Whenever it is necessary to replace screening equipment with new screening equipment of similar performance, it may be necessary to modify the BHS so that it can support the new unit types (if the BHS were not already designed to support the new type of screening equipment). Costs associated with the modification of infrastructure to support EDS unit replacement are presented in Table 8-3.

Table 8-3: Infrastructure Modification Costs for EDS Replacement

Screening system type	Infrastructure modification cost per EDS replacement	Source
In-line	$ 200,000	(a)
Mini in-line (all equipment types)	$ 50,000	(b)
Stand-alone	$ 0	(b)

(a) Input from TSA, November 2014 including PLC Modification, Testing & Commissioning, and HMI/Software Update (if needed)

(b) Input from TSA, November 2014.

BHS modification costs can vary significantly among CBIS types. It is highly recommended that actual cost estimates be developed for the specific site and CBIS design rather than using the cost estimates provided herein. These cost estimates are included mainly to provide planners with a rough estimate based mostly on high-level conceptual designs.

Planners should consult with TSA regarding new unit types that should be considered as replacement options. Costs of those replacement options should be assessed by planners based on actual CBIS design and actual modifications that are required for the BHS to be able to support the new types of EDS screening equipment.

8.2.1.5 EDS Removal Costs and Disposal Costs

Prior to replacing EDS units, installed EDS equipment and UPS units must be removed. This removal may result in costs to access equipment in space-constrained installations, disassemble conveyor segments, and temporarily modify surrounding facilities. Planners should estimate EDS removal costs for the specific screening alternatives.

It should be assumed that the EDS has no residual value at the end of its useful life.

8.2.1.6 Required Building and BHS Infrastructure Modification Costs

Facility modifications and infrastructure costs represent the majority of the upfront costs associated with implementing an in-line system. Compared with other types of security screening equipment, EDS units require significant facility design and construction costs because of their size and weight and the need to integrate these units into the BHS. Examples of facility modification work include, but are not limited to:

- Constructing extra baggage make-up rooms to replace existing baggage make-up areas displaced by EDS equipment.
- Constructing CBRAs to provide conditioned workspace for alarm resolution screening (e.g., alarm resolution with OSR or ETD).
- Redesigning and upgrading BHS conveyors to support integration with EDS equipment.
- Moving walls, partitions, and any other structural components.
- Reinforcing flooring to support additional weight.
- Upgrading mechanical and electrical systems (and HVAC systems, if required).

As the nature of the work will vary significantly from airport to airport and greatly depends on the type of checked baggage inspection system installed, facility modification costs can vary significantly. Planners shall develop a detailed, bottom-up cost estimate for facility modification and infrastructure costs for all alternatives being considered.

Because of their high upfront capital cost and the high degree of cost variability, facility modifications and infrastructure represent the highest risk to overall project cost and schedule. Small percentage changes in these costs can significantly affect the life cycle cost of a project.

For each screening system type, the assumed average cost of facility modifications and infrastructure per EDS unit is presented in Table 8-4. Facility modification costs shall be adjusted to account for regional differences in construction costs based on the latest *RS Means Construction Cost Data Indexes* published by Reed Construction Data or by other industry-standard cost adjustment practices. Given the high variability of this cost category, these assumed averages are provided herein as a starting point only and should be refined by planners in the life cycle cost analysis to reflect site-specific conditions.

Table 8-4: Average Cost of Facility Modifications and Infrastructure

System Type	Average Cost per Unit	Source
In-line	$ 5,600,000	(a), (b)
Mini in-line	$ 844,000	(c)
Stand-alone EDS	$ 62,000	(d)
Stand-alone ETD	$ 6,000	(d)

(a) Average of selected existing in-line installations with fully integrated EDS equipment.
(b) Facility modification and infrastructure cost per EDS depends on the level of integration with the baggage handling system.
(c) Bottom-up cost estimates of template designs and data from existing installations of mini in-line systems.
(d) TSA estimates from existing installations. Estimates include recent installations of reduced size and weight EDS units, which require lower facility modification and infrastructure costs because of the greater opportunities for a better fit in existing buildings.

Source: TSA, actual funded Fiscal Year 2013 facility modifications and infrastructure costs.

8.2.2 O&M Costs

O&M costs to be considered include:

- Screening equipment maintenance costs
- Screening equipment operating costs
- Incremental BHS maintenance costs (including additional maintenance personnel)
- Incremental BHS operating costs

8.2.2.1 Screening Equipment Maintenance Costs

Screening equipment maintenance costs include costs for preventive and corrective maintenance, related program management, replenishment of spares, repair parts, shipping and handling, technical update training, data manuals, other direct expenses. Maintenance costs for new technology equipment are assumed to also be on a fixed price per unit basis, equal to 10% annually of the purchase price.

All EDS vendors provide 2-year warranty periods so the first 2 years of maintenance costs are included in the equipment purchase price. Planners should confirm equipment maintenance cost assumptions with TSA for the specific screening equipment being considered as part of the alternatives under development.

8.2.2.2 Screening Equipment Operating Costs

The largest operating cost for screening equipment is the electrical consumption of the EDS equipment. Typically, electrical consumption per unit can be estimated from equipment specifications and duration of use (which can be estimated based on baggage flow). Table 8-5 provides information regarding the power consumption of screening equipment. Planners should take into account the costs of local electricity (in cents per kilowatt hour) and calculate overall utility costs of the screening equipment.

Table 8-5: Screening Equipment Electrical Consumption

Screening equipment	Consumption (kW)
L-3 eXaminer 3DX 6700	6.2
L-3 eXaminer 3DX 6700 ES	6.2
L-3 eXaminer 3DX 6600	6.2
L-3 eXaminer 3DX 6600 ES	6.2
MD CTX 9800 DSi (Classic)	10.3
MD CTX 9800 DSi (SEIO)	10.3
MD CTX 5800	2.1
Reveal CT-80DR+	4.4
Reveal CT-80DR	4.4
Reveal CT-80DRXL	4.4

Sources: TSA and screening equipment manufacturers, 2014.

8.2.2.3 Incremental BHS Maintenance Costs

Planners should account for incremental costs for BHS maintenance directly related to the CBIS. These costs typically include preventive as well as corrective maintenance to all BHS components above and beyond the current BHS maintenance costs.

<u>For the purposes of the life cycle cost analysis of screening alternatives, planners shall only consider the incremental cost of BHS maintenance which is calculated by subtracting the existing maintenance cost of the current BHS (with or without a CBIS) from the total estimated maintenance cost of the new BHS with the proposed CBIS.</u>

For the most part, baggage handling systems repair costs without the CBIS are negligible, except in airports that have large sortation systems. <u>The overall annual cost of O&M for the full CBIS shall be estimated at 10% of the initial overall cost of the system.</u> As the system ages, a reduction in this cost may occur if proper preventative and corrective maintenance is performed.

Table 8-6 provides estimated national average costs for incremental annual BHS maintenance. However, planners should obtain accurate maintenance costs from airport personnel or the BHS operator.

Table 8-6: Estimated Annual Incremental BHS Maintenance Costs for Systems Without Existing CBIS

Screening system type	Incremental BHS maintenance cost per EDS unit
In-line	$290,000
Mini in-line (all equipment types)	$38,000
Stand-alone	$0

Source: Existing in-line systems data, May 2006, escalated to Federal Fiscal Year 2013 dollars.

8.2.2.4 Incremental BHS Operating Costs

Planners shall compare utility costs for the BHS on an incremental basis. To calculate the incremental BHS operating costs, planners shall subtract the existing operating cost of the current BHS (with or without a CBIS) from the total estimated operating cost of the new BHS with the proposed CBIS.

8.2.3 Staffing Costs

Staffing costs to be considered include:

- TSA TSO and supervisor costs
- Incremental staff costs associated with clearing bag jams or for baggage porters (if not included in O&M costs described earlier)

In addition, if other airport-specific staffing costs are expected, such costs should be included in staffing or O&M costs as applicable.

8.2.3.1 TSA Personnel Costs

TSA will assess staffing costs for TSA TSOs and supervisors. Planners shall request staffing cost estimates for the screening alternative(s) under consideration upon submittal of the Preliminary Alternatives Analysis Report (see Chapter 2). As part of this request, planners must provide TSA with the following:

- Descriptions of the screening zones
- Descriptions of the screening system type and equipment for each screening zone assumed in the concept
- Estimated baggage flow for the Design Day in 10-minute bins (or increments)

- Assumed annual growth rate based on the forecasts used to determine equipment requirements

TSA will provide estimates of the total screening cost by year for each alternative under consideration.

8.2.3.2 Incremental Costs for Baggage Porters and Other Airport/Airline Staff

Any increase or decrease in costs for baggage porters or other airport/airline staff shall be included in the life cycle cost analysis. Planners shall include only incremental costs for baggage porters or other airport/airline staff.

8.3 Cost Estimating

The PGDS requires airport and project sponsors to submit cost estimates as part of the design package submission at each design phase (Pre-Design, Schematic, 30%, 70%, and 100%). While the Pre-Design and Schematic Design phases require ROM costs, the 30% through 100% designs require detailed cost estimates based on the Basis of Design Report.

To ensure that TSA is only funding that portion of a project that is necessary to implement a CBIS, airport sponsors requesting funding support from TSA shall provide a detailed cost estimate summary as included in Figure 8-1 at each phase of design.

Figure 8-1: Detailed Cost Estimate Summary

CURRENT WORKING ESTIMATE SUMMARY		Prepared by:				
AIRPORT IDENTIFIER:						
AIRPORT NAME:						
PROJECT NAME:						
ESTIMATED PROJECT COMPLETION DATE:		Estimate Construction Cost at Award ($s)				
Current Working Estimate - Effective Pricing Date:		CBIS Matrix Estimate	CBRA Area Estimate	OSR Room Estimate	Non Allocable Estimate (NA)	TOTAL ESTIMATE ALLOCABLE
Current Working Estimate - Level of Design:						
Currency:	US					
HARD COSTS (ECCA)						
BAGGAGE HANDLING SYSTEM/CHECKED BAGGAGE INSPECTION SYSTEM COSTS						
Div. 34 Transportation, includes items below						
Project Management						
Equipment						
Installation						
Engineering						
Controls						
Testing						
a. Subtotal BHS (Rounded)		$ -	$ -		$ -	$ -
OTHER CONSTRUCTION RELATED COSTS						
Div. 1 General Requirements						
Div. 2 Existing Conditions						
Div. 3 Concrete						
Div. 4 Masonry						
Div. 5 Metals						
Div. 6 Woods and Plastics, and Composites						
Div. 7 Thermal and Moisture Protection						
Div. 8 Openings						
Div. 9 Finishes						
Div. 10 Specialties						
Div. 11 Equipment						
Div. 12 Furnishings						
Div. 13 Special Construction						
Div. 14 Conveying Systems4						
Div. 21 Fire Suppression						
Div. 22 Plumbing						
Div. 23 Heating Ventilation, and Air Conditioning						
Div. 25 Integrated Automation						
Div. 26 Electrical						
Div. 27 Communications						
Div. 28 Electronic Safety and Security						
Div. 31 Earthwork						
Div. 32 Exterior Improvements						
Div. 33 Utilities						
Div. 34 Transportation w/o BHS						
Div. 35 Waterway and Marine Construction						
Div. 40 Process Integration						
Div. 41 Material Processing and Handling Equipment						
Div. 42 Process Heating, Cooling and Drying Equipment						
Div. 43 Process Gass and Liquid Handling, Purification and Storage Eqp.						
Div. 44 Pollution Control Equipment						
Div. 45 Industry Specific Manufacturing Equipment						
Div. 48 Electrical Power Generation						
b. Subtotal Other Construction Related Costs (Rounded)		$ -	$ -	$ -	$ -	$ -
PRIME CONTRACTOR MARK-UPS						
Insurance & Bond	0.00%	$ -	$ -	$ -	$ -	$ -
Home Office Overhead	0.00%	$ -	$ -	$ -	$ -	$ -
Profit	0.00%	$ -	$ -	$ -	$ -	$ -
Sales Tax (Material only)	0.00%	$ -	$ -	$ -	$ -	$ -
Design Contingency	0.00%	$ -	$ -	$ -	$ -	
c. Contractor Mark-ups (Rounded)		$ -	$ -	$ -	$ -	$ -
Hard Costs Subtotal (a + b + c)		$ -	$ -	$ -	$ -	$ -
SOFT COSTS						
Construction Contingency	0.00%	$ -	$ -	$ -	$ -	$ -
Design w/Const Admin	0.00%	$ -	$ -	$ -	$ -	$ -
Project & Construction Management	0.00%	$ -	$ -	$ -	$ -	$ -
Escalation	0.00%	$ -	$ -	$ -	$ -	$ -
Soft Costs Subtotal		$ -	$ -	$ -	$ -	$ -
TOTAL ESTIMATED COSTS (TEC) (CURRENT $'s)		$ -	$ -	$ -	$ -	$ -

8.3.1 Basis of Estimate

Estimates submitted for funding request purposes shall include a BOE document which includes, at a minimum, the following elements:

- Purpose
- Executive summary
- Project scope description
- Methodology used to prepare the estimate
  - Work breakdown structure
  - Tools and data sources
  - Major cost components: labor, equipment, and material
  - Subcontractor and prime contractor markups and fees
  - Allowances
  - Other factors
  - Schedule requirements
  - Assumptions, exclusions, and exemptions
  - Areas of risks

The cost estimate summary submitted at each design phase should provide a level of detail commensurate with the level of design. Further explanation of each section of the BOE is provided in the following sections.

8.3.1.1 Purpose

This section of the BOE is intended to provide a brief description of the major components of the project scope, level of the estimate, and major exclusions. A clearly stated purpose will provide context for the Executive Summary of the project and those efforts that took place prior to preparing the estimate, as well as readying the user for the ensuing detail throughout the estimate.

8.3.1.2 Executive Summary

The Executive Summary shall provide a brief (no more than one page) overview of the project for which the independent cost estimate, cost estimate validation, or cost to complete report is being prepared. The Executive Summary section shall include, not necessarily in this order, discussions of:

- Where the project sponsor is in the bid and construction contract award process, if applicable
- Whether construction has already begun and, if so, how much of the construction has been completed, if applicable
- If the airport sponsor has awarded the construction contract, the type of construction contract instrument (firm fixed price, time and materials, design-build, etc.), if applicable
- Name of the general contractor and BHS contractor, if available
- Name and telephone number of the airport representative that provided the cost information
- Brief statement of the design level the estimate was based on and statement as to whether the Current Working Estimate (CWE) is authored by a single entity or is a reconciliation of two or more estimates
- Statement of the escalation that has been used, based on a project schedule and a summary of the CWE at a high level to show BHS costs, other construction-related costs, and soft costs
- Discussion of any known areas of risk
- Total estimated cost
- Statement regarding whether the airport sponsor's estimate is reflective of current market conditions. This statement should address:
  - Description of current bidding climate relative to number of bidders responding to requests for proposals
  - Use of Davis Bacon Act wage rates, where applicable
  - List of current construction projects, including project name, type, approximate construction value, and schedule
  - Use of union versus nonunion labor
  - Narrative of labor availability
  - Narrative of material and equipment availability
  - Review of typical contracting methods used in location
- Statement of the currency (i.e., age) of the airport sponsor estimates. Estimates for projects constantly change. In order to maximize use of limited funding cost estimates for projects must be current and validated for funding to be approved.

8.3.1.3 Project Scope Description

This section of the estimate should be organized to correspond to the Work Breakdown Structure (WBS) and will include a more detailed description of the major components of the project and the means and methods assumed in the estimate to construct them.

8.3.1.4 Methodology Used to Prepare the Estimate

8.3.1.4.1 Work Breakdown Structure

The explanation of the estimate structure plays a significant role in any future required reconciliation. As such, a generic description of the estimate format and relationships of detailed cost items to their hierarchy shall be presented. A sample WBS is provided in Figure 8-2.

Figure 8-2: Sample Work Breakdown Structure

TSA CBIS Project
Sample Work Breakdown Structure

- 010000 General Requirements
- 020000 Existing Conditions
  - 022000 Assessment
  - 023000 Subsurface Investigation
  - 024000 Demolition and Structure Moving
  - 025000 Site Remediation
  - 026000 Contaminated Site Material Removal
  - 027000 Water Remediation
  - 028000 Facility Remediation
- 030000 Concrete
  - 031000 Concrete Forming and Accessories (Typically not allocable)
  - 032000 Concrete Reinforcing (Typically not allocable)
  - 033000 Cast-in-Place Concrete (Typically not allocable)
  - 034000 Precast Concrete (Typically not allocable)
  - 035000 Cast Decks and Underlayment (Typically not allocable)
  - 036000 Grouting
  - 037000 Mass Concrete (Typically not allocable)
  - 038000 Concrete Cutting and Boring
- 040000 Masonry
  - 042000 Unit Masonry
  - 044000 Stone Assemblies
  - 045000 Refractory Masonry
  - 046000 Corrosion-Resistant Masonry
  - 047000 Manufactured Masonry
- 050000 Metals
  - 051000 Structural Metal Framing (Typically not allocable)
  - 052000 Metal Joists (Typically not allocable)
  - 053000 Metal Decking (Typically not allocable)
  - 054000 Cold-Formed Metal Framing (Typically not allocable)
  - 055000 Metal Fabrications
  - 057000 Decorative Metal (Not allowable)
- 060000 Wood, Plastics, and Composites
  - 061000 Rough Carpentry
  - 062000 Finish Carpentry
  - 064000 Architectural Woodwork
  - 065000 Structural Plastics
  - 066000 Plastic Fabrications
  - 067000 Structural Composites
  - 068000 Composite Fabrications
- 070000 Thermal and Moisture Protection
  - 071000 Damp proofing and Waterproofing
  - 072000 Thermal Protection
  - 073000 Steep Slope Roofing (Typically not allocable)
  - 074000 Roofing and Siding Panels (Typically not allocable)
  - 075000 Membrane Roofing (Typically not allocable)
  - 076000 Flashing and Sheet Metal
  - 077000 Roof and Wall Specialties and Accessories
  - 078000 Fire and Smoke Protection
  - 079000 Joint Protection
- 080000 Openings
  - 081000 Doors and Frames
  - 083000 Specialty Doors and Frames
  - 084000 Entrances, Storefronts, and Curtain Walls (Typically not allocable)
  - 085000 Windows (Typically interior only)
  - 086000 Roof Windows and Skylights (Typically not allocable)
  - 087000 Hardware
  - 088000 Glazing (Typically interior only)
  - 089000 Louvers and Vents
- 090000 Finishes
  - 090000 Painting and Coating
  - 092000 Plaster and Gypsum Board
  - 093000 Tiling
  - 095000 Ceilings
  - 096000 Flooring
  - 097000 Wall Finishes
  - 098000 Acoustic Treatment
- 100000 Specialties
  - 101000 Information Specialties
  - 102000 Interior Specialties
  - 104000 Safety Specialties
  - 105000 Storage Specialists
  - 108000 Other Specialties
- 110000 Equipment
- 120000 Furnishings
  - 121000 Art (Not Allowable)
  - 122000 Window Treatments (Typically not allowable)
  - 123000 Casework
  - 124000 Furnishings and Accessories
  - 125000 Furniture
  - 126000 Multiple Seating (Typically not allowable)
  - 129000 Other Furnishings
- 130000 Special Construction
  - 131000 Special Facility Components
  - 132000 Special Purpose Rooms
  - 133000 Special Structures
  - 134000 Integrated Construction
  - 135000 Special Instrumentation
- 140000 Conveying Equipment
  - 142000 Elevators
  - 143000 Escalators and Moving Walks (Typically not allowable)
  - 144000 Lifts
  - 147000 Turntables (Typically not allowable)
  - 148000 Scaffolding
  - 149000 Other Conveying Equipment
- 210000 Fire Suppression
  - 211000 Water-Based Fire Suppression Systems
  - 212000 Fire-Extinguishing Systems
  - 213000 Fire Pumps
  - 214000 Fire-Suppression Water Storage
- 220000 Plumbing
  - 221000 Plumbing Piping and Pumps
  - 223000 Plumbing Equipment
  - 224000 Plumbing Fixtures
- 230000 Heating Ventilating and Air-Conditioning (HVAC)
  - 231000 Facility Fuel Systems
  - 232000 HVAC Piping and Pumps
  - 233000 HVAC Air Distribution
  - 234000 HVAC Air Cleaning Devices
  - 235000 Central Heating Equipment
  - 236000 Central Cooling Equipment
  - 237000 Central HVAC Equipment
  - 238000 Decentralized HVAC Equipment
- 250000 Integrated Automation
  - 251000 Integrated Automation Network Equipment
  - 253000 Integrated Automation Instrumentation and Terminal Devices
  - 255000 Integrated Automation Facility Controls
  - 259000 Integrated Automation Control Sequences
- 260000 Electrical
  - 261000 Medium-Voltage Electrical Distribution
  - 262000 Low-Voltage Electrical Transmission
  - 263000 Facility Electrical Power Generating and Storing Equipment
  - 264000 Electrical and Cathodic Protection
  - 265000 Lighting
- 270000 Communications
  - 271000 Structured Cabling
  - 272000 Data Communications
  - 273000 Voice Communications
  - 274000 Audio-Video Communications
  - 275000 Distributed Communications and Monitoring Systems
- 280000 Electronic Safety and Security
  - 281000 Electronic Access Control and Intrusion Detection
  - 282000 Electronic Surveillance
  - 283000 Electronic Detection and Alarm
  - 284000 Electronic Monitoring and Control
- 310000 Earthwork (Typically not allocable)
  - 311000 Site Clearing
  - 312000 Earth Moving
  - 313000 Earthwork Methods
  - 314000 Shoring and Underpinning
  - 315000 Excavation Support and Protection
  - 316000 Special Foundations and Load-Bearing Elements
  - 317000 Tunneling and Mining
- 320000 Exterior Improvements (Typically not allocable)
  - 321000 Bases, Ballasts, and Paving
  - 323000 Site Improvements
  - 327000 Wetlands
  - 328000 Irrigation
  - 329000 Planting
  - 330000 Utilities
  - 331000 Water Utilities
  - 332000 Wells
  - 333000 Sanitary Sewerage Utilities
  - 334000 Storm Drainage Utilities
  - 335000 Fuel Distribution Utilities
  - 336000 Hydronic and Steam Energy Utilities
  - 337000 Electrical Utilities
  - 338000 Communications Utilities
- 340000 Transportation
  - Baggage Handling Systems
    - Project/Site Management – The costs associated with the baggage contractor's project management, site supervision, administration and support infrastructure associated with the project
    - Equipment – The costs for the conveyor components excluding motor control panels, PLCs and other control equipment
    - Installation – The costs for the millwright's and electrician's labor associated with the installation of the baggage system.
    - Engineering – The cost for the baggage system contractor to prepare shop drawings for the baggage system
    - Controls (limited to those control necessary to operate the CBIS and tie into the existing system) – The costs for the Equipment, hardware, software and labor associated with programming and installation of the controls
    - Testing – The cost for labor associated with testing the motors and providing labor to support the ISAT process
- 350000 Waterway and Marine Construction (Typically not allocable)
- 400000 Process Integration (Typically not allocable)
- 410000 Material Processing and Handling Equipment (Typically not allocable)
- 420000 Process Heating, Cooling, and Drying Equipment (Typically not allocable)
- 430000 Process Gas and Liquid Handling, Purification and Storage Equipment (Typically not allocable)
- 440000 Pollution Control Equipment (Typically not allocable)
- 450000 Industry-Specific Manufacturing Equipment (Typically not allocable)
- 480000 Electrical Power Generation

8.3.1.4.2 Tools and Data Sources

The BOE shall indicate the primary estimating methodology used in preparing the cost estimate, including that used for cost resources, historical data, and estimating tools and documents.

8.3.1.4.3 Major Cost Components: Labor, Equipment, Material

Sources for labor, equipment and material cost elements used in preparing the estimate shall be described, thereby further demonstrating the estimator's level of effort and knowledge of the project requirements. For example: "equipment cost estimates were derived from multiple indexes, including RSMeans' Blue Book equipment rental rates; in the case of the casting yard equipment and specialized erection equipment, actual invoices from other projects were used."

8.3.1.4.4 Subcontractor and Prime Contractor Markups and Fees

Since markups and fees can be subjective, articulating the style of contract and the expected general requirements and fees used is inherent to the BOE's purpose.

8.3.1.4.5 Allowances

Allowances used in the estimate and the reason they were used shall be clearly stated. For example, "a 10% cost allowance has been included for project phasing due to the contractor being required to fully mobilize and demobilize workers and equipment to the project site each day."

8.3.1.4.6 Other Factors

For the effort to be factual and complete, the estimator should describe any other elements bearing on the estimated calculations, including: project options, cost risks, and deviation from standard practices.

8.3.1.4.7 Schedule Requirements

A complete BOE must address the project schedule. A complete BOE will address those specific requirements provided for in the estimate to maintain all major and interim milestones, including: procurement, fabrication, anticipated shift work, and work week schedule. Any assumptions made regarding the key project milestones should be stated.

Section 2.2.4 requires the Project Sponsor to submit an updated Construction Schedule to TSA stakeholders at a minimum of every 30 days after construction award for construction of the BHS/CBIS identified/agreed to in the Letter of Intent or OTA. The schedule should be submitted in both hard and soft (i.e., Microsoft Project) copies and must contain enough detail for TSA to monitor the status of activities related to the design, construction, installation, and testing of the CBIS, OSR room, and CBRA. In addition, the schedule should include anticipated delivery dates for EDS, ETD, and any other equipment TSA is anticipated to provide.

This schedule, in conjunction with the project cost estimate, provides the basis for the Earned Value Management (EVM) information required in Section 8.3.6.

8.3.1.4.8 Assumptions, Exclusions, and Exemptions

The BOE shall include three separate and distinct bulleted listings that concisely identify the assumptions, exclusions, and exemptions used in developing the estimate. The assumptions should document any assumed premiums for shift work, compressed phasing, and work anticipated to be completed by other entities. Additionally, a clear list of all activities and work that is not included in the assumption or presumed to be excluded based on the statement of work should be clearly identified.

8.3.1.4.9 Areas of Risks

Once existing conditions have been established and reflected in the design documents, the estimate should include material and equipment costs—as either pricing factors on line items or as estimate-wide factors that inflate the costs of labor—as globally as necessary, as well as assessments for:

- The sequence of work to adjust for labor productivity, shift premiums, unusual daily access to the site, multiple and phased staging
- Area/space constraints that may require hand tool versus large equipment use
- Any other subsidiary work the contractor will be required to perform to safely proceed with construction
- Any other constructability issues

8.3.2 Cost Estimate Breakouts

Estimates submitted for funding request purposes should, at a minimum, include the elements shown in Figure 8-1 and summarized below:

- Subtotal estimated construction values as cost accounts (columns):
  - Baggage handling system
  - Checked baggage inspection system
  - On-screen resolution area

- Checked baggage resolution area
- Infrastructure construction

Each account above should be organized in a report by the most recent version of the Construction Specifications Institute Division Summary Master Format.

- The CWE includes the following contractor markups:
  - Insurance and Bond
  - Home office overhead
  - Profit
  - Sales tax
- The CWE also includes the following soft costs:
  - Construction contingency
  - Design and programming
  - Project/construction management
  - Escalation
- Additionally, the CWE includes BHS estimates listed separately under Construction Standards Institute division 34 “Transportation,” and includes as separate items each of the following:
  - Project management
  - Equipment
  - Installation
  - Engineering
  - Controls
  - Testing

8.3.3 Definition of Soft Costs

Project management, construction management, escalation, design fees, and other so-called "soft costs", many of which are undefined, can range from 2% to 3% or as much as 47% of the project construction cost.

Project management as discussed in this appendix refers solely to the airport, project sponsor or project sponsor's existing Program Management Office contractor's oversight and management of activities necessary to install a CBIS solution (whether in-line, stand-alone, or otherwise). Conversely, construction management, as discussed in this appendix, consists of the management activities undertaken by the general construction contractor and/or BHSC to construct and install the CBIS solution (whether in-line, stand-alone, or otherwise).

8.3.3.1 Design Contingencies

<u>Design contingencies shall be noted as separate and distinct items apart from direct construction costs and other associated markups.</u> Design contingencies are understood to represent amounts added to the estimate to allow for items, conditions, or events for which the status, occurrence, or effect is uncertain, but that experience shows will likely result in additional costs.*

Design contingencies may include:

- Errors and omissions in the estimating process
- Variability associated with the quantification effort
- Incomplete design of anticipated final quantities
- Minor variability in labor (productivity, availability, etc.)
- Historically supported weather impacts
- Minor variability in wage rates
- Minor variability in material and equipment costs
- Substitute construction materials

*Association for the Advancement of Cost Engineering (AACE) International, Recommended Practice No. 10S-90, "Cost Engineering Terminology," copyright 2004.

Design contingencies do not include:

- Significant changes in scope, such as unavailable specified EDS vendor equipment
- Errors and omissions in design
- Major unexpected work stoppages (strikes, etc.)
- Disasters (hurricanes, tornadoes, etc.)
- Excessive, unexpected inflation
- Excessive, unexpected currency fluctuations
- Other areas of risk

8.3.3.2 Construction Contingencies

Construction contingencies shall be noted as separate and distinct items apart from direct construction costs and other associated markups. In most construction budgets, an allowance is provided for contingencies or unexpected costs occurring during construction. Construction contingencies cover the uncertainty associated with inadequacies of project scope definition, estimating methods, and estimating data. For example, construction contingencies may include:

- Design development changes
- Schedule adjustments
- General administration changes (such as wage rates)
- Differing site conditions for those expected
- Third party requirements imposed during construction, such as new permits

8.3.4 Escalation

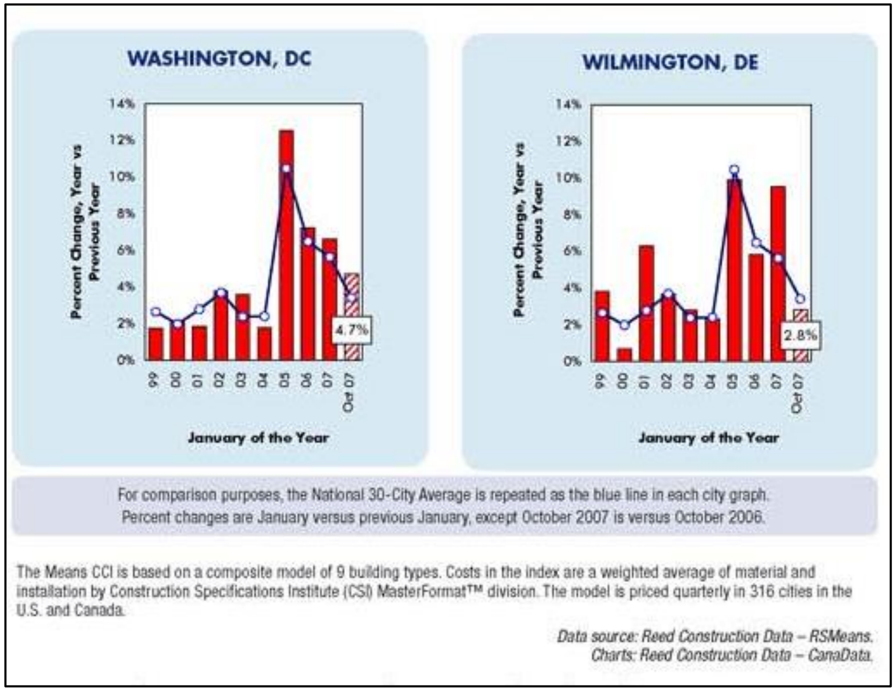
8.3.4.1 Current Escalation

It is typical practice for estimators to use or reference legacy estimates/quotes and commercial databases that have aged several months to several years as part of their CWE. The body/details of the estimate shall have all cost items in current year dollars. The historical escalation rate used to make data current shall be based on the RSMeans Building Construction Cost Index (CCI) or another comparable industry standard from the relevant source date to the current date.

8.3.4.2 Forward Escalation

Escalation shall be based on the average annual rate of cost escalation for the three years prior to the estimate development date, as established by the most current quarterly published RSMeans Building CCI. The rate used shall be based on data for the nearest city provided in the CCI. Figure 8-3, an excerpt from the CCI, is provided as an example.

Figure 8-3: RSMeans Building Construction Cost Index
Major U.S. Cities (W) – October 2007



Escalation shall be noted as a separate and distinct item apart from direct construction costs and other associated markups. Escalation is understood to represent a provision in actual or estimated costs for an increase in the cost of equipment, material, labor, etc, over that specified in the purchase order or contract due to continuing price level changes over time*.

Escalation shall be calculated from the scheduled construction start date to the midpoint of construction on a compounding basis. Escalation shall be applied to the sum total of direct construction costs, general conditions, overhead, and profit. Other related markups should be based on the sum total as described above.

Should a construction schedule not be available, the CWE shall be presented in nonescalated dollars and clearly noted as such.

8.3.4.3 Cost Estimate Currency/Age

All CWE pricing shall be effective as of the date of the submittal. The BOE documentation should clearly indicate that the estimate is reflective of current market conditions.

Estimates submitted for funding request purposes shall be accompanied by a market analysis specific to the airport location and timeframe during which proposed improvements will be implemented. At a minimum, the analysis should include:

- Description of the current bidding climate relative to the number of bidders responding to requests for proposals
- Use of Davis-Bacon Act wage rates, where applicable
- List of current construction projects, including project name, type, approximate construction value, and schedule
- Use of union versus nonunion labor
- Narrative of labor availability
- Narrative of material and equipment availability
- Review of typical contracting methods used in location

8.3.4.4 Estimate Reconciliation

It is common practice for two independent estimates; one prepared by the Project Sponsor and one prepared by the TSA at a given design level to increase confidence and accuracy in the CWE for project and budget decisions. If a reconciled estimate is sought, which is recommended for

*AACE International, Recommended Practice No. 10S-90, "Cost Engineering Terminology," copyright 2004.

variances exceeding 10% between the Project Sponsor's estimate and TSA allowable costs, the approach to reconcile the estimates will proceed with the following ground rules:

- Estimate summaries will strictly adhere to the CWE format illustrated in Figure 8-1. As a rule of thumb, variances in excess of 10% for each division will be reconciled further. The rationale for the reconciliation will be documented to provide an understanding of the reconciled value.
- The formats for the estimate will strictly adhere to a WBS to evaluate the scope of the project. A sample WBS is provided in Figure 8-2. Scope variance will be reconciled prior to review of pricing. Once scope differences are resolved, updated estimate summaries will be generated.
- The “reconciled” estimate will be used as the go-forward estimate.

8.3.4.5 Estimate Trending

As the subsequent design level is completed, the CWE should be compared with the prior design phase CWE. Any changes to scope or design shall be identified, documented, and submitted to the TSA Project Coordinator for approval prior to initiation of the next design phase. Once a project budget has been established, changes in cost should be added or deducted from the design contingencies with Contracting Officer approval. Hence, with the exception of major changes, the Total Estimated Cost should remain the same as the CWE for the prior phase.

8.3.5 TSA Funding

In general, the CWE can contain both costs that are allowable and allocable and those that are not. TSA non-allowable/allocable costs are segregated in the Infrastructure column of the CWE. The Project Sponsor shall include both allowable/allocable and non-allowable/allocable costs in the appropriate CWE column. All allowable/allocable costs associated with the CBIS, CBRA, and OSR room should be included in the appropriate column (see example in Figure 8-4). TSA will only reimburse the airport or project sponsor for those costs that are considered allowable, allocable and reasonable under Federal grant rules and guidance and are properly identified as such on the CWE.

Figure 8-4: TSA Reimbursable Funding Breakout Sample

ESTIMATED PROJECT COMPLETION DATE:	TBD	ECCA ($s)	TSA ALLOCABLE COSTS		TSA AGREED TO FUNDING		Additional Allocable Funding Needed (Non-TSA)
Current Working Estimate - Effective Pricing Date:	May-08	TOTAL ESTIMATE					
CWE Scope Based on Design Level of:	10%		%	$s	%	$s	
HARD COSTS (ECCA)							
a. Subtotal BHS (Rounded)		23,615,000	100%	23,615,000	90%	21,253,500	2,361,500
b. Subtotal Other Construction Related Costs (Rounded)		16,702,000	100%	16,702,000	90%	15,031,800	1,670,200
c. Hard Costs Subtotal (a. + b.)		40,317,000	100%	40,317,000	90%	36,285,300	4,031,700
SOFT COSTS							
Construction Contingency	5.00%	2,015,000	100%	2,015,000	90%	1,813,500	201,500
Design w/Const Admin	8.00%	3,226,000	100%	3,226,000	90%	2,903,400	322,600
Project & Construction Management	7.00%	2,823,000	100%	2,823,000	90%	2,540,700	282,300
Escalation NONE	0.00%	-	100%	-	90%	-	-
Soft Costs Subtotal		8,064,000	100%	8,064,000	90%	7,257,600	806,400
TOTAL ESTIMATED COSTS (TEC) (CURRENT $s)		48,381,000	100%	48,381,000	90%	43,542,900	4,838,100

For more information on TSA's funding policy, see the Electronic Baggage Screening Program Policy Memo – TSA Funding of Checked Baggage Inspection System Project Costs at https://www.fbo.gov/index?s=opportunity&mode=form&id=5f27246b608d3914c43bb0dd2d11ebd9&tab=core&_cview=1.

8.3.6 Invoicing and Earned Value Management

Invoices/requests for payment should include a summary page presented in the same format as the cost estimate to allow for ease of tracking and comparing actual expenses to agreed-upon costs. For invoicing instructions, please refer to the Project OTA.

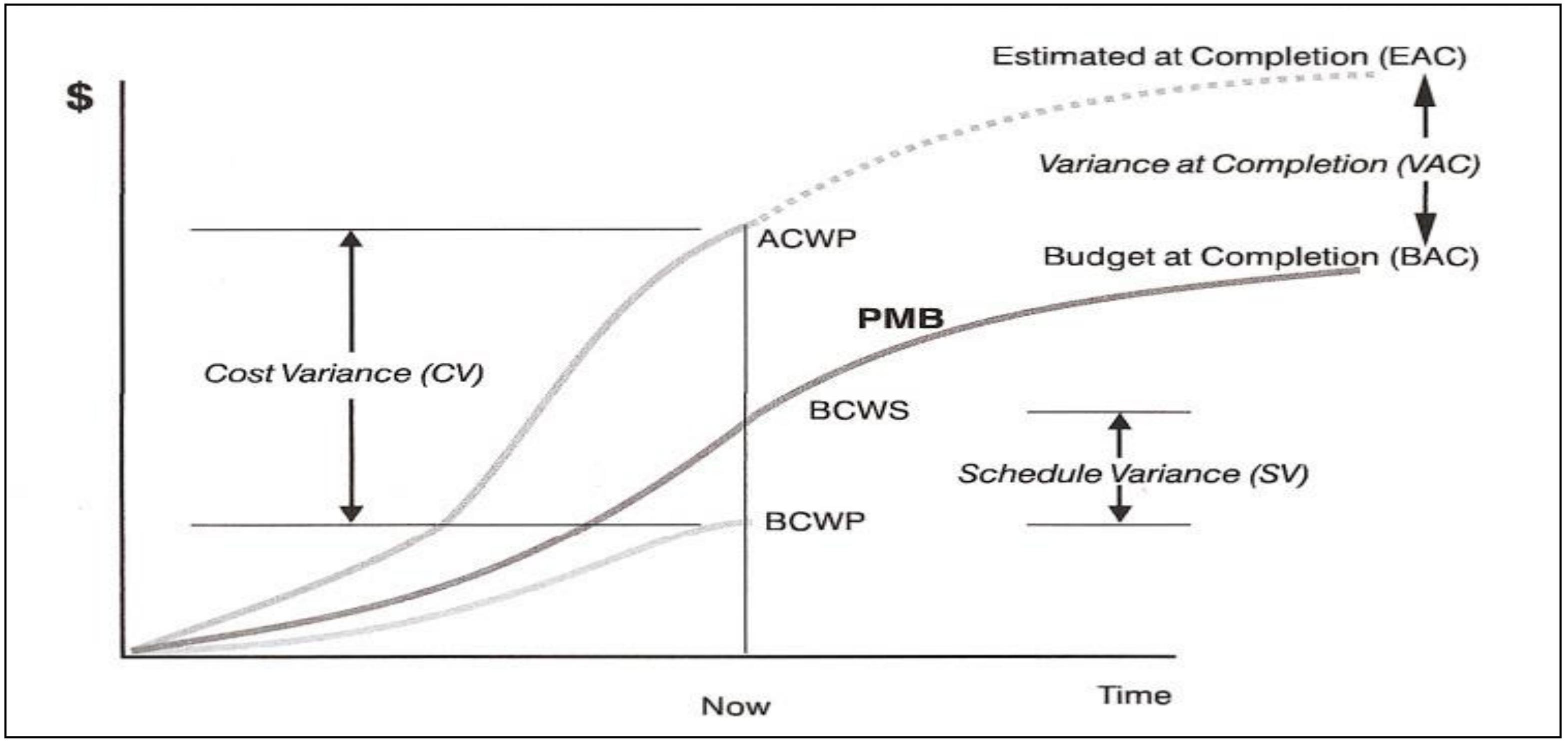
Additionally, because of the widely accepted practice of EVM and the equation's ability to measure cost performance, airport sponsors, airlines, or other organizations requesting funding support from TSA should provide a current EVM analysis. This analysis should identify work completed to date and include a forecast of the work anticipated to be completed during the next month or invoicing period, whichever is longer. The EVM data should be representative of the entire project scope in the WBS format, using the most current cost-loaded project schedule. Estimates with EVM calculations submitted for funding reimbursement request purposes should include, at a minimum, the following EVM elements:

- Budgeted Cost of Work Scheduled (BCWS) - Representative of all costs, including indirect costs that are planned or scheduled. A well designed schedule usually reflects these planned cost as a traditional S-curve shape.
- Actual Cost of Work Performed (ACWP) – Representative of all costs, including indirect costs charged against activities that are completed.
- Budgeted Cost of Work Performed (BCWP) – More traditionally described as “earned value”, these costs are representative of the costs, including indirect costs, for activities that are completed. These costs are distinct from the BCWS, which is for activities that are planned to be completed.
- Budget at completion (BAC)
- Estimate at completion (EAC)
- Schedule variance (SV)
- Variance at completion (VAC)
- Cost performance index (CPI) (which equals ACWP/BCWP)

The BCWS, ACWP, and ACWS provide the mechanics for a full analysis of project progress and performance in the EVM environment. As depicted in Figure 8-5, the projections of EAC, SV, and VAC will be derived from these initial investments where the EAC for the data on the date compiled is calculated as EAC = ((BAC-BCWP)/CPI) + ACWP.

Note: CPI = ACWP/BCWP (poor performance is greater than 1).

Figure 8-5: Earned Value Management Graph



8.4 Selecting the Preferred Alternative

Alternatives shall be evaluated on the basis of the present value of total life cycle costs, defined as the present value of the annual sum of capital, O&M, and staffing costs. Costs should be separated by stakeholder (e.g., TSA, airport operator, and airline) for transparency in the evaluation process.

For the purposes of estimating the present value of these costs, planners shall use the 20-year Real Interest Rate on Treasury Notes and Bonds of Specified Maturities found in the latest version of the Office of Management and Budget Circular No. A-94 Appendix C at http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c as the real discount rate. This discount rate corresponds to guidance from the Office of Management and Budget for projects that accrue costs and/or benefits to governmental and nongovernmental parties. Discounting of life cycle costs is necessary to ensure that all alternatives are compared on a standardized basis. The discount rate is meant to reflect the time value of money (cash received today is worth more than the same amount of cash received tomorrow because of the opportunity to invest that cash in other projects) and the risk associated with uncertain future cash flows.

The formula below can be used to calculate the present value cost of the screening system alternative.

$$PV = \frac{C1}{(1+r)1} + \frac{C2}{(1+r)2} + \frac{\dots}{\dots} + \frac{C20}{(1+r)20}$$

where C1 is the total cost in year 1 and r is the real discount rate.

Once the costs of all concept-level alternatives have been developed to include the full present value life cycle costs, alternatives shall be ranked based on present value life cycle costs and the lowest-cost alternative that meets all other requirements shall be selected as the preferred alternative. Other higher-cost alternatives may be carried forward for further development and evaluation in the Schematic Design Phase with approval from TSA and the ILDT.

The least expensive design may not be the most efficient for all concerned. The ILDT should present their position as to why a particular alternative is more efficient compared with another.

CHAPTER 9:

CHECKED BAGGAGE RESOLUTION AREA PLANNING STANDARDS

REQUIREMENTS TABLE

Section	Requirement
All	All underlined statements in Chapter 9 are requirements and shall be met.

This chapter provides requirements for CBRA installations.

9.1 Background

The CBRA provides the space and equipment needed by TSOs to conduct bag inspection per the Checked Baggage SOP as mandated by the TSA. The proper layout and furnishing of the CBRA are essential to ensuring that TSOs can effectively, efficiently, and safely perform their duties. Careful consideration needs to be given to the operational controls, environmental and ergonomic configuration, and equipment specified for the CBRA.

Although each airport is different and the available space may differ, all CBRAs need to follow the same layout concept, baggage inspection station (BIS) configuration, functionality, and BSD operations. This standardizes training and improves personnel utilization across multiple CBRAs within an airport. The following sections provide details in these four aspects of the CBRA design. Deviations from the Chapter 9 requirements shall be submitted through an RFV for review and approval by TSA.

9.2 CBRA Layout

The CBRA layout shall be designed to optimize TSO utilization, avoid bag lifting, and reduce equipment costs. The CBRA layout shall be centralized and incorporate the following:

- Single Alarm Line (AL) and single Clear Line (CL)
- Connected to the end of the AL, a Reinsert Line (RL) with no side guard to ease bag placement during manual reinsertion
- Transport of OOG bags via the AL and leave via the CL
- Transport of OS bags via a dedicated conveyor line

For smaller configurations, the optimal layout shall include a straight Alarm Line (AL) and a parallel Clear Line (CL) as shown in Figure 9-1. For larger configurations, the optimal layout shall include a "U" shape AL with a single CL in the middle as shown in Figure 9-2.

Figure 9-1: Optimal CBRA Layout for Smaller Systems

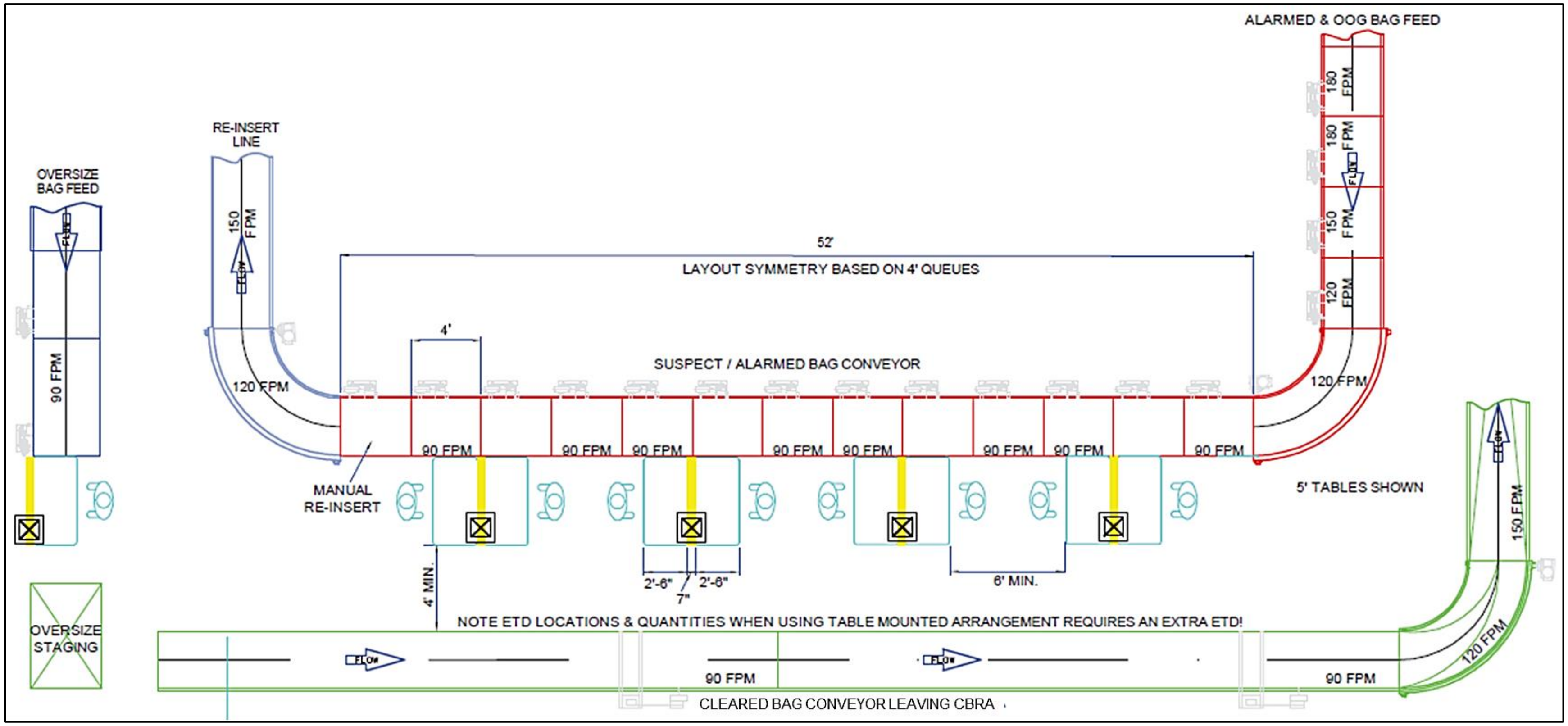
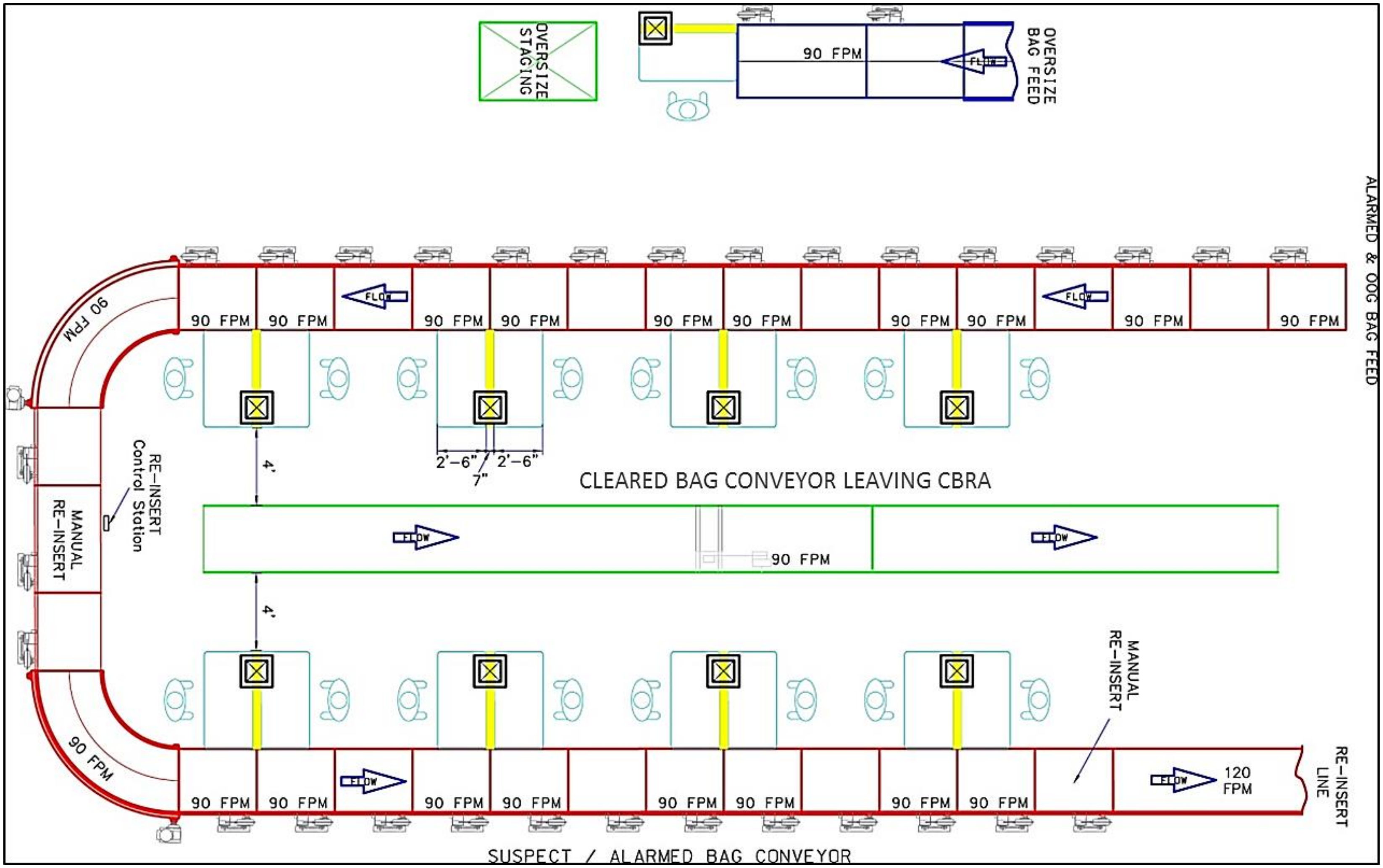


Figure 9-2: Optimal CBRA Layout for Larger Systems



9.3 Baggage Inspection Station

The BIS is a workstation that provides the TSO with all the tools needed and an ergonomically sound space for inspecting bags. In previous versions of the PGDS, the BIS included a back wall and a sliding-top, stainless steel table. However, in order to promote innovation, new designs and technologies for the BIS will be considered. Any BIS design shall meet the requirements presented in this section.

BIS designs shall include a flat work surface for the TSO to place the bag and remove any objects inside the bag as needed. The work surface shall be made of a non-porous material that can resist isopropyl alcohol decontamination. The BIS work surface shall be 30" W x 60" L and be placed at 30" high above the finished floor.

The CBRA screening process, which includes operation of the BIS, shall not require TSOs to lift bags.

The BIS design shall be capable of processing up to 750 bags per day in an environment with a temperature range of 50-100°F and a humidity of 30-70%. The baggage to be screened may weight up to 125lbs. The BIS shall provide a 36" W x 60" L workspace in front of the working surface for the TSO to move freely. In addition, the BIS shall allow maintenance access to all components and shall accommodate all the CBRA ancillary equipment listed in Section 9.3.2.

The BISs for the OS line do not require the SVS, scan gun, or BSD as these bags were not screened by the EDS.

The bag inspection process requires the use of certain tools that will vary depending on the bag. The BIS shall provide a storage system for these tools to increase TSO efficiency, prevent theft, and avoid leaving tools inside passenger luggage after the inspection. The tool storage system shall be:

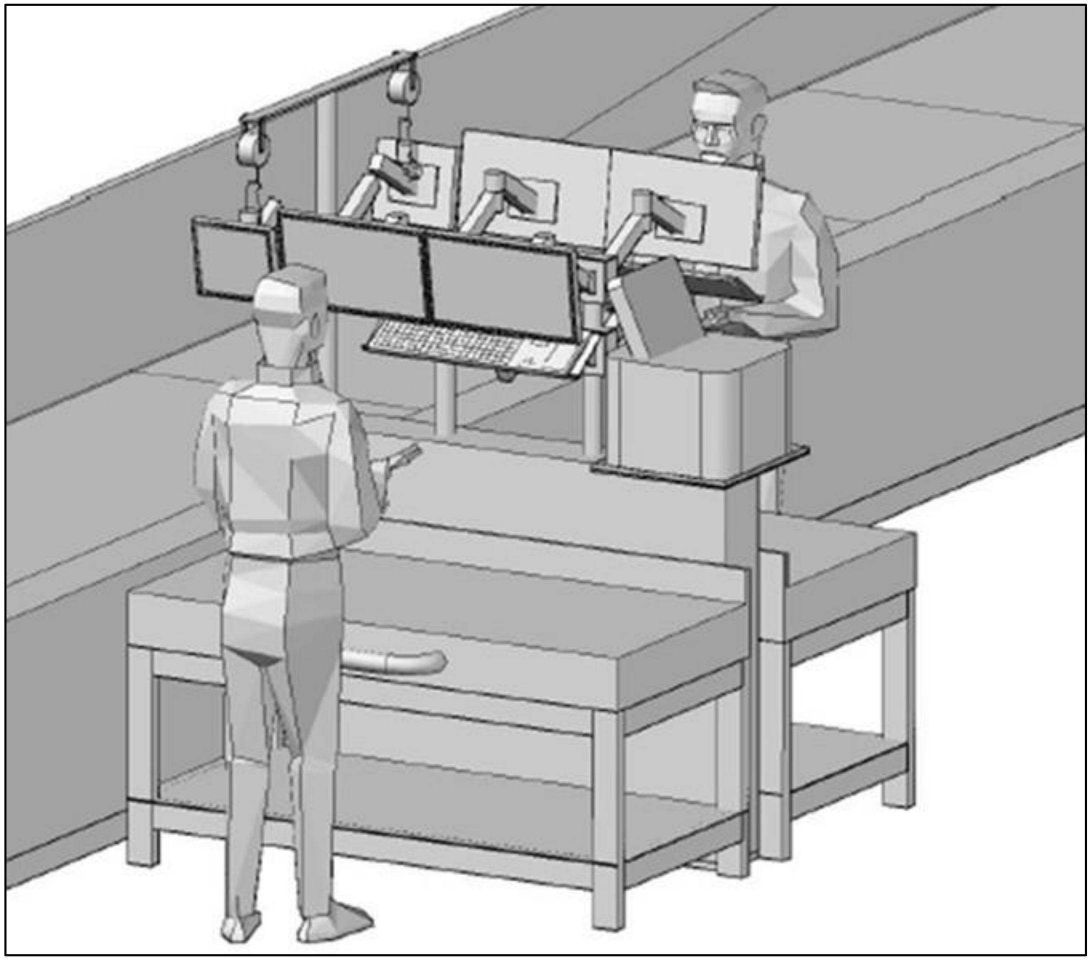
- Organized for easy inventory checks at the end of each shift by the TSM
- Visually trackable for quick inventory checks after each bag inspection by the TSO

A list of primary, secondary, and special tools to be stored can be found in Table 9-1. The storage system shall allow quicker access to primary and secondary tools as these are the most used, while the special tools may require more time to obtain since they are only used occasionally.

Table 9-1: List of Tools Needed for the Bag Inspection Process

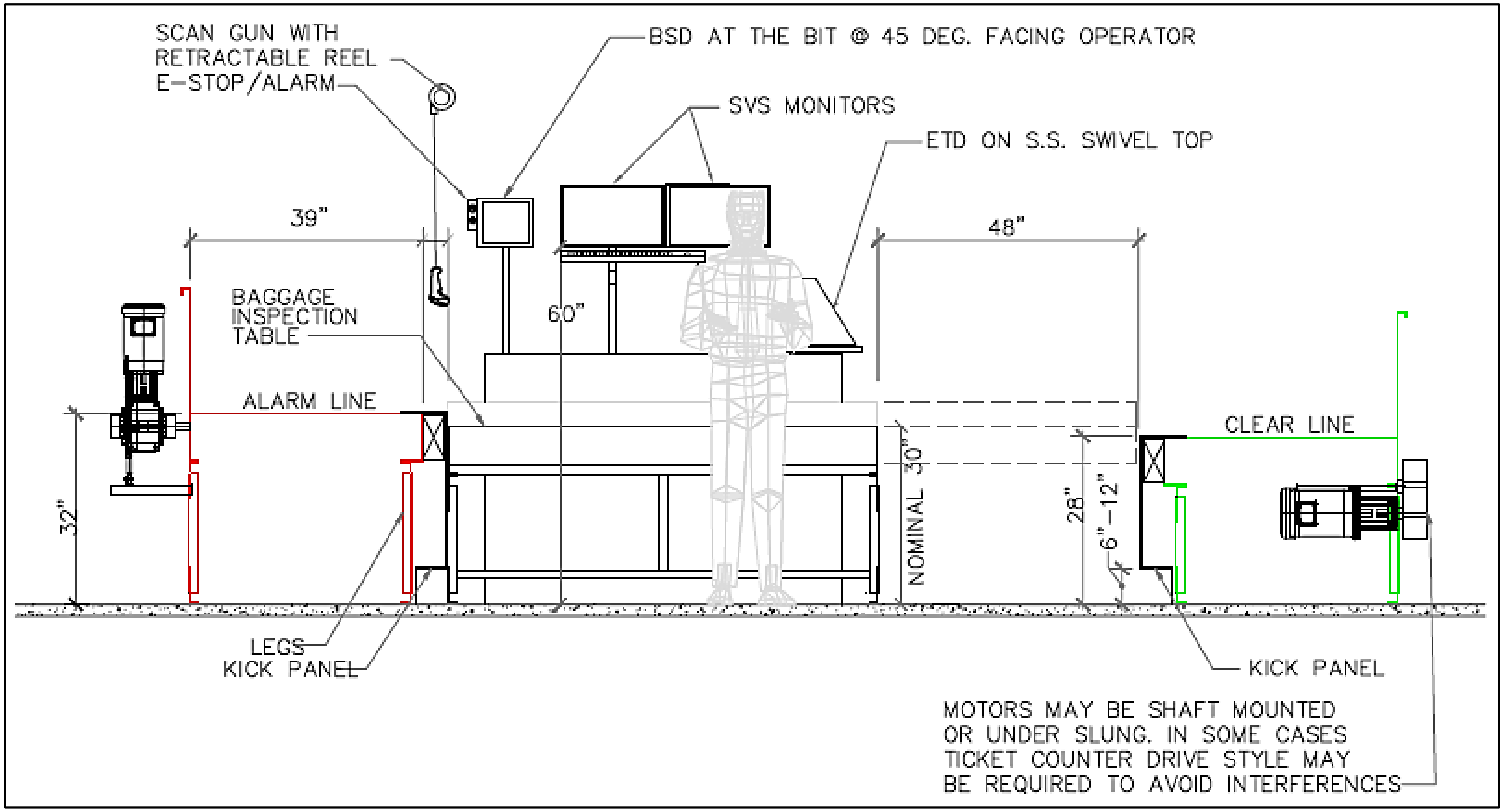
Primary	Secondary	Special
Lock Keys	Alcohol bottle	Screw driver
TSA note	Paper towel	Pry-bar
ETD wand	Gloves box	HAZMAT note
ETD disks	Hand sanitizer	Scissor
	Marker	Box cutter
	Bolt cutter	Tape gun

Figure 9-3: Isometric View of Example Baggage Inspection Station



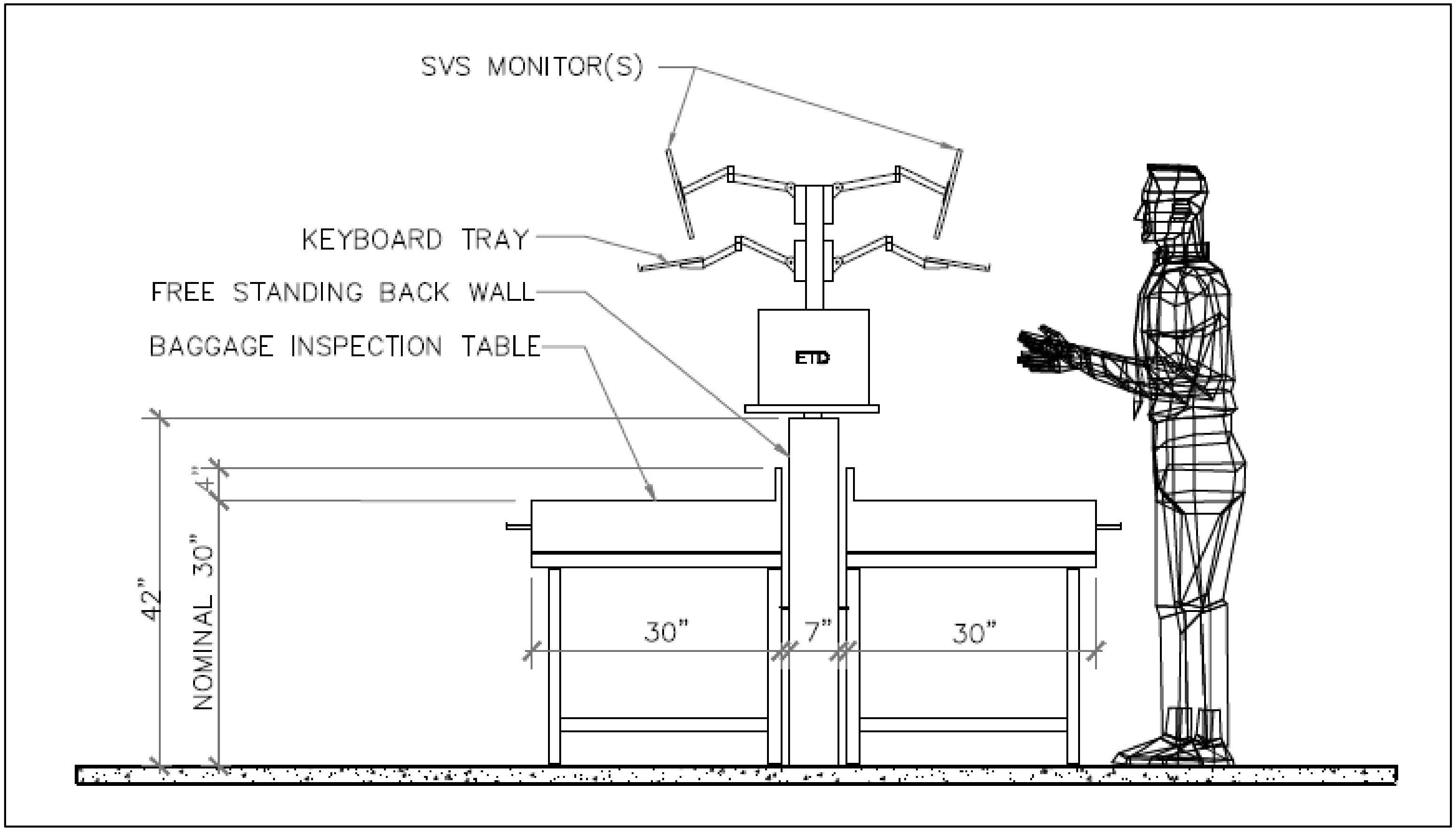
Note: The table shown in the figure is only for reference. Other baggage inspection worksurface solutions may be used.

Figure 9-4: CBRA Workstation Elevation



Note: The table shown in the figure is only for reference. Other baggage inspection worksurface solutions may be used.

Figure 9-5: CBRA Workstation Cross Section



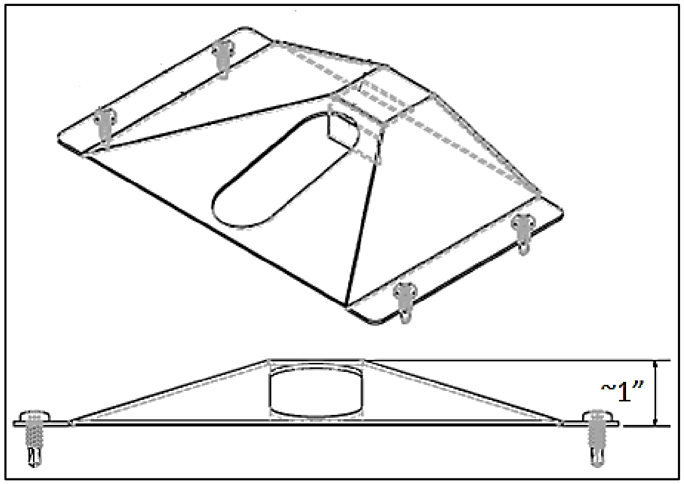
Note: The table shown in the figure is only for reference. Other baggage inspection worksurface solutions may be used.

9.3.1 Baggage Removal Point

The **BRP** is the queue conveyor where bags stop for removal and processing by the TSO.

- The BRP shall be 48" L and 32" H (floor to the conveyor bed). The photo eye (PE) location and programing of the BRP shall ensure that arriving bags are centered (with respect to the width of the conveyor) and stop next to the corresponding BIS. In addition, the photo eye reflector cover shall be of a slim design no more than 1" H that allows bags to be slid over it. Refer to Figure 9-6 for an example.

Figure 9-6: Photo Eye Reflector Cover



- The queue conveyors situated between the BRPs are termed "**Intermediate Queues**" and shall be a minimum of 48" L and 32" inches in Height. Intermediate queues shall be installed in the space between BIS pairs adjacent to the circulation space for the TSOs.

9.3.2 BIS Ancillary Equipment

The BIS shall include all the supports needed to mount the ancillary equipment listed in this section. Refer to Figure 9-4 and Figure 9-5 for the positioning of this equipment with respect to the BIS and the standing position of the TSO.

- The **BSD** is the interface between the TSO and the BHS. It displays specific baggage information and allows the TSO to take action on a given bag. One BSD shall be installed per BIS. The BSD shall be color and touch capable with an 8" to 12" diagonal display size. The bezel of the BSD shall not exceed 1" in any direction and shall be located near the BRP at a 45 degree angle. The BSD mounting solution shall be adjustable in X, Y, Z dimensions.

- The **SVS** is the interface between the TSO and the EDS. It permits the TSO to conduct searches using the bag ID and image of the bag. The SVS is provided by the EDS OEM and may be comprised of one or two monitors, a keyboard, a mouse, and a CPU. The SVS monitors, keyboard and mouse shall be located towards the middle of the BIS and shall be adjustable in X, Y, Z dimensions. The SVS CPU shall be located in a lockable compartment where it will not interfere with the screening process.
- The **Scan Guns** are devices that read the 10-digit IATA bag tag and transfer the information to the BSD, which then sends the information to the SVS for image retrieval. The scan gun shall include a shock absorbing protector (i.e., rubber or similar) and be located near the adjacent BRP on a retractable reel. Scan guns shall be corded with stationary mounting solutions.
- The **ETD** is a device used to screen a bag for explosives. The CBRA design shall provide means to place and share an ETD between two adjacent BISs. The ETDs are provided by the TSA.
- The **Emergency Stop (E-stop)** shall stop all conveyors in a contiguous line when pressed during an emergency. Each BIS shall have a local E-Stop attached to the BSD (see Figure 9-4). Alternatively, an E-stop lanyard the length of the alarm line can be utilized. A single start push button shall be installed to ensure the system can only be started (reset) from one location within the CBRA after an emergency stop has been pulled. Kick panels shall be installed at all locations where a bag is opened along the AL and CL. E-stop stations at other locations (such as the CL or an OS line) are also encouraged.
- The **UPS** is a device capable of temporarily providing power to the BIS equipment whenever power outages occur. The BIS shall provide a place to locate the UPS.

9.3.3 CBRA BHS Displays

The CBRA shall be equipped with a display of additional BHS information that is useful for the TSA to effectively respond to system issues or bag surges. This information shall be visually available as follows:

- BHS Status Display – A visual representation of the conveyor belt design that uses industry-wide standard color codes to communicate real-time equipment status
- BHS Dashboard Display – A numeric and graphical representation of the system performance in real time. The specific metrics to display are noted below. The calculation parameters shall be adjustable via a user interface, but access shall be restricted to TSA only. The exact threshold values to be displayed shall be determined during the project submittal phase through concurrence with the TSA.

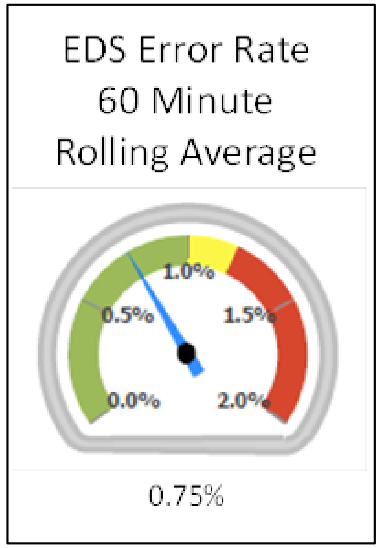
The number, locations, and size of displays will depend upon the BHS design, TSM desk location, and CBRA layout. Smaller airports may require one to two smaller displays (22" to 27"), while bigger airports may require one to three larger displays (42" to 60"). The exact configuration shall be coordinated between TSA and the ILDT during the project submittal phase.

The following metrics shall be displayed (values noted as SSI will be provided to the ILDT by the TSA Project Coordinator):

- Throughput rate – 10-minute rolling average
  - Minimum: 0
  - Maximum: system throughput=non-redundant EDS x Current PGDS bph)
  - Green: 0 – 50% of maximum
  - Yellow: 50% of maximum to 80% of maximum
  - Red: 80% of maximum to maximum
- Throughput rate – 60-minute rolling average
  - Minimum: 0
  - Maximum: system throughput=non-redundant EDS x Current PGDS bph)
  - Green: 0 – 50% of maximum
  - Yellow: 50% of maximum to 80% of maximum
  - Red: 80% of maximum to maximum
- Lost in tracking rate – 60-minute rolling average
  - Minimum: 0
  - Maximum: 5%
  - Green: 0 to 1%
  - Yellow: 1% to 2.5%
  - Red: 2.5% to 5%
- EDS error rate – 60-minute rolling average
  - Minimum: 0
  - Maximum: 2%
  - Green: 0 to 1%
  - Yellow: 1% to 1.25%
  - Red: 1.25% to 2%
- Timed Out – 60-minute rolling average
  - Minimum: 0
  - Maximum: 2%
  - Green: 0 to 1%
  - Yellow: 1% to 1.25%
  - Red: 1.25% to 2%
- OSARP Clear rate – 60-minute rolling average
  - Minimum: 0
  - Maximum: 100%
  - Red: 0 – SSI
  - Yellow: SSI – SSI
  - Green: SSI – SSI
  - Yellow: SSI – SSI
  - Red: SSI – 100%
- Total False alarm rate – 60-minute rolling average
  - Minimum: 0
  - Maximum: 100%
  - Green: 0 – SSI
  - Yellow: SSI – SSI
  - Red: SSI – 100%
- Average inspection time – 60-minute rolling average
  - Minimum: 0
  - Maximum: SSI minutes
  - Green: 0 – SSI minutes
  - Yellow: SSI minutes – SSI minutes
  - Red: SSI minutes – SSI minutes

Each metric shall be displayed as shown in the EDS Error Rate example in Figure 9-7:

Figure 9-7: EDS Error Rate Display Example



9.4 Ergonomic Design Dimensions

The following horizontal dimensions shall be maintained in the CBRA:

- The work space at the workstation and visual acuity ranges for off-station displays shall conform to the following ISO standards:
  - 11064-01:2000 Ergonomic design of control centres – Part 1: Principles for the design of control centres
  - 11064-02:2000 Ergonomic design of control centres – Part 2: Principles for the arrangement of control suites
  - 11064-03:1999 Ergonomic design of control centres – Part 3: Control room layout

Designers shall verify with local authorities that routes of egress within and external to the CBRA comply with applicable life safety codes. Additionally, sufficient clearance for utilization of bomb disposal robots shall also be taken into account. Peripheral equipment stations shall have sturdy and durable mounting systems that allow vertical and lateral adjustments to allow TSOs to function from a standing position with good posture in accordance with DOT/FAA/CT-03-05, Human Factors Design Standard for Acquisition of Commercial Off-the-Shelf, Non-developmental, and Developmental Systems to accommodate the 95th percentile male and 5th percentile female.

9.5 CBRA Functionality

This section provides a description of the functionality and controls required by the equipment in CBRA. The CBRA shall be programmed to automatically apply two different queuing methods based on three queuing prioritization levels.

9.5.1 Normal Alarm Line Queuing Method

A BIS is considered enabled when an operator is logged in. An enabled BIS is considered available when it is not occupied with a bag for screening.

During normal operations, bags arriving on the AL shall be assigned to the BIS that has been available for the longest period of time. If there are no available BISs, the bags shall queue and hold on the BRP prior to the most-upstream enabled BIS. If there are no enabled BISs, the bags shall queue at the second most downstream BRP.

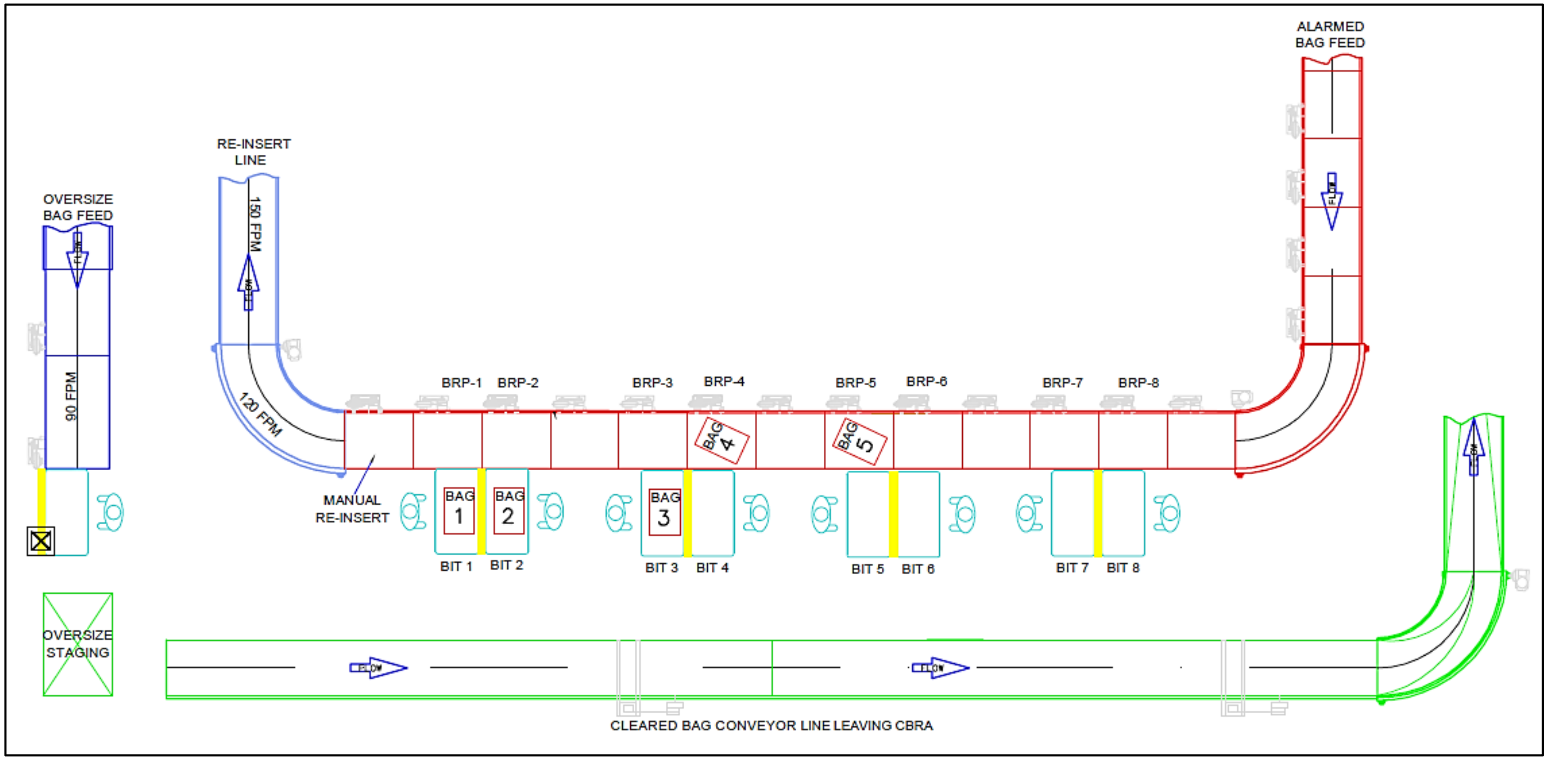
When a bag is assigned by the BHS to an available BIS, the bag cannot be reassigned to another BIS unless the BIS is disabled (i.e., the operator logs out).

The queuing prioritization levels shall be as follows:

1. Disabled BRPs, starting from the most downstream
2. Storage space outside of CBRA
3. Intermediate queues starting from the most upstream

Figure 9-8 assumes that BIS-1, BIS-2, and BIS-3 are enabled and available and five bags arrive in the CBRA consecutively. Following the logic above, the first three bags will be assigned to BRP-1 through BRP-3, respectively. Bag 4 and Bag 5 will queue at BRP-4 and BRP-5. Whenever a BIS becomes available, Bag 4 will advance to it and Bag 5 will advance to BRP-4. If a TSO logs into BIS-4, then Bag 4 is automatically assigned to the station and the operator may proceed with the screening as needed.

Figure 9-8: Normal Alarm Line Queuing Method



9.5.2 Alternate Alarm Line Queuing Method

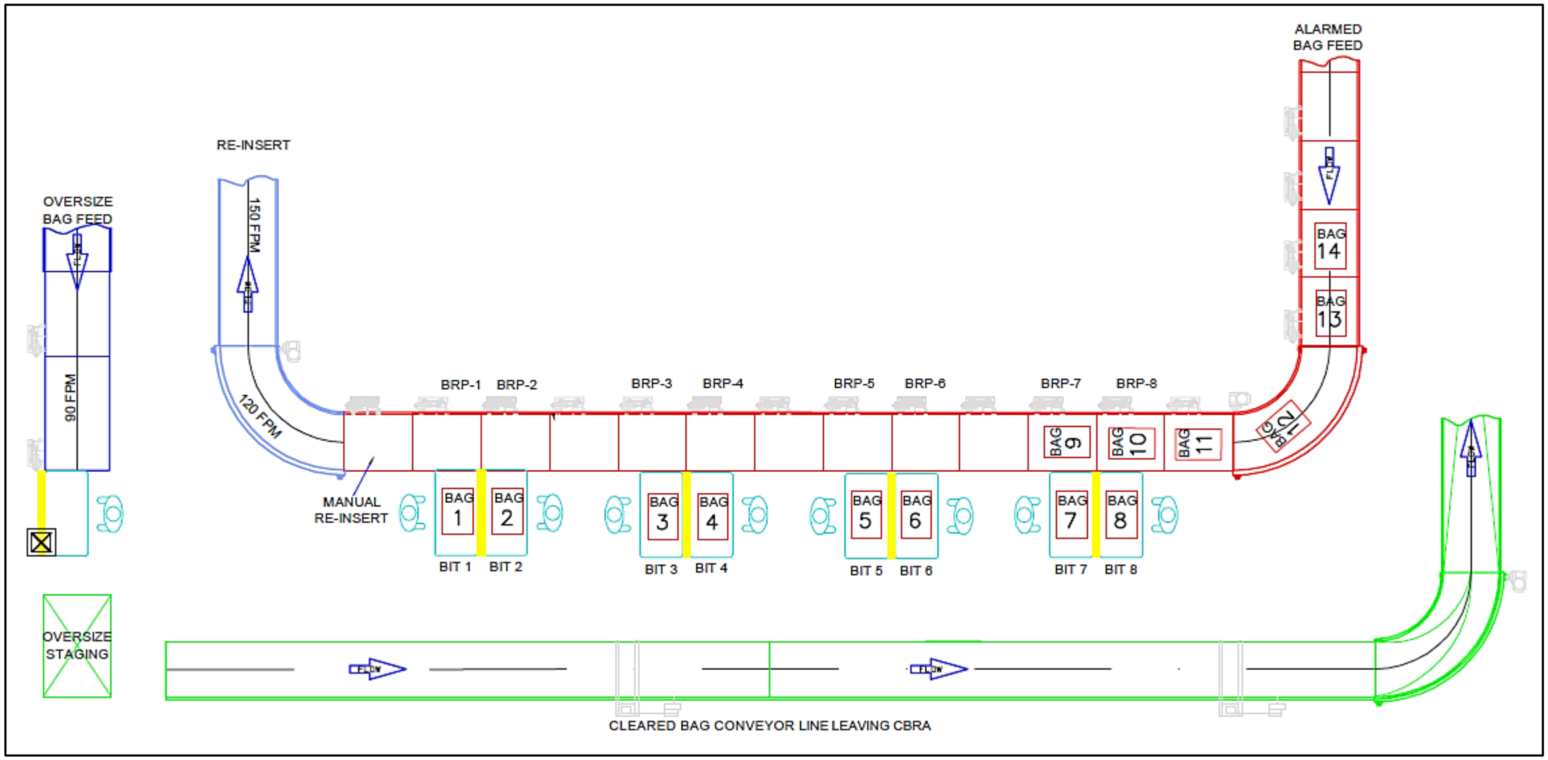
When the CBRA becomes overwhelmed and the queuing prioritization level 3 reaches capacity, the system shall switch to an Alternate Queuing Method (AQM) where the system starts advancing all additional bags arriving in the CBRA one conveyor at a time.

While the AQM is taking place, bags may pass unavailable BISs, blocking the path to the RL for any subsequent bag. Operators at the associated BISs will be instructed by the BSD to manually reinsert bags as necessary. The BRPs affected by AQM shall return to normal operations when the condition is lifted (i.e., a clear conveyor path to the RL is reestablished).

For example, as shown in Figure 9-9, if all 8 BISs are available and 14 consecutive bags are sent to CBRA, the first 8 bags will proceed to the respective BIS's BRPs. Since only four bags can be stored upstream of BRP-8, the BHS will automatically force Bag 9 to BRP-7 and Bag 10 to

BRP-8. Since Bag 9 passed an unavailable BIS (BIS-8), BIS-8 goes into the AQM and restricts this operator to only reinsert bags manually. Note that if BIS-8 proceeds to inspect Bag 10, no clear path to the RL is available due to Bag 9 being in the way). When a BIS becomes available and Bag 9 is removed from the BRP, the AQM mode on BIS-8 is lifted and returns to normal operations. BIS-7 can still automatically reinsert Bag 9 since no other bags are stopped on downstream BRPs.

Figure 9-9: Alternate Alarm Line Queuing Method



9.5.3 Baggage Removal Point

After a bag has been removed from a BRP and an action button has been selected on the BSD (the chronological order is irrelevant, but both conditions must be met), the system controls shall have an adjustable lag timer for the BRP belt to resume operations (i.e. advance other bags). The default value shall be three seconds.

9.5.4 Scan Guns

The scan guns shall be connected to the BSD so data is passed from the BHS to the SVS via a predefined communication port.

9.5.5 Baggage Process Timer

The BHS shall use a Baggage Process Timer (BPT) to record every bag processing time at each BIS using the first press of a BSD button as the start signal for the timer. BPT information is considered SSI and can only be retrieved or viewed by the TSA. Example reports are provided in Appendix A, Section A.8.

9.5.6 Reinsert Line

Under normal mode, the RL conveyor shall automatically start when a reinserted bag is detected on the upstream queue conveyor and the bag is automatically transferred onto the RL for rescreening.

Bags eligible for either automatic or manual reinsertion shall be assigned a new unique BHS tracking ID prior to rescreening.

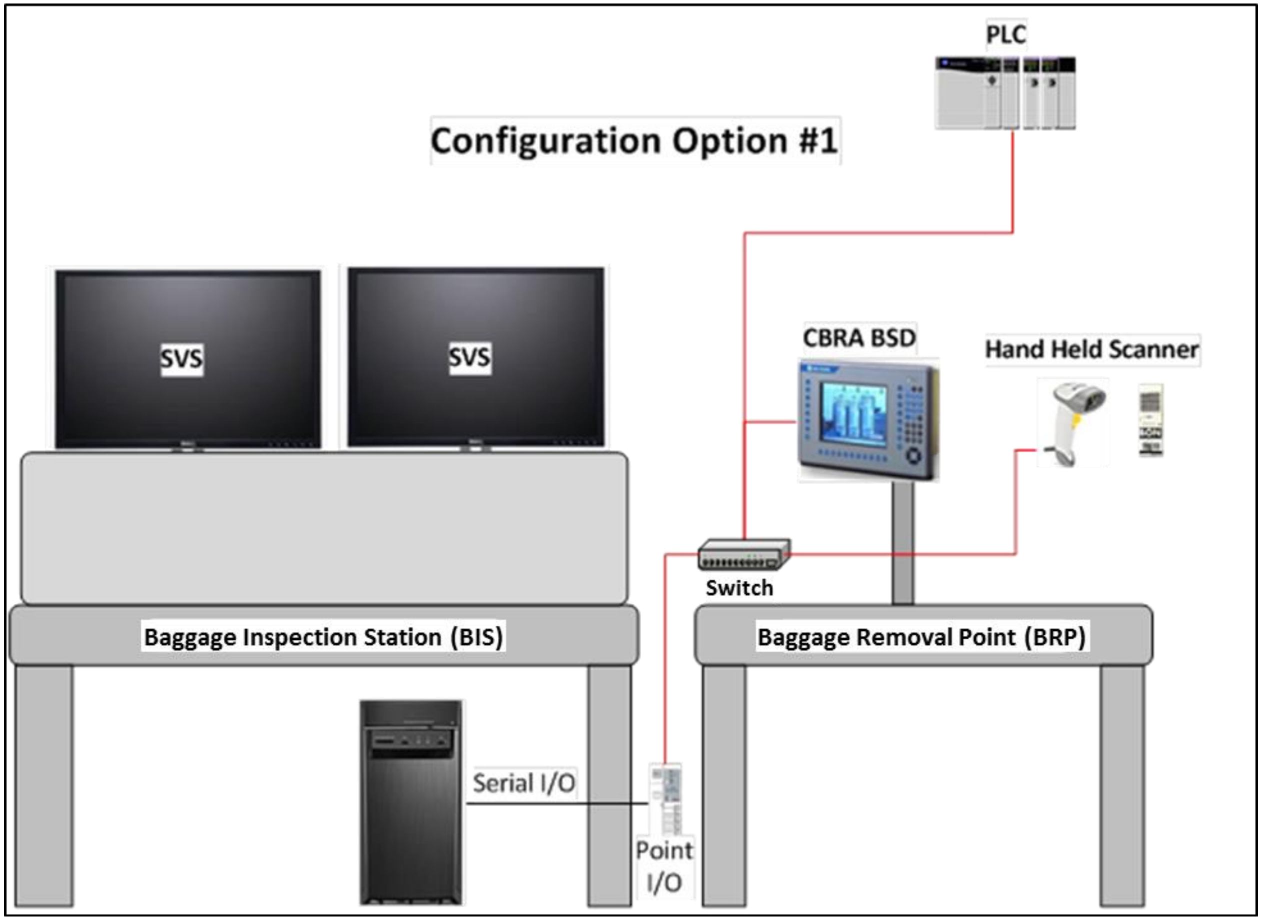
A control station shall be provided to operate the RL conveyor and allow for the manual placement of a bag under the AQM mode. AQM only allows manual reinsertion. At the manual reinsert points, located in optimal layouts shown in Figure 9-1 and Figure 9-2, the design shall incorporate a control station with the functionality of "Insert Bag" which will stop the conveyor and queue bags upstream to allow a bag to be manually placed on the conveyor (manual reinsert process). After the bag is placed on the conveyor, pressing a "dispatch" button shall send the bag downstream tracked with a status of "REINSERTED". In the case of the optimal layout in Figure 9-2, bags are placed in the center reinsert point (bottom of the horseshoe). Reinserted bags shall not stop at enabled BRPs and will be advanced directly to the RL line.

9.5.7 Serial Communication Requirements

BSD to SVS serial communication requirements are being refined by the TSA to include, in part, two-way communications. This section details information pertaining to the serial communications between the BSD, controlled by the BHS, and the SVS, controlled by the EDS network. Projects based on this version of the PGDS shall include provisions for these requirements to be incorporated during the project or as defined by the EDS Integration Documentation at the time of installation.

Figure 9-10 depicts one option to accomplish the serial interface as outlined.

Figure 9-10: Serial Communications Configuration Option



Note: The BSD is shown over the conveyor for clarity in the figure but is normally installed over the baggage inspection work space.

When the operator logs into the SVS, a heartbeat will be sent from the SVS and used by the BHS to automatically enable the BSD/BRP for bag processing.

When a bag arrives in the CBRA, the BSD will send the associated ID to the SVS based upon the options available to the operator as described below. This data will be used by the FDRS to log the time an image was sent to the screen to the time a final disposition was rendered by the CBRA operator.

After each bag has been processed by the TSO, the SVS will send back the associated ID string in addition to the bag's disposition to the BSD based upon the actions taken at the SVS. For example, if the operator renders a clear disposition on a given bag, that information will be sent back to the BHS. This will in turn be used by the BHS to declare that position available.

9.5.7.1 Communication Port Parameters

The SVS serial communications port shall be configured for two-way communications send and receive, with the following parameters:

- Baud Rate – 9600
- Data Bit – 8
- Parity – 0
- Stop Bits – 1

9.5.7.2 Communications Data Format

Data formatting between the BSD and SVS shall comply with the American Standard Code Information Interchange (ASCII) standards.

For any instance where either no "pseudo" or "IATA" ID is available from the BHS to the SVS or SVS to the BHS, the 10 digits shall be populated with "?" marks. (Where a "?" is equivalent to an ASCII 63.)

Note: Numbers below within "( )" indicate the ASCII equivalent value.

9.5.7.3 BSD to SVS

Data format is <<STX,Pseudo,IATA,ETX>> where

- STX (02) = Start of Text
- . (44)
- Pseudo = BHS generated ID for tracking purposes and displayed on the BSD
- , (44)

- IATA = IATA ID Displayed on BSD
- . (44)
- ETX (03) = End of Text

9.5.7.4 Order of Bag ID Lookup

1. The SVS will use the pseudo ID as the primary ID to recall the associated image.
2. Where a bag cannot be recalled due to BHS issues such as lost in tracking, the EDS will use the IATA as a secondary means to recall the image.
3. Where no ID is found, either pseudo or IATA, the SVS will provide a positive response that no image was found associated with the ID(s) provided. This will be indicated as a “popup” message on the SVS monitors.

9.5.7.5 SVS to BSD Heartbeat

When the operator has logged into the SVS, a heartbeat will be sent from the SVS to the BSD denoting it is active and available to process bags.

When the BHS detects the heartbeat from the SVS, the BSD shall automatically be enabled and the active screen will be “Waiting For Bag”.

This data will be a toggle between two separate ASCII values and shall be as follows every two seconds:

Data format is <<STX,HB,ETX>> where

- STX (02) = Start of Text
- , (44)
- HB = Toggles between H (72) and h (104)
- , (44)
- ETX (03) = End of Text

Note: The BHS is expected to monitor this data for a change of state. If a change of state is not detected within 10 seconds, the BHS is expected to automatically log out of the BRP and declare the BRP unavailable.

9.5.7.6 Bag ID and Disposition String Format

Data format is <<STX,IATA,Pseudo,Disposition,ETX>> where

- STX (02) = Start of Text
- , (44)
- IATA = IATA ID Displayed on BSD
- , (44)
- Pseudo = BHS generated ID for tracking purposes and displayed on the BSD
- , (44)
- Disposition
  - Clear = C (67)
  - Alarm = A (65)
  - No Image Found = F (70)
- , (44)
- ETX (03) = End of Text

9.6 BSD Operations

9.6.1 BSD Screens Design

The BSD Interface is comprised of different elements and specific visual characteristics that shall be replicated on every design. The visual design shall include:

- Font style: The font shall be a web-safe sans-serif typeface such as Arial, Verdana, or Calibri.
- All Capital Letters: Bag statuses, UICs, and operator messages shall be displayed in all capital letters. Everything else will follow the typical format of the first capital letter only
- The elements to screen size ratio shall be maintained regardless of the display size. For instance, when determining the width of the elements:

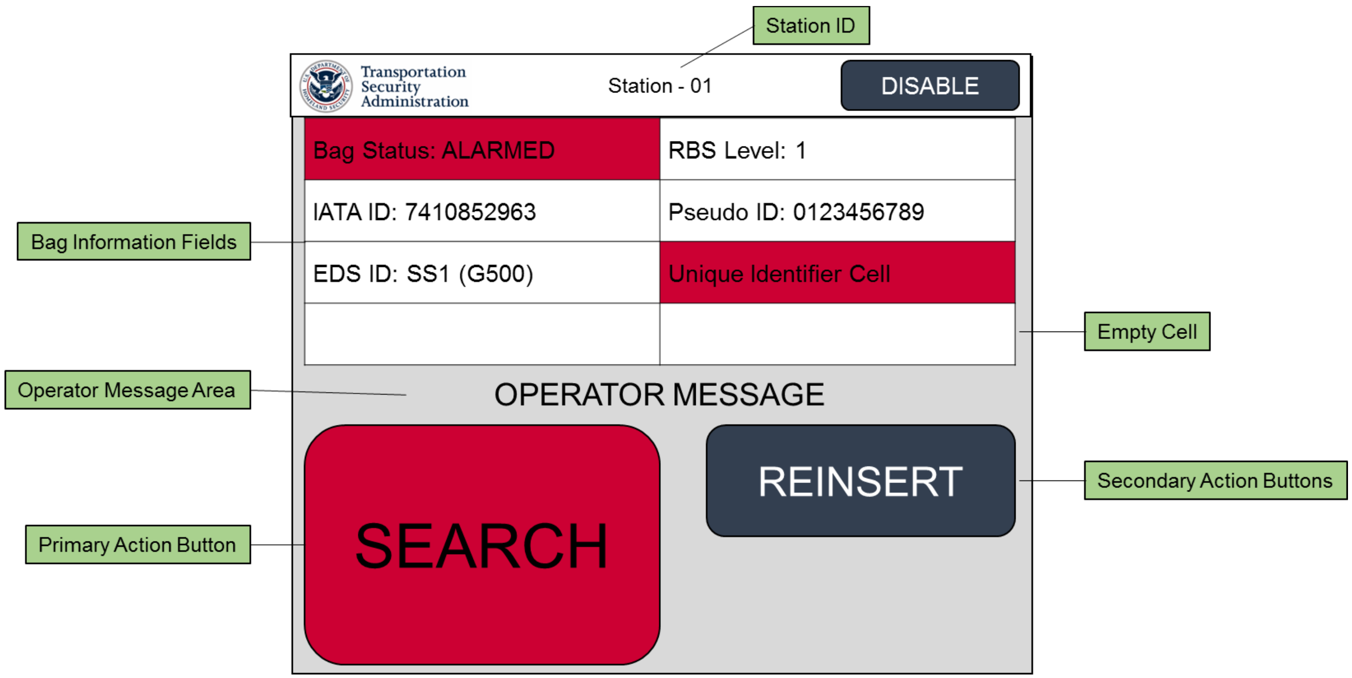
- Data fields – 10% each (or 40% total)
- Operator Message – 10%
- Primary Buttons – 40%
- Secondary buttons – 20%

- All colors used throughout the displays shall follow the pantones in the table below:

Color	Pantone	R	G	B
Blue	2955 C	0	51	102
Gray	Cool Gray 6 C	176	177	179
Red	187 C	204	0	51
Light Blue	307 C	0	102	153
Green	370 C	51	153	0
Orange	159	191	87	0
Yellow		246	229	0

The BSD structure shall include the following key elements illustrated in Figure 9-11:

Figure 9-11: Elements of Bag Status Display Screen



- **Station ID:** Numbering convention in the form of "STATION –XX", which correlates to the BIS number in which it is mounted.
- **Bag Information Fields:**
  - **Bag Status:** Disposition of the bag as indicated by designator and color listed in Section 9.6.1
  - RBS Level: The EDS algorithm used to screen the bag (This is a placeholder for now. No additional information is available).
  - IATA ID or RFID: If an ATR is being used upstream of the EDS units, the IATA number shall be populated here. If an RFID system is being used, the RFID ID shall be displayed.
  - PSEUDO ID: The generated pseudo ID (either by the BHS or the EDS) shall be shown.
  - EDS ID: EDS screening line and EDS serial number used to process the current bag in the format of SS8 (G500)

- Unique Identifier Cell **(UIC):** Used to identify when any of the following scenarios occur:
  - Duplicate IATA
  - Timeout
  - Communication Error
  - Length Change
  - Others may be added with an approved RFV
- **Found at** PE**:** PE ID that correlates to the location where bags that have been lost in tracking were "found".

- **Operator Message Area:** Used to display any messages for the operator.
- **Primary Buttons:** These represent the primary action typically taken by the operator. These also work as a trigger for the Bag Auto ID Transfer functionality when needed, as referenced in TSA's Integration Requirements Document (IRD).
- **Secondary Action Buttons:** These provide an optional action for the operator under certain circumstances.

Throughout the following sections, multiple BSD screens will be presented to show the desired results from each processing step. The ILDT is required to match every aspect of each screen including colors, font style, button location and size, messages displayed, and others. If the ILDT desires additional functionality, or would like to propose changes to improve operations, an RFV could be submitted to start the dialogue.

9.6.2 BSD Statuses and High Level Processing Procedures

Baggage that arrives in the CBRA shall be limited to the following five statuses with their corresponding designator codes, color, and RBS level.

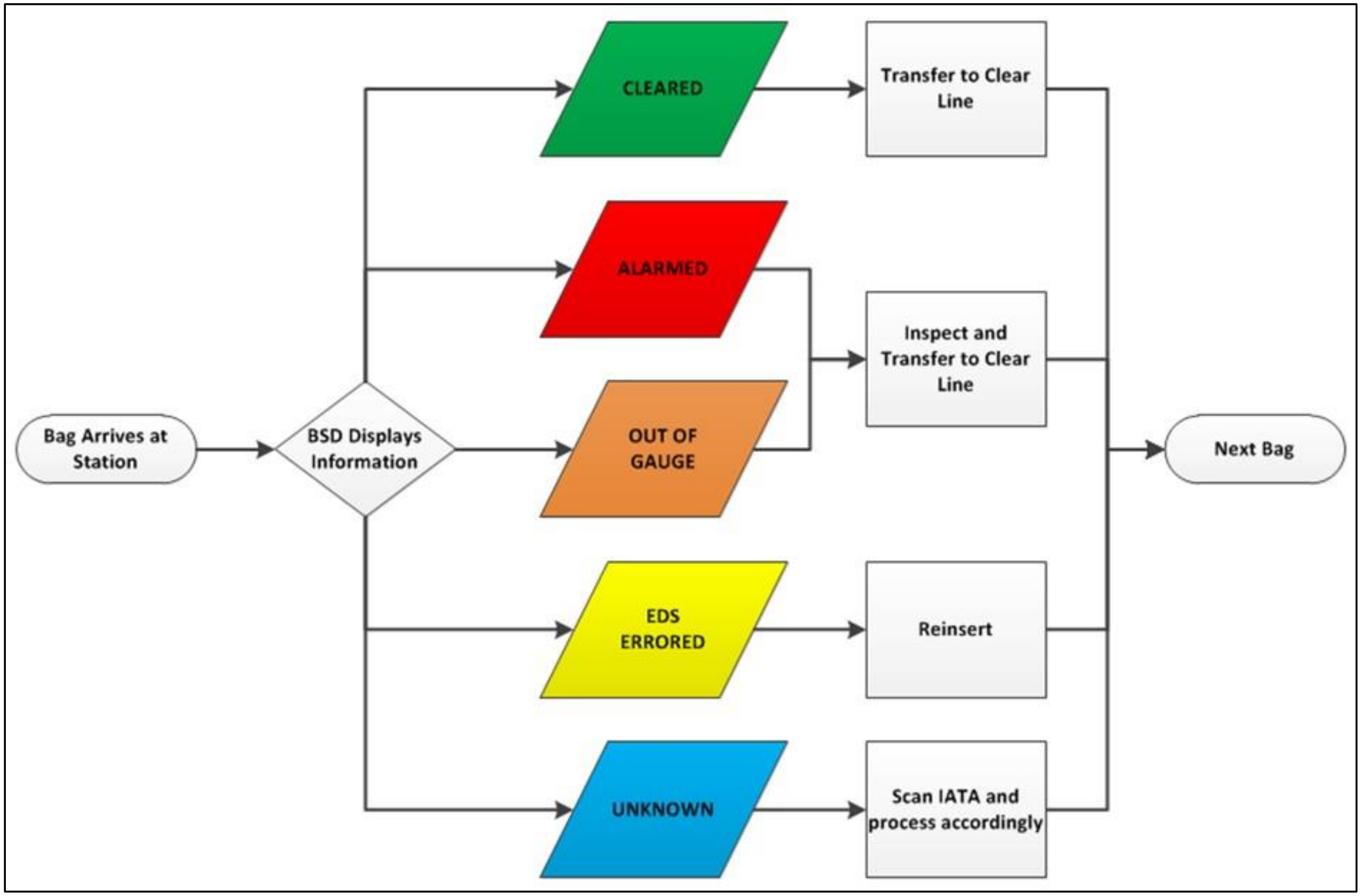
- **CLEARED** (Green) – Bags that received a clear status from the EDS or OSR. Cleared bags include:
  - Clear – Standard bag with RBS level - 0
  - PRE-Clear – Pre-Check bag with RBS level - P
  - SEL-Clear – Selectee bag with RBS level - S
- **ALARMED** (Red) – Bags that generate an automatic alarm on an EDS unit and were viewed but not cleared by the Level 2 OSR Operator. Alarmed bags include:
  - Alarmed – Standard bag with RBS level - 0
  - PRE-Alarmed – Pre-Check bag with RBS level - P
  - SEL-Alarmed – Selectee bag with RBS level – S

  - Timeout – Bags that received an alarm status from the EDS but timed out during OSR or didn't make it to the OSR at all. RBS level can be 0, P, or S.

- **OUT OF GAUGE** (Orange) – Bags that do not fit into EDS units. RBS level - UNK
- **EDS ERRORED** (Yellow) – Bags that received an error status from the EDS. RBS level – UNK
- **UNKNOWN** (Blue) – Bags that have become lost in tracking between the exit of the EDS and the BRP or forced unknown for security reasons. RBS level – UNK
  - Communication Error – BHS will assign this status in scenarios where a disposition has not been received by the BHS from the EDS. This status is NOT an indication of an EDS or BHS error, but indicates a possible communications error. Where the status is persistent, the BHS and EDS engineers should review the possible condition causing the error. RBS level – UNK
  - Length Change – BHS will assign this status to bags that are believed to have "changed" their length. RBS level - UNK

These five statuses will be processed primarily utilizing five operator sub processes as shown in Figure 9-12. These sub processes are discussed in greater detail in the next sections utilizing diagrams to illustrate multiple tasks happening simultaneously throughout each bag status resolution.

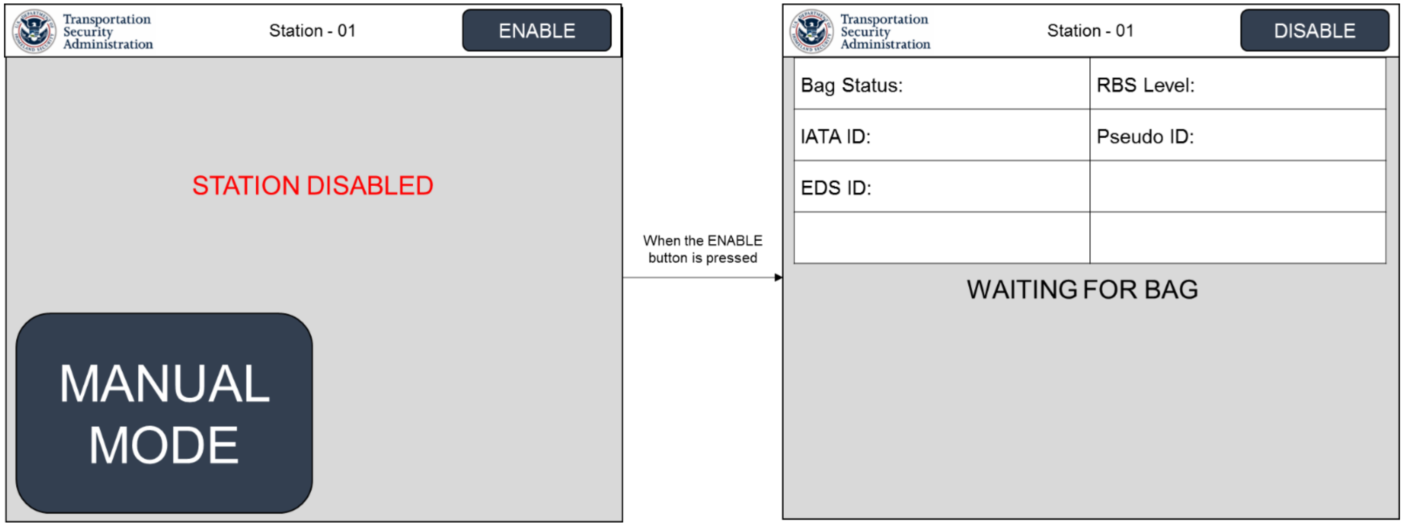
Figure 9-12: High Level Procedure Per Bag Status



9.6.2.1 Station Disabled and Waiting for Bag Screens

After the BHS startup procedures are completed, the BSD shall remain DISABLED until an operator presses the ENABLE button shown in Figure 9-13 or logs on to the SVS with two-way communication.

Figure 9-13: Station Disabled (left side) and Station Enabled (right side) Screens



The MANUAL MODE above allows for processing of bags hand carried to a BIS. Entering the MANUAL MODE can only be accomplished from a "DISABLED" BSD and the BHS will not queue bags on the associated BRP. When turned on, the BSD will assume that every bag has an "UNKNOWN" status in order to allow for a tag scan. Therefore, the processing of bags while in MANUAL MODE follows the sequence for UNKNOWN bags shown in Section 9.6.2.2.5.

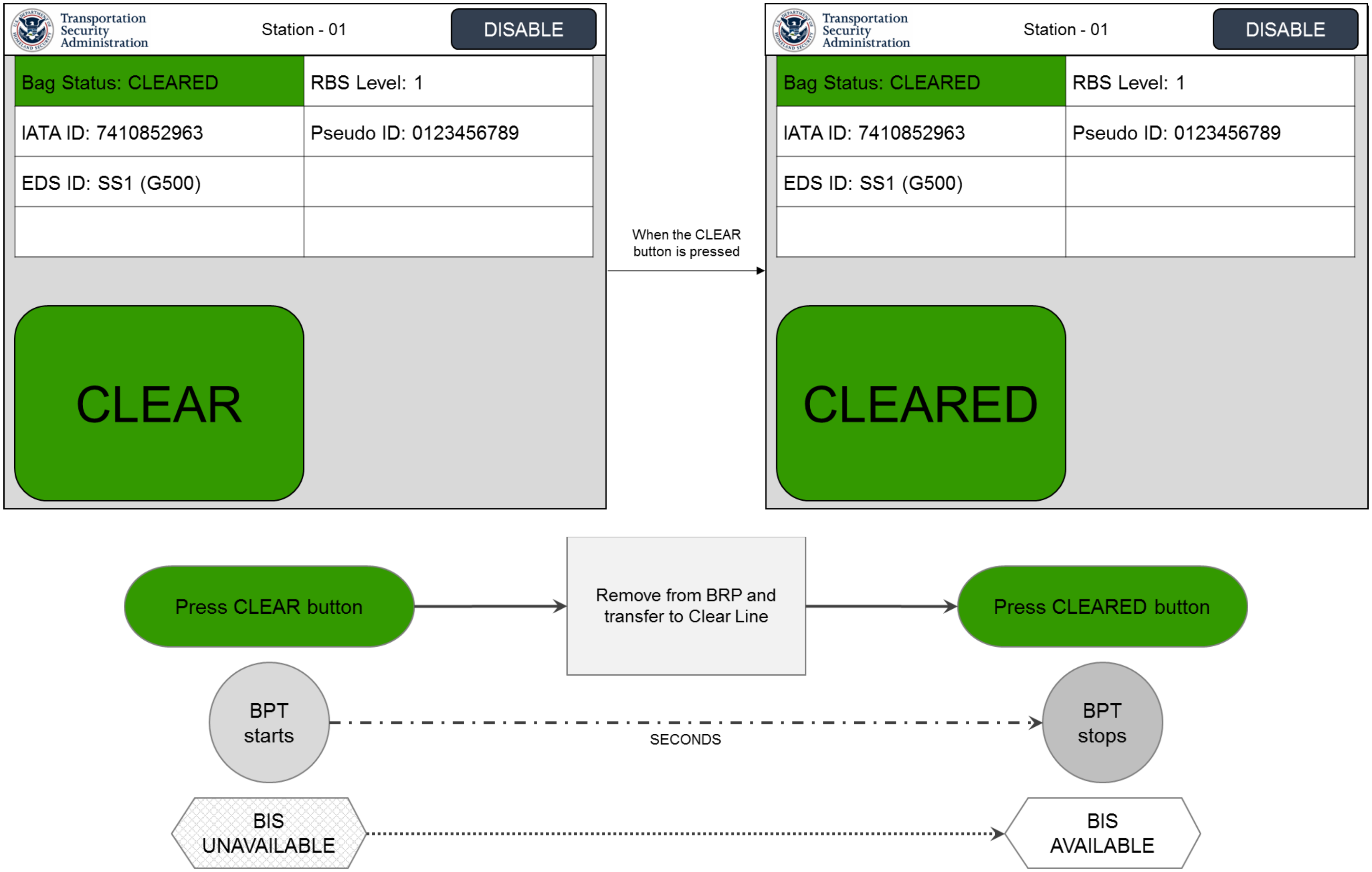
9.6.2.2 Bag Processing

The figures in this section depict the following information regarding bag processing:

- The BSD screens required for processing all five bag statuses
- The physical sequence of operations required by the operator to complete the process, and;
- The controls requirements throughout the process

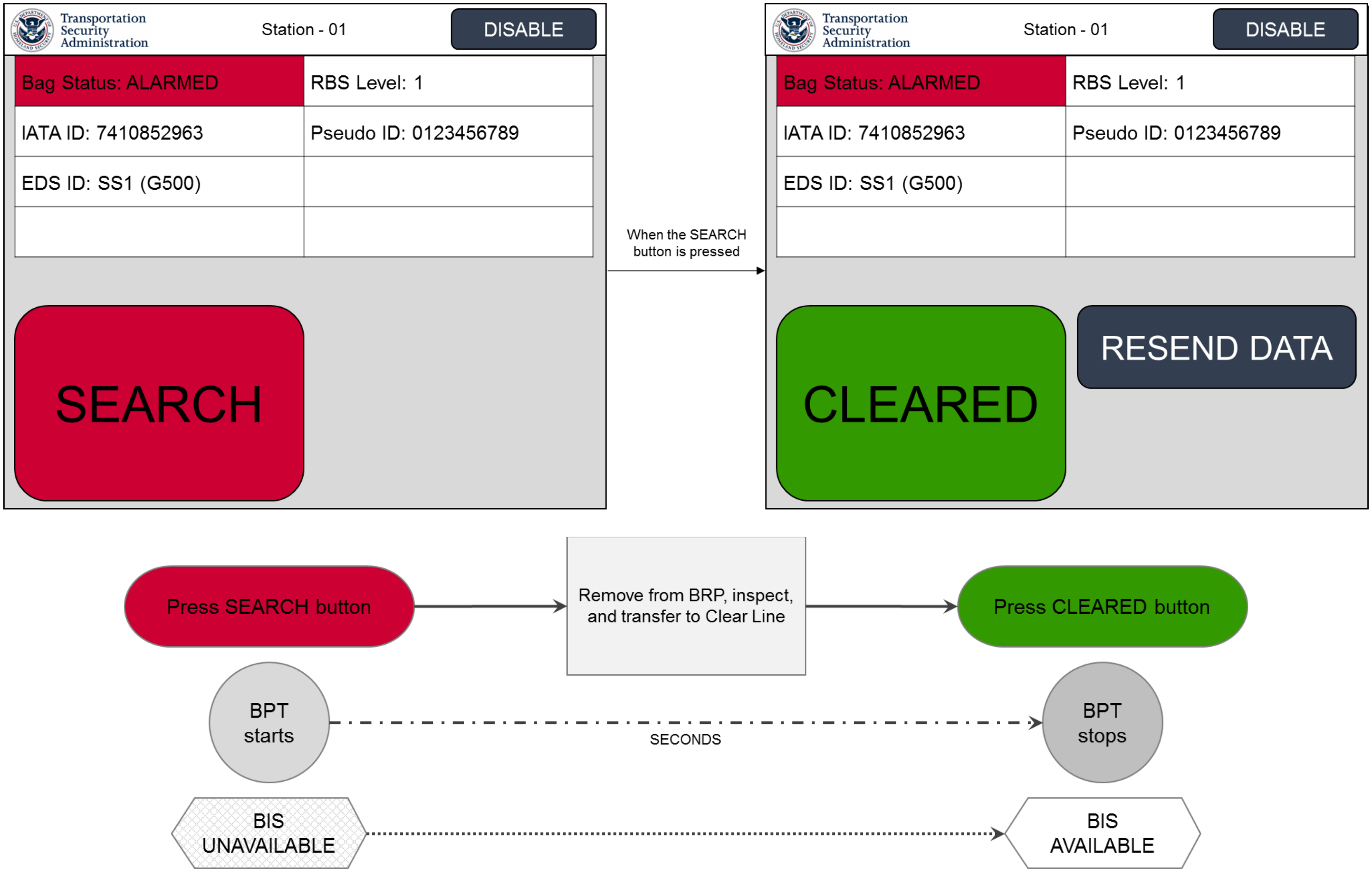
9.6.2.2.1 Cleared Bags

Figure 9-14: Cleared Bag Processing Screens and Sequence of Operations



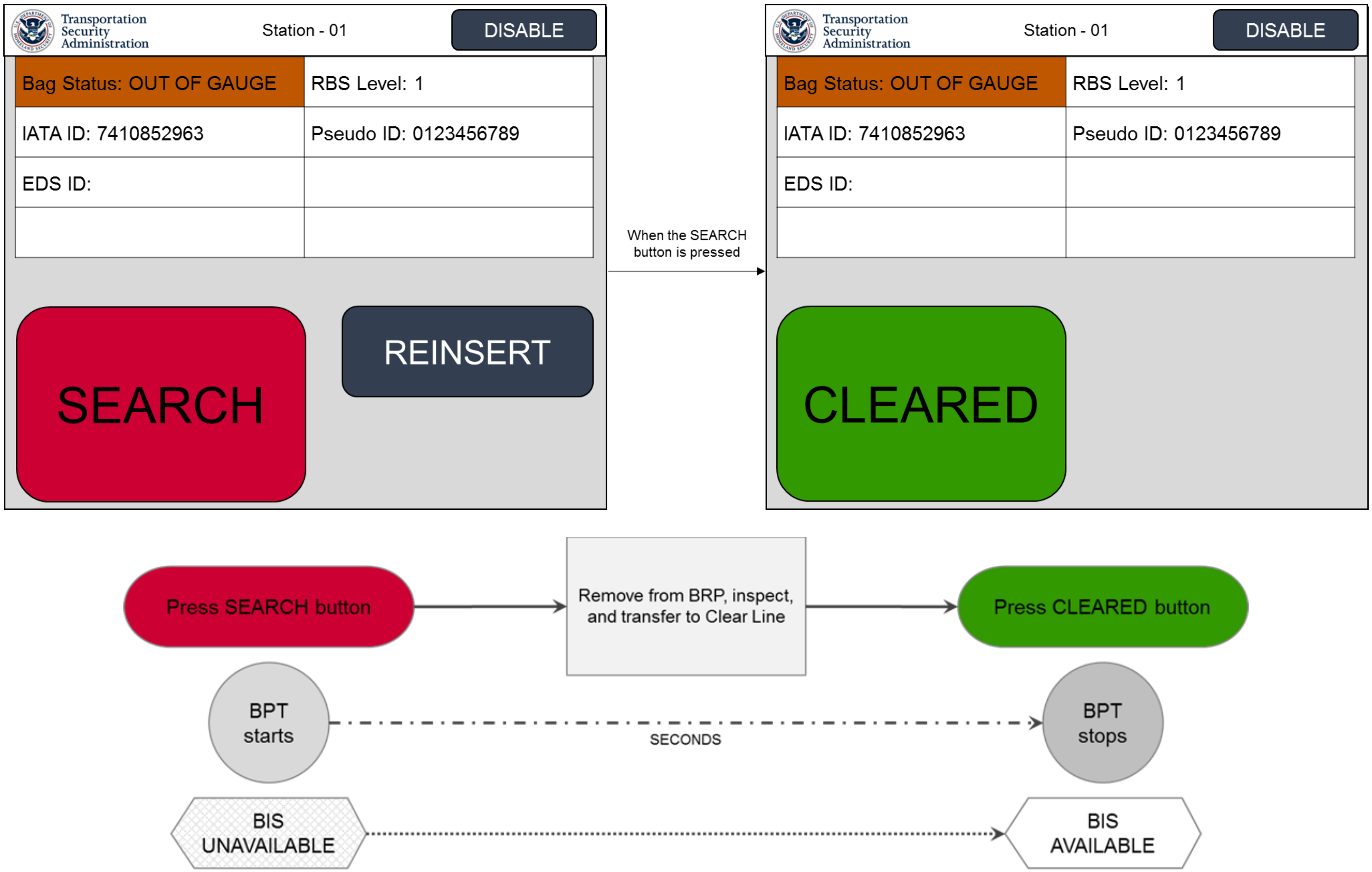
9.6.2.2.2 Alarmed Bags

Figure 9-15: Alarmed Bag Processing Screens and Sequence of Operations



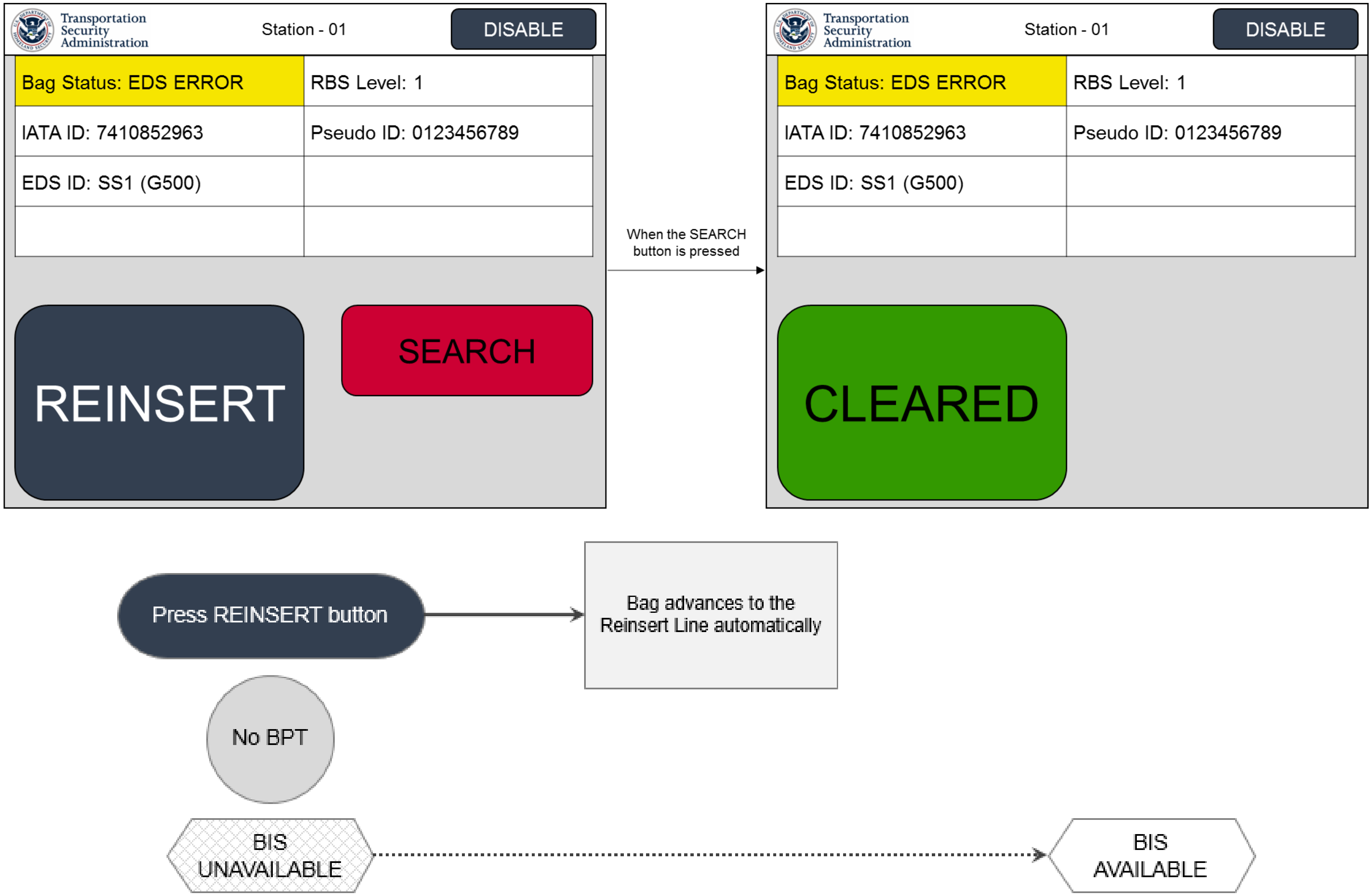
9.6.2.2.3 Out of Gauge Bags

Figure 9-16: Out of Gauge Bag Processing Screens and Sequence of Operations



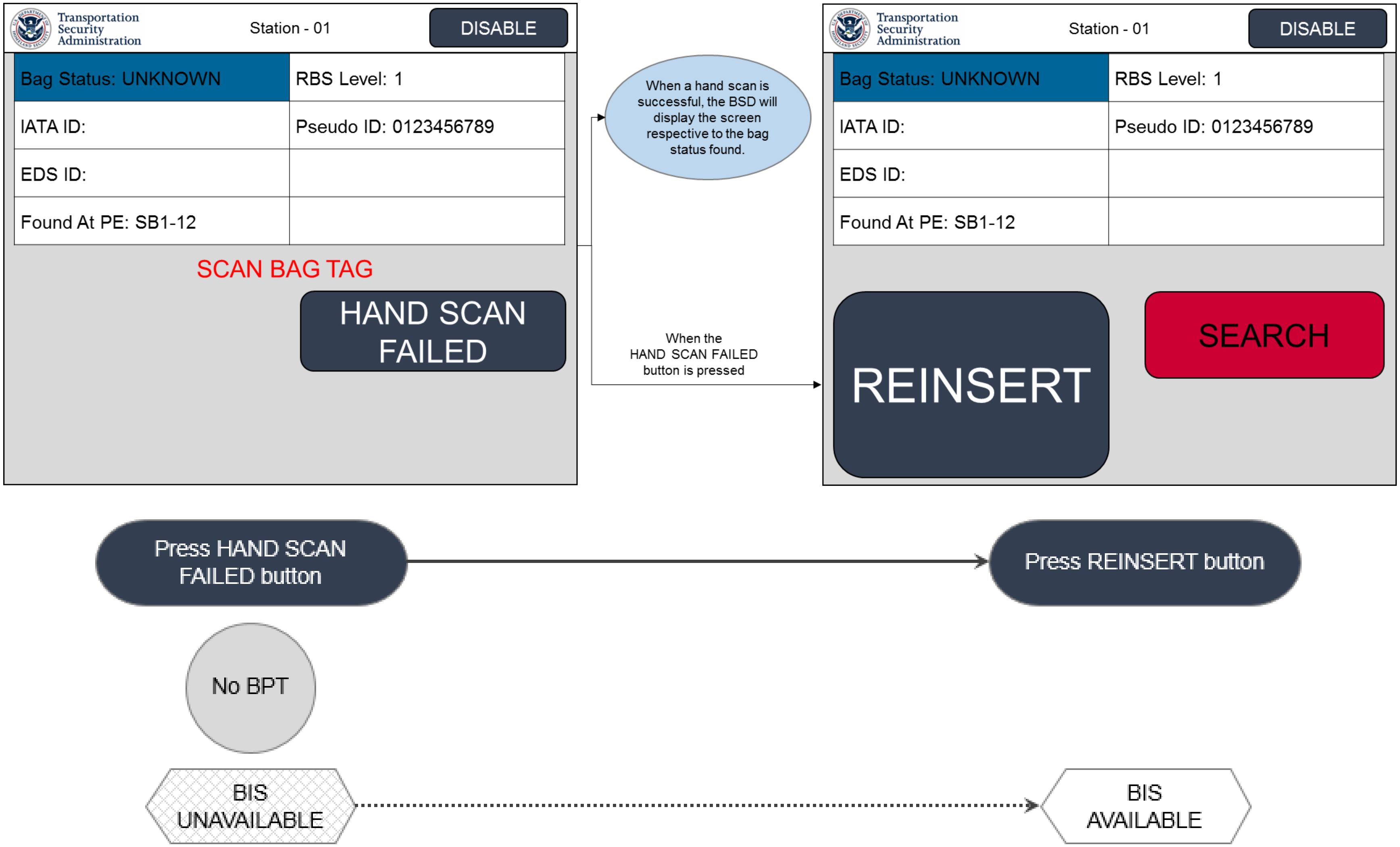
9.6.2.2.4 EDS Errored Bags

Figure 9-17: EDS ERRORED Bag Processing Screens and Sequence of Operations



9.6.2.2.5 Unknown Bags

Figure 9-18: UNKNOWN Bag Processing Screens and Sequence of Operations



9.6.2.3 Alternate Queueing Method

As stated in Section 9.5.2, there will be times when the BHS will trigger the AQM in CBRA. During this condition, any operator working on a bag requiring reinsertion at an affected BIS will notified by the BSD to reinsert the bag (manually). This slightly different process applies only to OOG, EDS ERRORED, and UNKNOWN statuses requiring the BSD screens shown in Figure 9-19, Figure 9-20, and Figure 9-21.

Figure 9-19: AQM Out of Gauge Bag Screen

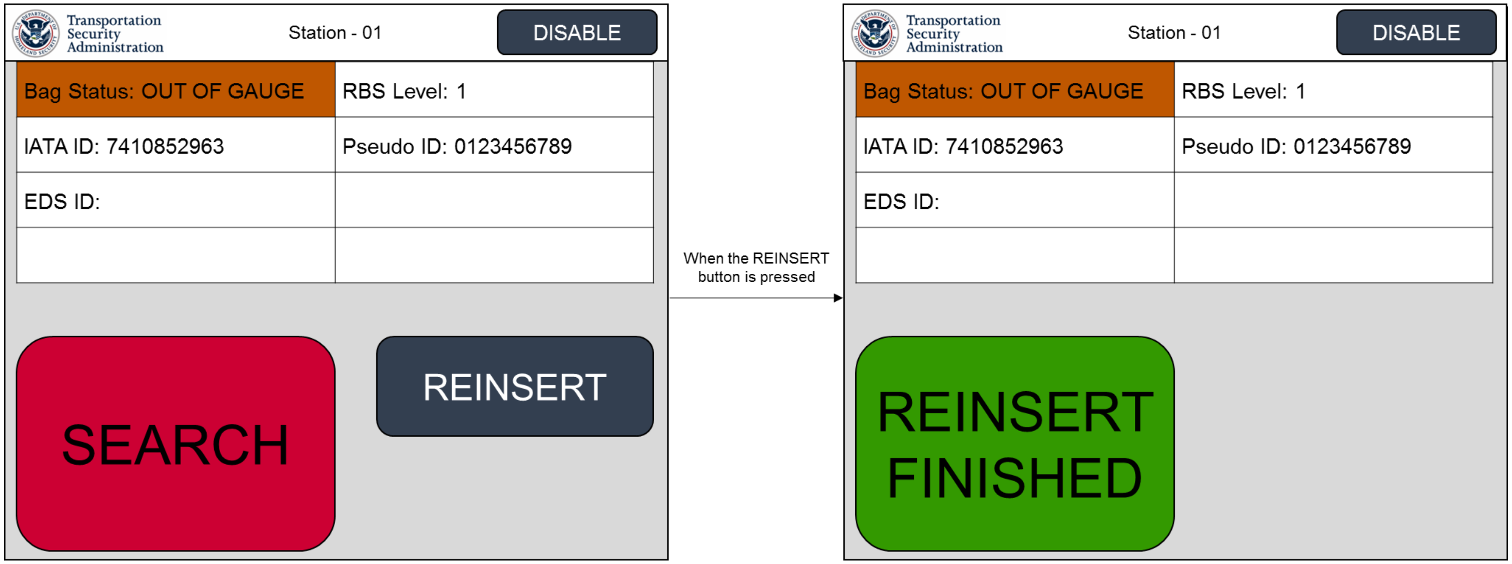


Figure 9-20: AQM EDS ERROR Bag Screen

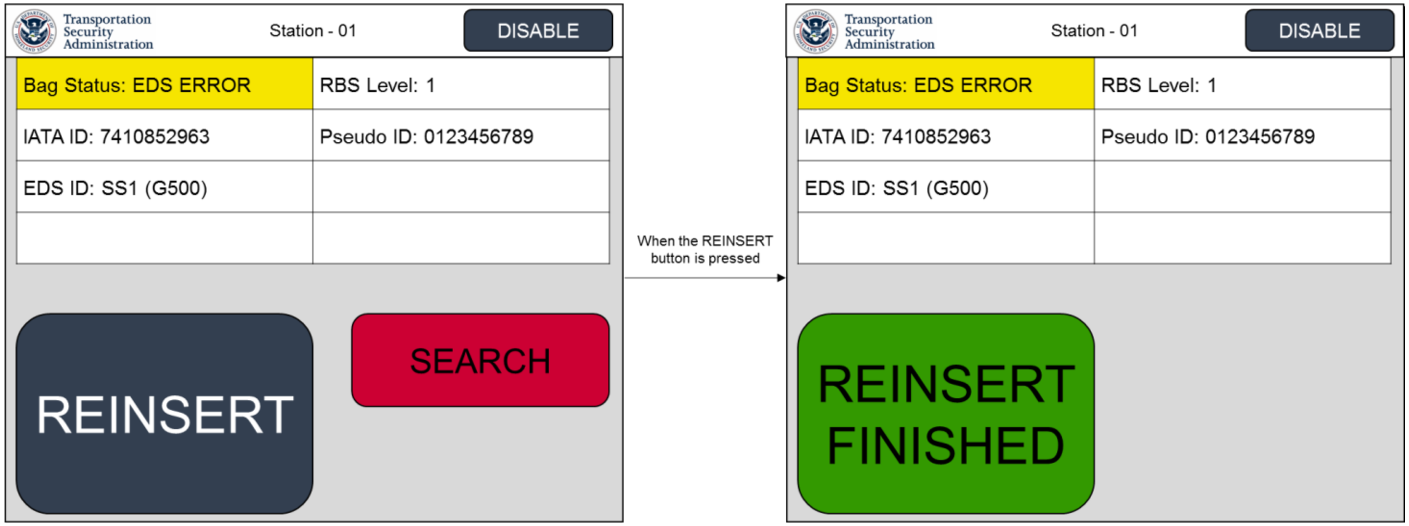
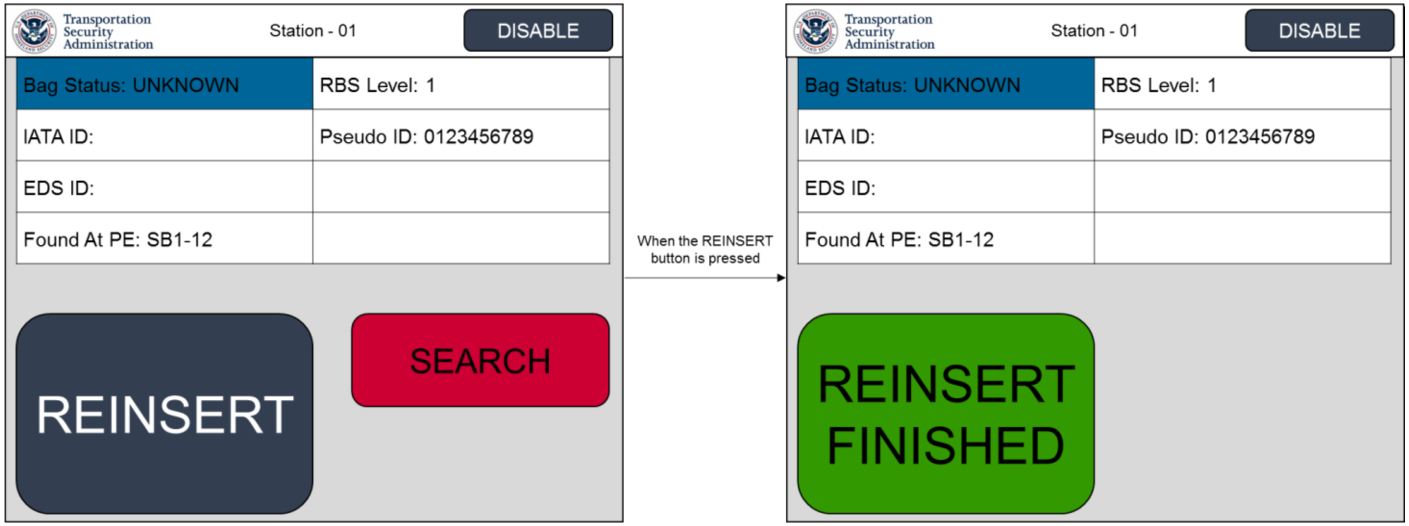


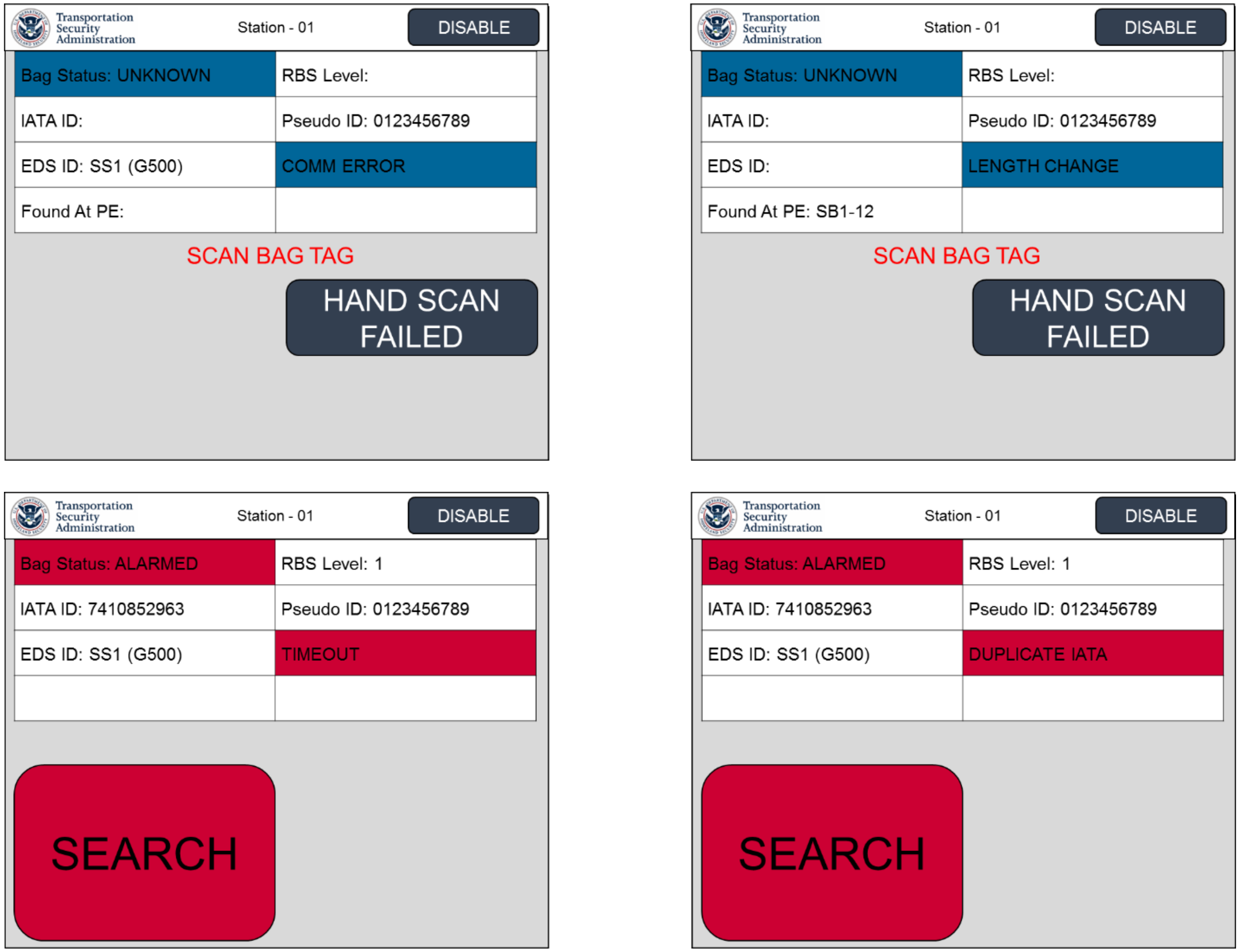
Figure 9-21: AQM Unknown Bag Screen



9.6.2.4 Unique Identifiers Cell

There are four messages that may be displayed in the UIC. These messages are used mostly for troubleshooting purposes and shall be displayed as shown in Figure 9-22. Additional UIC messages may be used if submitted through an RFV and approved by the TSA.

Figure 9-22: Unique Identifier Cell Messages



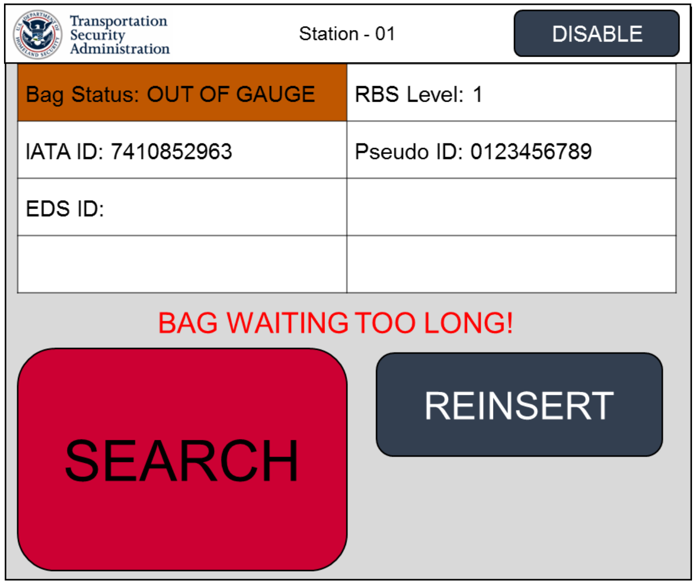
9.6.2.5 Bag Waiting Alerts

In an attempt to mitigate unnecessary dieback in the CBRA, visual and audible alarms shall alert operators to a condition where manual intervention is required.

The following conditions shall trigger the Bag Waiting Alert on the BSD:

- If the BIS is available and a bag requiring manual intervention (i.e., pressing a button) is queued at the adjacent BRP, a bag waiting timer shall start.
- If the bag is left unattended for 15 seconds (adjustable), the BSD shall display a BAG WAITING TOO LONG message in red until an action is taken on the bag as shown in the example in Figure 9-23. This applies to all bag types screens.
- If the bag is left unattended for 30 seconds (adjustable), the audible alarm on the BSD station shall sound until an action is taken on the bag.

Figure 9-23: Example of Bag Waiting Alert for Alarm Bag Screen



9.7 General Design Considerations

The following sections describe general design considerations for TSA's "no bag lifting" policy, reinsert lines, OOG and OS lines, and screening station queuing at CBRA.

9.7.1 Bag Storage Capacity

The TSA staffing methodology allows for 10 minutes of bag processing in CBRA per TSO. Therefore, the CBIS design shall be capable of storing the proper quantity of bags needed to avoid system diebacks. The following equations shall be used to determine the bag storage needed to meet this requirement:

$$Total\ bags_{to\ accomodate} = \frac{10min}{Average_{screening\ time}(\mathrm{min})}\ x\ Quantity\ of\ BITs_{\mathrm{Alarmed/OOG}}$$

$$Bag\ Storage\ Capacity = Total\ bags_{to\ accomodate} - Quantity\ of\ BITs_{\mathrm{Alarmed/OOG}}$$

For example, Table 9-2 shows how the storage capacity changes based upon the number of BISs and the average processing times.

Table 9-2: Example of CBRA Accumulation

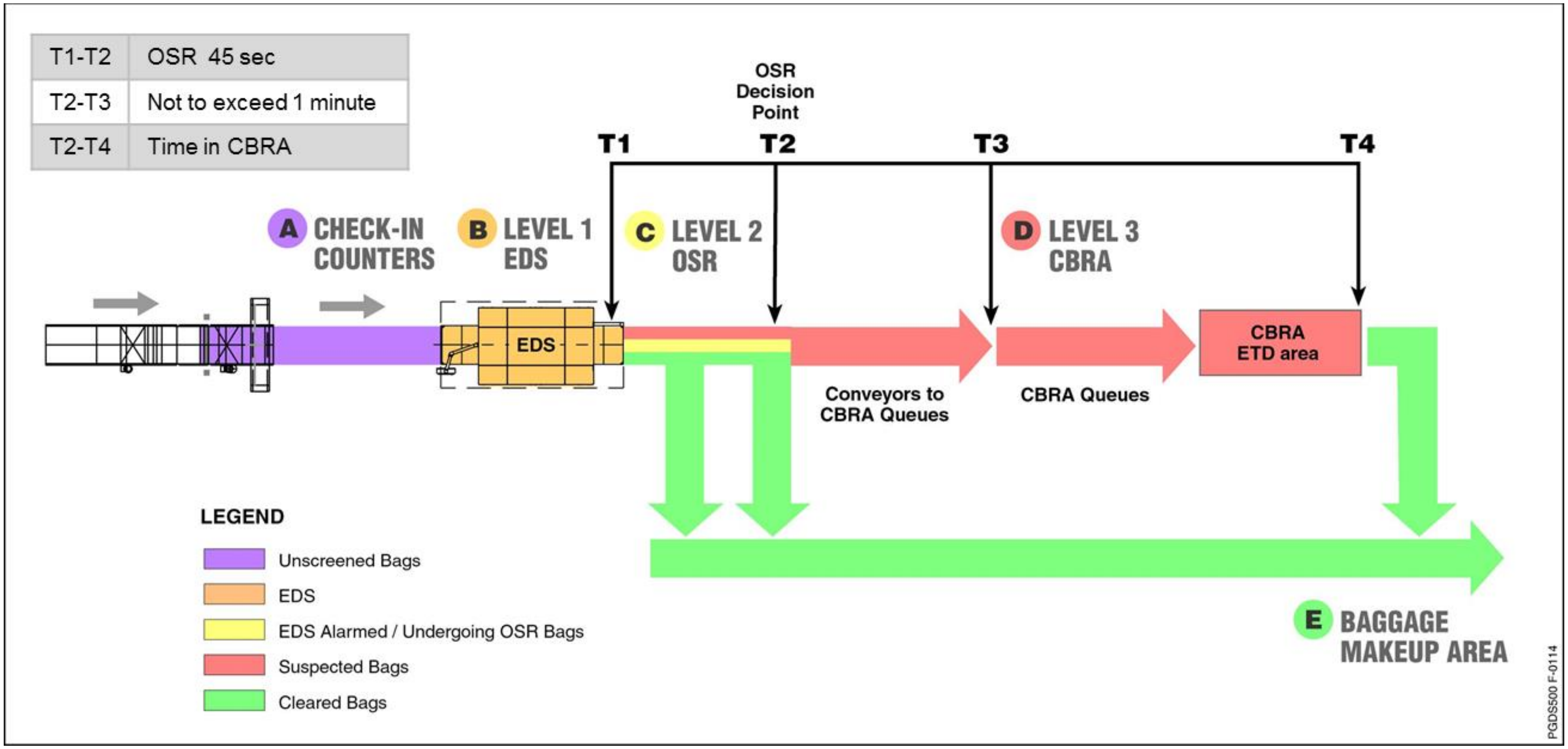
# of BISs	Default BRPs/ Intermediate Queue	Bag Storage Capacity Needed for Domestic @ 3min/bag	Bag Storage Capacity Needed for INTL @ 6min/bag
4	6	10	3
8	12	19	6
12	18	28	8
16	24	38	11
20	30	47	14
30	45	70	20
40	60	94	27

When analyzing the bag storage capacity needed for a particular design, the ILDT shall consider the third and fourth column from the table above.

For instance, using a CBRA with 4 BISs and a 3-minute average screening time, the conveyor system will need to accommodate up to 10 bags. Since the layout will include four BRPs and two intermediate queues, another four bags will need to be stored somewhere else.

The bag storage capacity shall be achieved using a combination of queues, inch and store conveyor belts, and/or other cost-effective means between the OSR 2nd/last chance divert point and the entrance to the CBRA as well as BRPs and Intermediate Queues within CBRA. Refer to the area between T2 and T4 in Figure 9-24 for a pictorial diagram.

Figure 9-24: Bag Time In System and Bag Time In CBRA



9.7.2 CBRA Physical Requirements

The CBRA is an enclosed space that is separated from the bag room provided with the necessary infrastructure to ensure a secure and climate-controlled environment with adequate acoustic controls to provide a safe working environment for the TSOs. The size of the room is dictated by the number of queues and BISs required to adequately meet the screening demands of the CBIS.

The space requirements for the staging room for OS bags shall be based on the individual airport handling of OS bags. For instance, if the OS area is located at the lobby it is unlikely that many bags will arrive at the same time. If the OS bag screening is performed in the CBRA, the airlines may send multiple bags via carts or tugs.

In addition, space shall to be allocated for the storing of hazardous materials outside of the CBRA. The space requirement shall be based on the historical frequency of these materials and the frequency to which the airport collects them.

9.7.3 Architectural Features

The CBRA shall be fully enclosed with segregating partitions extending to the structural deck to allow for the security and comfort of the TSOs. The CBRA shall be provided with finished horizontal and vertical surfaces as follows:

- **Flooring** shall be composed of a safety/anti-fatigue material configured for a continuous installation under all TSO work and movement areas with a service-life of no less than seven years.
- **Walls** shall have durable, impervious surfaces, such as painted masonry, plastic laminate or drywall that is taped, bedded, and textured with epoxy or enamel paint.
- **Ceilings** shall include the use of painted suspended drywall, or suspended, lay-in acoustical tile at a minimum height of 9 feet. An acceptable design can include exposed structure with no ceiling. See Section 9.7.8 below for noise abatement recommendations.
- **Access** shall be provided with at least one set of double doors (or a rollup door) for access for equipment movement into and out of the area.

Designers shall consult with local authorities to determine the proper protocol(s) and routing for the removal of threat bags from the CBRA including a designated exit path for TSOs when a threat is discovered, as well as adequate access to the CBRA room for local authorities with threat containment units.

9.7.4 Lighting

Proper illumination is required in the CBRA to allow the TSOs to perform their duties without unnecessary fatigue and eye strain. Luminance shall be measured at the surface of the BIS and found to be in the range of 500 to 750 lux. In other areas of the CBRA, the luminance shall not fall below 300 lux.

These values are easily realized with the proper placement of light sources. Color rendition by the TSO is important. Color corrected and full spectrum lighting lamps shall be used and fluorescent lights are preferred.

9.7.5 Heating, Ventilation, and Air Conditioning

The CBRA shall be a climate-controlled space. Temperature and humidity control shall be supplied commensurate with the locale. A separate temperature control thermostat shall be provided for the CBRA.

If forced-air ventilation is provided, fresh outside air shall be delivered to the CBRA at rates specified by the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE) Standard 62.1-2016 *Ventilation for Acceptable Indoor Air Quality*. The CBRA shall be under positive pressure relative to ambient BHS areas to minimize the migration of contaminants (e.g., products of combustion from tugs and vehicles, as well as outside dirt, dust, and debris) from entering into the CBRA.

9.7.6 Power and Communications

Power shall be provided to the CBRA to support TSA- and airport operator-provided equipment. The Project Sponsor shall coordinate the final requirements based on the actual equipment list and layout, but as a minimum:

- Two quad receptacles (120V/20A) shall be provided for each BIS to support screening operations and ancillary equipment.
- One duplex outlet shall be provided on the side of the back wall between the two BISs for access by cleaning personnel.
- Convenience outlets shall be provided on the perimeter walls as required by local codes.

The CBRA requires both voice and data communication provisions. The ILDT will determine the requirements based on the actual equipment selected for the CBRA, but at a minimum:

- A wall-mounted telephone shall be provided for use by TSOs, with access to the airport communication network, and for placing outside calls.
- The network cabling shall be provided to support the BHS, EDS, and TSA workstations.
- All cabling and associated outlets shall be installed in a location where they cannot to be damaged by BISs or cause a safety hazard.

9.7.7 Connectivity to TSA Network

The connection of the CBRA ETD equipment to the TSA Network (TSANet) shall be provided via a “Dual Drop” consisting of 2 RJ45 Cat5e/Cat6 connections terminated at a wall or floor box.

This connectivity allows TSA to collect valuable information on the screening performance of the equipment in place within each CBIS. Please also refer to the STIP Data Requirements listed in Section 7.2.12.

In addition, the following requirements shall be met:

- All core drilling shall support a minimum of 4 "Dual Drops"
- All new fiber installations shall be single in conflict with 7.2.13.3-mode, 6-strand bundles enclosed in innerduct
- All cabinet installations require 2 110v 20A service
- All cabinet installations shall meet the local seismic rating requirements and can be floor/bracket mounted

9.7.8 Noise Abatement

The CBRA shall have adequate acoustical insulation so that the background noise levels do not exceed 70dBA as measured at the natural TSO standing points at each screening station using a time-weighted average over an 8-hour shift.

9.7.9 Conveyor Shaft End Caps

End caps shall be installed on conveyor shaft bearing assemblies within TSO-occupied spaces to avoid operational hazards. End caps shall be attached to conveyor shaft bearing assemblies via mounting hardware. Press fit end caps or caps retained by tabs shall not be used.

9.7.10 Conveyor System Crossovers and Catwalks

CBRA conveyor system crossovers shall consist of up and down treaded stairs, a full railing system, and a toe-boarded catwalk. Crossover configurations can be straight, L-shaped, U-shaped, or Z-shaped to conform to existing immovable structures within the CBRA footprint.

9.7.11 Conveyor Belt End Points on Alarm Line

End points of in-bound conveyor belts shall have a photo eye installed across the conveyor belt to stop baggage from falling off the end. Termination photo eyes shall be located sufficiently upstream to prevent baggage straps from becoming entangled in the conveyor belt at the end point.

9.7.12 Design for Safety

The AL conveyor belt surfaces shall be smooth or semi-smooth to facilitate easier baggage retrieval. Such surfaces minimize the amount of exertion required by TSOs to remove bags from in-bound belts.

All motor drives and associated tracking devices shall not be intrusive to the screening workspace. The design shall use motor drives mounted on the opposite side of the inbound and outbound lines from screening personnel or, if this is not feasible, the designers shall ensure that all hazardous moving parts (e.g., drive shafts, roller spindles, etc.) are guarded to prevent accidental contact.

Any moving part located in any area of the CBRA where TSOs are required to perform their duties shall be shielded to avoid injury.

All bearings and components exposed in the screening work area shall be shrouded with covers that have no sharp or pointed edges.

All aspects of the CBRA layout shall take into account the requirements for maintenance and custodial services access as stated in Mil Standard 1472G Section 5.9.

9.7.13 CBRA Space Requirements

The only equipment installed in the CBRA shall be directly required for the operations in that space, e.g., SVSs, BISs, and BSDs. No other equipment such as motor control panels, UPSs for EDS equipment, IT racks or any other equipment not directly related to CBRA operations shall be installed in the CBRA.

CHAPTER 10:

ON-SCREEN RESOLUTION AREA PLANNING STANDARDS

REQUIREMENTS TABLE

Section	Requirement
10.1 Background	National Fire Protection Association (NFPA) 70, National Electrical Code and NFPA 101, Life Safety Code or similar standards adopted by the authority having jurisdiction, shall be used, as appropriate, in the design of OSRAs.
10.3.2 Entrances/Exits	Door widths and access to space shall comply with applicable building codes and the American with Disabilities Act (ADA).
10.3.6.1 Multi-level floors	Wheelchair access shall be provided by ramps, which require additional floor space or wheelchair lifts.
10.3.6.1 Multi-level floors	Where changes of floor level are introduced in conjunction with entrances or exits, proper physical "aids" shall be provided (such as guardrails, handrails, anti-slip surfaces, and appropriate signage, when indicated) to minimize potential workplace hazards.
10.3.7 Windows	The ratio of luminances for task areas that are frequently viewed in sequence (for example, screen, document and windows) shall be lower than 10:1 as referenced in Mil-STD-1472G 5.2.1.3.8.
10.3.7 Windows	Displays shall be free from glare.
10.3.7 Windows	When windows are included in OSRAs, the following shall be taken into account: • Workstations shall not be facing windows. • Windows shall not be located behind the OSR monitors. • Windows located on the left and/or right side of a workstation shall have a minimum distance of 9 feet to that workstation. • Windows shall be included in meeting and relaxation areas and offer an alternative visual environment to that of the OSRA.
10.3.8 Noise Abatement	The OSR Area shall be provided in an environment that minimizes noise as much as possible. Because of the likely proximity to the BHS bag room, the walls and ceiling of the CBRA require adequate acoustical insulation so that the background noise levels shall not exceed 65 dBA as measured at the natural TSO sitting points at each screening station using a time-weighted average over an 8-hour shift.
10.4.3 OSR Room Layout	OSR layouts shall include: • Workstations. • Supervisor/CI workstations. • Separation between the OSR room and the BHS control room; the two cannot be one in the same. • A BHS monitor screen in the OSR room. This screen shall only show the CBIS area as related to TSA operations. • A centralized location for remote stop/start devices in order to minimize delays in re-setting EDS in faulted conditions. • CCTV displays of EDS entrances and exits in order to enhance situational awareness and expedite responses to bag jams or EDS unit fault events. • A direct line of communication from the airport operator to the OSR room and to the CBRA as well as a direct line of communication between the OSRA and CBRA with a visual indicator in addition to an audio indicator. • The lighting in the area shall include dimmers to allow for better screen viewing. • Equipment racks. • Storage both on and off the workstation.

Section	Requirement
	• Notice board. • Where counters are used for the receipt or collection of documents, these often need to be near entrances or easily accessible from certain operating positions and should accommodate organizational bins and file cabinets. • Clear Line of sight to enable supervision of the entrances/exit points • Access to electrical panel boxes (including disconnecting means) • Access to first aid equipment, emergency equipment and emergency exits • Primary workstations shall be shielded from windows present in non-operational areas of the OSR room. • Shared off-workstation displays. • Desks • Printer stands, photocopying machines and other office equipment, as necessary.
10.4.3 OSR Room Layout	A secondary passive CBIS display shall be added to provide real-time performance metrics identical to that required in Section 9.3.3. The display shall be installed on the supervisor's desk. The exact location shall be coordinated between TSA and the ILDT during the project submittal phase.
10.4.4 Workstation Arrangements and Ergonomic Considerations	Where confidential information is presented on display monitors and/or situated on desktops, it shall not be possible to see this information from the public viewing areas.
10.4.4.1 Plan Arrangements	Workstation arrangements shall take into account operations under normal and abnormal modes of system operation.
10.4.4.1 Plan Arrangements	Luminance shall be measured at the center of the monitor, and found to be in the range of 300 to 500 lux.
10.4.4.2 Control Workstations	A Supervisor/CI workstation shall include communications infrastructure for telephone and TSA network access.
10.4.4.4 Table 10- Monitor/Desk/Task Chair Ergonomic Design Reference–Monitors	• Height: top of monitor shall be at or slightly below eye level • Size: 20-23-in. monitor shall be sufficient • Distance: shall be 20-40-in. from the eye to the front surface of the monitor • Position: shall be directly in front of you, so your head, neck and torso face forward when viewing the screen. Monitors should not be farther than 35 degrees to the left or right • Glare: shall be positioned away from windows
10.4.4.4 Table 10- Monitor/Desk/Task Chair Ergonomic Design Reference–Monitors	• Height: shall be adjustable between 20 in. and 28-in. • Clearance: shall be 15 in. for knees and 24 in. for feet, width at least 20 in. • Glare: desktops shall have a matte finish, avoid glass tops

Section	Requirement
10.4.4.4 Table 10- Monitor/Desk/Task Chair Ergonomic Design Reference–Monitors	• Height: shall be fully adjustable with a minimum range of 16-in. • Backrest: at least 15-in. high and 12-in. wide, and should recline 15 degrees from vertical • Seat Size: seat pan length shall be 15-in. to 17-in. and depth-adjustable • Chair Base and Rotation: 5-legged base; 360 degrees unrestricted rotation • Armrests: shall be removable, distance between them shall be at least 16-in. and adjustable
10.4.5 Off-workstation Shared Visual Displays	The layout of the OSRA shall ensure that all off-workstation shared visual displays necessary for the TSO operator task are visible from all relevant workstations (see Section 10.4.3).
10.4.5.1 Horizontal and Vertical Viewing Distances	Necessary information presented on shared overview visual displays shall be visible by personnel with applicable 5th to 95th percentile body dimensions of the TSO operator population from their normal working positions.
10.4.5.1 Horizontal and Vertical Viewing Distances	Operational information presented on the lowest part of an off-workstation shared visual display shall be visible to a 5th percentile seated non-upright TSO operator.
10.4.5.1 Horizontal and Vertical Viewing Distances	He is the design-eye-position, measured from the floor to the outer corner of the eye; 5th percentile shall be applied
10.4.6 Personnel Circulation and Custodial Services Access	All aspects of OSRA layout shall take into account the requirements for maintenance and custodial services access as stated in Mil Standard 1472G Section 5.9.
10.4.6.1 Personnel Circulation	Planning for the circulation of personnel throughout the OSRA shall include the following: • Adequate general circulation, such that OSRA operations are not interrupted by either visual or auditory distraction. • Adequate circulation areas where shift changeover is protracted and 2 shifts are present in the OSRA at the same time. • Orderly evacuation of the area via easily identifiable routes of egress in the event of an emergency, such as a fire alarm. • OSRA circulation routes arranged to avoid cross-circulation. • Restricted ceiling heights, where present, be indicated using ceiling-mounted warning.
10.4.6.2 Custodial Services Access	Inadvertent activation of any safety-critical controls shall not be possible during cleaning tasks.
10.5 Verification and Validation of OSRA Layout	In all cases, local, state, and Federal regulations regarding design and construction shall supersede the recommendations included in this chapter.

10.1 Background

This chapter provides ergonomic requirements and recommendations for the layout of OSRAs, including workstation arrangements, the use of off-workstation visual displays, and OSRA maintenance. This chapter draws on provisions and other information provided in ISO 11064-1, ISO 11064-2, ISO 11064-3, Mil-STD-1472G, as well as the Occupational Safety and Health Administration (OSHA) website (www.osha.gov) on computer workstations.

Additionally, National Fire Protection Association (NFPA) 70, National Electrical Code and NFPA 101, Life Safety Code or similar standards adopted by the authority having jurisdiction, shall be used, as appropriate, in the design of OSRAs.

OSRAs are devoted to Level 2 of the CBIS screening process. During Level 2 screening, TSA personnel view alarm bag images captured during the Level 1 EDS scan, and clear any bags whose status can be resolved visually. This allows the continuous flow of bags through the BHS system as bag decision status determinations are made. Any bags that cannot be resolved at Level 2, and all bags that cannot be directed to Level 1 because of size restrictions, are sent to Level 3.

The following is a list of key OSRA equipment and components:

- Control/supervisor workstation with a control interface (CI), closed circuit television (CCTV) interface, and communications
- Individual workstations with PVS
- Administrative area that includes a printer
- Wall-mounted BHS display
- CCTV display of the CBRA

10.2 General Ergonomic Recommendations

Several high-level ergonomic considerations are listed below which should be used to guide the OSRA design process:

- TSO population
- TSO attributes
- Work organization and process flow
- Job aids and work practices
- Shift rotation system

- Personnel qualification
- Training program
- Technology transfer
- Cross-cultural aspects

10.3 Architectural Considerations

10.3.1 Traffic and Routing

When designing OSRAs it is important to take into account the flow of both people and equipment:

- Distances should be minimized while taking travel and communication needs into account.
- Any restrictions placed on access for unauthorized personnel should not impede access for authorized personnel.
- Special consideration should be given to undesirable walking routes, such as short cuts using emergency exits. The layout of the site should be such as to permit easy access to all areas that might legitimately need to be visited.
- TSOs may feel uncomfortable sitting with their backs to an entrance or frequently used walkways.

10.3.2 Entrances and Exits

Main entrances and exits should not form part of the working visual fields of the TSOs.

Entrances and exits should not be positioned behind TSOs.

NFPA 101, Life Safety Code or similar standards adopted by the authority having jurisdiction must be considered when locating entrances/exits in light of mean of egress from OSRAs.

Door widths and access to space shall comply with applicable building codes and the American with Disabilities Act (ADA). Access is required for typical office furniture and computer equipment.

Due to the specific requirements of OSRAs, the design of exits, entrances, and walkways should take into account the following considerations:

- The location and number of the exits and entrances should take account of the number of TSO operators and the functional links to areas outside the OSRA, including routes of egress from the OSRA.

- A single main entrance and exit offers the best solution for security and staff control. However, other emergency exits may need to be provided.
- Entrance location should be considered in relation to supporting functions situated around the OSRA, such as restrooms, relaxation areas, supervisors, and offices.
- The sizes of entrances/exits should allow for the movement of equipment and the introduction of any other maintenance equipment which can sometimes be required to be used in the OSRA. Entrances that are sized for equipment passage are usually adequate for persons needing wheelchair access.
- The ceiling height as an exit should be at least 7 feet 6 inches tall.

Emergency egress paths should be considered when positioning entrances and exits.

10.3.3 Equipment Requirements for Design Year

OSRA layouts should allow for expansion. As referenced in Section 5.3.1, the design year for equipment requirements is assumed to be 5 years after the initial operation startup for a given baggage screening system (i.e., DBU+5 years). This is the time horizon which should be used when designing OSRAs.

10.3.4 Equipment Requirements for Future Growth

To plan for future baggage growth, the OSR Station equipment requirements for 10 additional years past DBU+5 years are to be listed in 1-year increments in a separate chart in the Basis of Design Report, from DBU+6 through DBU+15 years (including EDS units, PVS, and SVS workstations) as stated in the requirement in Section 5.3.2.

10.3.5 Plan Space Provision

The selection of space for an OSRA should be consistent with the following guidelines:

- The selection of a space for an OSRA should be based on the usable area, not the gross area.
- Obstructions and structural features, such as pillars and awkward corners, and overhead obstacles (for example, structural and HVAC components) within a proposed/planned OSRA, will severely reduce the available space and could result in sub-optimal work layouts.
- Provisions should be made to allow TSOs to cover several monitors at once from a singular position during non-peak hours in order to account for periods of lighter staffing.
- A typical heuristic value for planning floor-space allocation is to allow for 29 f^{t2} to 49 ft^2 per working position with a minimum of not less than 29 ft^2. This has been found to be satisfactory for rooms with more than one TSO workstation which are permanently staffed. It takes

account of typical equipment volumes, seating space and maintenance access and no large, off-workstation shared visual displays. Precise requirements should be based on a task analysis. This space provision is based on "usable" area. In some OSRAs, where large, shared overview displays are a dominant operational feature, space allocations of up to 164 ft^2 have been measured. These displays may include control interfaces and split displays showing various CCTV images from BHS and CBRAs.

- If additional staff, for example trainees, needs to be accommodated during off-normal operations, within the OSRA, sufficient space should be allowed for these additional staff to be housed.
- Temporary positions should be provided alongside permanent TSO operator positions, where this additional staff is expected to be present during shift changes.
- Square, circular, and hexagonal spaces are preferred for the arrangement of functional groups, because they offer the potential of maximizing the number of links; long narrow spaces should be avoided since they can unduly reduce options.
- The information presented in Section 10.4.4 illustrates different ways in which workstations can be arranged. Some of the factors considered include views to shared off-workstation visual displays, operational links between TSO operators and contact between supervisors and operators. The diagrams are intended to highlight some of the advantages and disadvantages of alternative groupings of workstations. They are not intended to be exhaustive or prescriptive.

10.3.6 Vertical Space Provision

When designing the vertical space of an OSRA the following should be taken into account:

- OSRAs with a single finished floor height offer greater flexibility for future change and for the movement of equipment and personnel, especially those with disabilities.
- For a given OSRA, single height ceilings are preferred.
- As a "rule of thumb," slab-to-slab heights should preferably be a minimum of 13 feet, to include false floors, false ceilings, indirect lighting systems and the accommodation of shared off-workstation visual displays. In practice, such a design would result in finished floor to finished ceiling heights of no less than 9 feet. This would accommodate the 99 percentile of the male population. NOTE: The appropriate user population data should be used.
- Uncluttered ceilings are preferred to avoid any distractions or stray reflections from luminaries; such as plain finishes, which are also recommended for walls and structural elements.
- Differing finished floor heights can sometimes offer advantages for viewing areas, supervisory overviews and a means of keeping a "public area" segregated. To avoid potential safety hazards, including trip hazards, ramps should be considered for movement of equipment and personnel between floor heights.

NOTE: The viewing of shared off-workstation visual displays by groups of TSO operators can sometimes be improved through the introduction of multi-level floor heights.

10.3.6.1 Multi-level Floors

The use of varying floor levels in an OSRA can offer some advantages in viewing shared overview visual displays and improving sightlines between TSO operators. These benefits can also be achieved by other means, such as the careful layout of the OSRA or the duplication of overview equipment. When considering the adoption of a solution based on varying floor levels in an OSRA, the following drawbacks should be taken into account:

- Can restrict direct visual and verbal links.
- Can create obstacles to the movement of people.
- Movement of larger items of equipment can be encumbered or restricted.
- Future changes in room layout can be more difficult and flexibility can be limited.
- Variation in workstation heights and locations of TSO operators can require additional measures to ensure proper lighting and HVAC control.
- Wheelchair access shall be provided by ramps, which require additional floor space or wheelchair lifts.

Where changes of floor level are introduced in conjunction with entrances or exits, proper physical "aids" shall be provided (such as guardrails, handrails, anti-slip surfaces, and appropriate signage, when indicated) to minimize potential workplace hazards.

10.3.7 Windows

Windows, if provided, require solar glare control and adjustable block-out treatments. Windows should be provided in OSRAs whenever possible for operational, psychological, and physiological reasons, not necessarily for illumination. Large luminance differences between the visual displays, used at a workstation, and areas around them, need to be avoided. The ratio of luminances for task areas that are frequently viewed in sequence (for example, screen, document and windows) shall be lower than 10:1 as referenced in Mil-STD-1472G 5.2.1.3.8. Within a static visual field, a significantly higher ratio of luminance's can be tolerated between the task area and its surrounds (for example., display housing and walls) and should not have any adverse effect. Displays shall be free from glare.

The provision of windows often gives rise to conflicting demands sometimes leading to the exclusion of windows from the OSRA (i.e., for security or safety reasons). When windows are included in OSRAs, the following shall be taken into account:

- Workstations shall not be facing windows.
- Windows shall not be located behind the OSR monitors.
- Windows located on the left and/or right side of a workstation shall have a minimum distance of 9 feet to that workstation.
- Windows shall be included in meeting and relaxation areas and offer an alternative visual environment to that of the OSRA.

10.3.8 Noise Abatement

The OSR Area shall be provided in an environment that minimizes noise as much as possible. Because of the likely proximity to the BHS bag room, the walls and ceiling of the CBRA require adequate acoustical insulation so that the background noise levels shall not exceed 65 dBA as measured at the natural TSO sitting points at each screening station using a time-weighted average over an 8-hour shift.

10.4 Operational Considerations

10.4.1 General Recommendations

OSRA layouts should be based on an agreed set of principles derived from operational feedback (if available), task analysis and an understanding of the TSO population, including employees with disabilities. These underlying principles should be fully documented (see Section 10.5). The layout of OSRAs should:

- Facilitate team working opportunities for TSOs.
- Reflect the allocation of responsibilities and the requirements for supervision.
- Optimize key operational links, including sightlines between OSRA staff, or direct speech communication between OSRA as well as between OSRA and CBRA staff (see Section 10.4.3).

10.4.2 OSRA Layout

In order to develop design specifications for an OSRA arrangement, the following activities should be performed:

- Confirm the functional areas making up the OSRA and what may already exist in other TSA support areas.
- Estimate the space requirements for each functional area, e.g., administration areas, rest areas and provision for visitors.
- Confirm suitability of the planned location within the terminal, for example space restrictions, local hazards, and environmental impacts.

- Acquire current copies of all pertinent standard building codes, user building policies, and the like.
- Verify the availability of necessary utilities and associated services and determine if their current capacity will meet projected requirements, as well as the future needs of the OSRA.

Determination of the operational links between the functional areas and the development of a preliminary OSRA layout should have been performed during the Schematic Design Phase.

Functional entities to be included are:

- OSR room
- Meeting room
- Training facilities
- Office
- Break room with a potable water source
- Locker rooms and toilets

NOTE: The proposed design specifications should facilitate the smooth transition between all the activities in the OSRA.

10.4.3 OSR Room Layout

The following tasks have to be undertaken in order to properly design an OSR room layout:

- Determine the usable space
- Identify the furniture, equipment, and workstation components to be accommodated within the OSR room
- Determine operational links which need to be provided between items to be housed within the OSR room, including personnel
- Specify circulation requirements for staff and visitors
- Specify maintenance access and custodial services requirements

OSR Rooms shall include:

- Workstations
- Supervisor/CI workstations
- Separation between the OSR room and the BHS control room; the two cannot be one in the same
- A BHS monitor screen in the OSR room that only shows the CBIS area as related to TSA operations
- A centralized location for remote stop/start devices in order to minimize delays in re-setting EDS in faulted conditions (NOTE: Not available with L-3 equipment)
- A direct line of communication from the airport operator to the OSR room and to the CBRA as well as a direct line of communication between the OSRA and CBRA with a visual indicator in addition to an audio indicator
- The lighting in the area shall include dimmers to allow for better screen viewing
- Equipment racks
- Storage both on and off the workstation
- Notice board
- Where counters are used for the receipt or collection of documents, these often need to be near entrances or easily accessible from certain operating positions and should accommodate organizational bins and file cabinets
- Clear Line of sight to enable supervision of the entrances/exit points
- Access to electrical panel boxes (including disconnecting means)
- Access to first aid equipment, emergency equipment and emergency exits
- Primary workstations shall be shielded from windows present in non-operational areas of the OSR room
- Shared off-workstation displays
- Desks
- Printer stands, photocopying machines and other office equipment, as necessary. NOTE: Isolation cabinets and/or rooms may be necessary for devices that exceed 65 dBA at each workstation.

OSR Room personnel circulation is addressed in Section 10.4.6.

A secondary passive CBIS display shall be added to provide real-time performance metrics identical to that required in Section 9.3.3. The display shall be installed on the supervisor's desk. The exact location shall be coordinated between TSA and the ILDT during the project submittal phase.

10.4.4 Workstation Arrangements and Ergonomic Considerations

The arrangement of workstations is closely linked to the ergonomic considerations of individual workstations, the positioning of supervisory workstations, vertical space usage and secondary workstations as all affect space and movement within the OSR room. Before going into details of each specific consideration there are a number of general aspects that deserve attention:

- OSR rooms that exhibit either overcrowding of work positions or widely dispersed work positions are not recommended. Layouts should allow, wherever practical, direct verbal communication between TSOs and avoid excessively short separations between adjacent TSOs (see Section 10.4.3).
- OSR rooms in the same terminal facility should adopt the same ergonomic principles of room layout to facilitate decision-making and teamwork.
- There are ergonomic benefits in varying postures during periods of work. Wherever practicable, it is recommended that TSO operator workstation layouts and work regimes allow TSOs to change their posture at the workstation and to move from their workstations from time to time (see ISO 9241-5:1998).
- Where confidential information is presented on display monitors and/or situated on desktops, it shall not be possible to see this information from the public viewing areas.

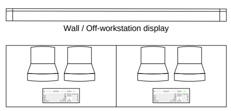
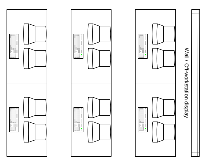
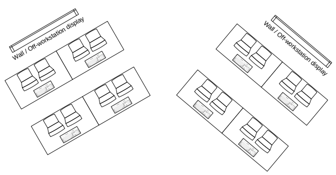
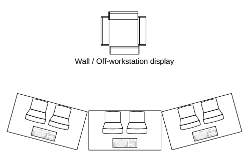
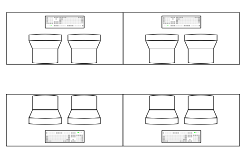
10.4.4.1 Plan Arrangements

Table 10-1 illustrates the wide range of alternative workstation arrangements that can possibly be configured in the OSRA space. The most suitable layout should be determined through the conduct of a task analysis. Where clusters of workstations are grouped together to form a single unit, the way in which TSO operators are arranged around the workstation can offer different advantages. When designing an arrangement plan the following elements should be considered:

- Operational links between TSOs, such as speech, sightlines or direct voice communication, should be documented using link association tables prior to developing workstation layouts. These should provide a benchmark against which alternative layouts can be assessed and detail primary and secondary operational means, including direct visual, message passing, or equipment sharing requirements.
- When considering alternative ways of laying out a number of workstations, the following factors should be considered:
  - Dedicated or shared workstations between TSOs.

- Whether each workstation is identical.
- Whether control operations and OSARP can be done from a single dual-use workstation or tasks are spread amongst a number of dedicated workstations.

Table 10-1: Workstation Layouts

Spatial layout	Layout description	Layout advantages/disadvantages
	**Single one-sided linear:** TSO and supervisor workstations are placed linearly facing the same direction.	Off-workstation displays can be shared Easier access for walkways, emergency egress and maintenance Easier to place windows Does not foster team communication
	**One-sided multiple banks:** Variants include positioning of the supervisor position and staggering the banks.	Large off-workstation displays may be shared Easier access Allows for separation of groups Does not foster team communication
	**Angled banks:** Workstations are split evenly into banks. These banks are placed angularly (either at obtuse or acute angels). The supervisor workstation may be placed behind the TSO workstations.	Off-workstation displays can be shared Can foster verbal communication without interrupting other teams Easier access for walkways and maintenance
	**Circular:** Workstations are placed along the circumference with the off-workstation display at the center.	Equipment can be shared Difficult for team communication Difficult from an external lighting perspective Inefficient access for maintenance
	**Opposite facing linear rows:** TSOs can be placed either inside or outside of the arrangement.	Group separation possible Verbal communication encouraged Efficient access for emergency egress and maintenance Equipment cannot be shared

Source: ISO 11064-3: 1999, Design of Control Centers. Part 3: Control room layout.

- Where a number of OSRAs operating on the same CBIS are needed, but located at various sites throughout the airport, each OSRA should have a similar layout. Adopting this approach facilitates the transfer of personnel from one site to another and can reduce training time and errors.
- Workstation arrangements shall take into account operations under normal and abnormal modes of system operation. For example, fallback arrangements for information transmission by paper or other non-electronic means.
- Where ventilation systems, light fixtures, and windows have already been installed, positioning of workstations should take into account these existing conditions to avoid draughts, and glare and reflections on visual display screens.
- Luminance shall be measured at the center of the monitor, and found to be in the range of 300 to 500 lux.
- Light sources should not be placed directly behind workstations, rather lighting should be diffuse throughout the OSRA so as to limit glare.
- Workstation layouts should provide an operationally satisfactory working environment under both maximum and minimum staffing levels.
- Workstation layouts should provide for the convenient storage and display of all necessary reference documentation which TSO operators require to access as part of their duties, as well as items which can be required in operational emergencies.
- Where workstations are grouped together, the minimum distances between adjacent positions should not result in individuals sitting within each other's personal space. While occasional close working relationships may be necessary and acceptable, working positions adopted for extended periods should avoid TSO operators having to intrude within each other's personal space.
- Spacing between TSO operators should take account of shared equipment, where consideration of common reach zones or potential problems of interference due to noise need to be applied.
- Approximate workstation sizing for initial room layout purposes should take into account such factors as equipment size, flat worktop provision, and the requirements for on-workstation storage and accommodation of employees with disabilities. Any such layouts should be fully checked through workstation and room trials prior to being finalized.
- When selecting room layouts, attention should be paid to training requirements for TSO operators, for example, additional space for equipment adjacent to a normal operator's position or a separate, discrete training workstation.
- Layouts should take into account maintenance requirements and access space for technicians and equipment removal, particularly where this involves bulky components.
- The general arrangement of workstations should be such that flow from general circulation areas is inhibited. However, the use of actual physical barriers to do this is not advocated.
- Layouts should optimize key operational links, such as sight lines to BHS, displays, CCTV displays, and communication links between OSR and the CBRA staff

10.4.4.2 Control Workstations

OSRAs will have an area designated as the Supervisory/CI workstation and additional requirements can be associated with their location in the OSRA:

- The Supervisory/CI workstation should take full account of the additional reference material which is sometimes required to be stored, displayed, and used at these workstations.
- In arranging Supervisory/CI layouts, it should be considered that the person at this workstation will be monitoring the EDS and CBRA processes, as well as providing supervisory support to the OSR operation. Layouts should place a high priority on equipment positioning (CI, CCTV, BHS monitors), while allowing for direct verbal communication with those positioned at the OSR workstations.
- A Supervisor/CI workstation shall include communications infrastructure for telephone and TSA network access.
- Layouts should allow for additional circulation around Supervisory/CI area and for the temporary accommodation of visitors.
- Where major screening incidents are handled from the Supervisory/CI area, the provision of extra vertical display surfaces needs to be considered for the presentation of additional images and/or procedures. Additional space may be required for extra staff who may also need to be accommodated in this area.

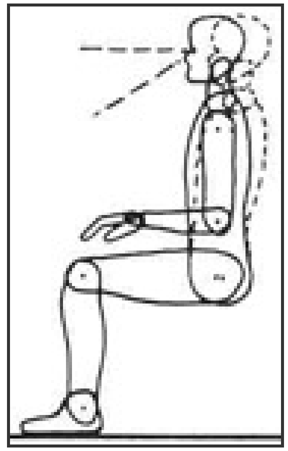
10.4.4.3 Secondary Workstations

Where it is impractical to store all equipment or reference material at the workstation (or at another workstation that can deal with an overflow of tasks during peak workloads), the provision of a secondary workstation should be considered. The layout and design of any such workstations should adhere to the same ergonomic principles as presented for primary positions and their layout based on a task analysis.

10.4.4.4 Specific Ergonomic Considerations

When designing workstations, the following specific ergonomic considerations should be taken into account in order to achieve a neutral body position that reduces strain on muscles, tendons, and the skeletal systems and allows TSO operators to vary their postures throughout the day. Figure 10-1 provides a visual reference, while Table 10-2 summarizes many of these points.

Figure 10-1: Neutral Body Position



Source: United States Department of Labor, Occupational Safety & Health Administration available at www.osha.gov/SLTC/etools/computerworkstations/index.html

Table 10-2: Monitor/Desk/Task Chair Ergonomic Design Reference

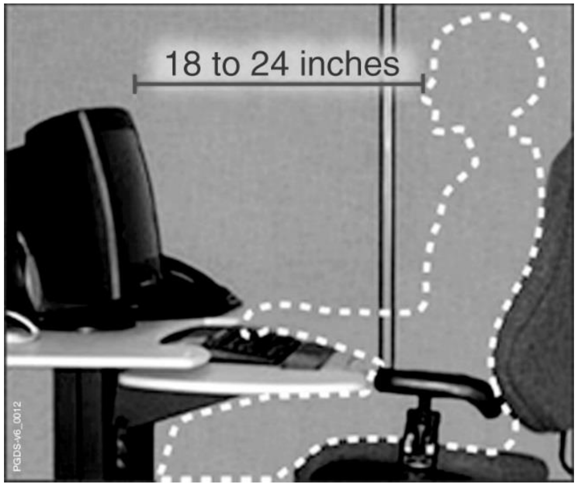
Monitors	Desks	Chairs
• Height: top of monitor shall be at or slightly below eye level • Size: 20-23-in. monitor shall be sufficient • Distance: shall be 20-40-in. from the eye to the front surface of the monitor • Position: shall be directly in front of you, so your head, neck and torso face forward when viewing the screen. Monitors should not be farther than 35 degrees to the left or right • Glare: shall be positioned away from windows	• Height: shall be adjustable between 20-in. and 28-in. • Clearance: shall be 15-in. for knees and 24-in. for feet, width at least 20-in. • Glare: desktops shall have a matte finish, avoid glass tops	• Height: shall be fully adjustable with a minimum range of 16-in. • Backrest: shall be at least 15-in. high and 12-in. wide, and should recline 15 degrees from vertical • Seat Size: seat pan length shall be 15-in. to 17-in. and depth adjustable • Chair Base and Rotation: shall be 5-legged base; 360 degrees unrestricted rotation • Armrests: shall be removable, distance between them shall be at least 16-in. and adjustable

Source: United States Department of Labor, Occupational Safety and Health Administration available at www.osha.gov/SLTC/etools/computerworkstations/index.html

NOTE: Where physically disadvantaged TSO operators or visitors (those exhibiting a physical disability) are expected to use the OSRA, these measurements will differ. Please refer to any local or national regulations that would be applicable in these circumstances.

- Workstations should be designed to allow the hands, wrists, and forearms to be in-line and parallel to the floor.
- Workstations should be designed to allow the TSO's head to be level and in-line with the torso.
- While seated, the design of the workstations should allow the TSO's elbows to stay in close to the body and be bent between 90 and 110 degrees.
- Accommodations should be made so that while TSOs are seated at their workstations in an ergonomic task chair their backs are fully supported vertically or leaning back slightly.
- When seated, the design of the workstation should allow for the TSO's knees to be at the same height as the hips with the feet slightly forward.
- The preferred viewing distance from TSOs to their monitors should be between 18 and 24 inches and the center of the monitor screen(s) should be located 15 to 20 degrees below the horizontal eye level of the TSO operators (see Figure 10-2).

Figure 10-2: Viewing Distance



Source: United States Department of Labor, Occupational Safety & Health Administration available at www.osha.gov/SLTC/etools/computerworkstations/index.html

- Adequate desk space should be provided to allow the placement of monitors within the viewing range of 18 to 24 inches to TSO operators, as well as to provide adequate room for the placement of any reference materials/other equipment which may be needed.
- Desks should have a leg clearance of between 20 and 28 inches. Ideally, height-adjustable desktops should be provided to afford maximum flexibility within the TSO population.
- Task chairs should have proper lumbar support that allow the TSO operators to recline up to 15 degrees from vertical, and which are height-adjustable.
- OSR room dimensions and workstation layout dimensions and features for which end-user sizes are relevant, for example, seated view over workstations, should take into account the range of TSO operators for which these items are being provided.

10.4.4.5 Additional Considerations

In particular, the following must be considered:

- The OSRA workstation layout should take into account the requirements that are likely to be in place at the end of the planned life span of the OSRA (refer to Section 5.3.1).
- The needs of persons with disabilities should be considered during the layout of the OSRA, for example, by allowing additional circulation spaces and introducing ramps for wheelchair access.
- Hard-copy information storage should be classified such that the most appropriate provisions can be made within the OSRA such as storage in a lockable drawer. An appropriate classification is suggested in Table 10-3.
- Adequate provisions should be made for the storage of personal items at workstations (briefcases and purses) or outside the OSRA in adjacent locker rooms (for clothing and other personal effects).

Table 10-3: Control Room Storage – Classification of Types

Storage requirement	Typical location	Example
Immediate access	Primary workstation	• Operational procedures • High-priority telephone numbers • Emergency procedures • Diagnostics
Secondary access	Secondary workstation	• Internal telephone directory • Secondary operating procedures
Secondary access	Adjacent workstation	• Architectural/engineering drawings
Occasional access	Library	• Non-critical screening equipment failure procedures

Source: ISO 11064-3: 1999, Design of Control Centers. Part 3: Control room layout.

10.4.5 Off-workstation Shared Visual Displays

The layout of the OSRA shall ensure that all off-workstation shared visual displays necessary for the TSO operator task are visible from all relevant workstations (see Section 10.4.3).

The requirements presented in this section concern the location of shared visual displays within the OSRA. Many differing technologies can be used for overview visual displays, including banks of CCTV monitors, projected displays, hard-wired mimics and static maps/diagrams. When designing OSRA layouts for these differing solutions, the constraints imposed by the various solutions should be considered. Such constraints include limitations on viewing angle, contrast ratios, and image construction.

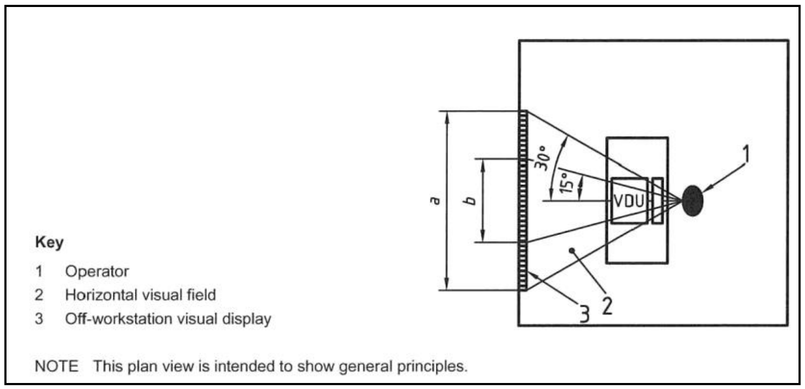
As an alternative to large shared displays, the option of presenting this information on the workstation, with smaller schematics, should be considered.

10.4.5.1 Horizontal and Vertical Viewing Distances

In particular, the following has to be taken into account:

- Where off-workstation shared visual displays need to be used on a regular or continuous basis, the preferred position is directly in front of the TSO operator where they can easily be seen when looking over the workstation or can be scanned by eye-movement alone (see Figure 10-3).

Figure 10-3: Preferred Location of Off-Workstation Shared Visual Displays



Source: ISO 11064-3: 1999, Design of Control Centers. Part 3: Control room layout.

- Where the information presented on an off-workstation shared visual display does not have to be read while operating the console or provides secondary information, the displays can sometimes be mounted to one side of the workstation. Such displays should be positioned so that all information required can be reliably read from the TSO operator's normal position, by a simple rotation of their task chair.
- For very large off-workstation shared visual displays which need to be monitored on a continual or regular basis, it is recommended that TSO operators be allocated sections of the common display which they can effectively and conveniently monitor.
- Where the information on an off-workstation overview visual display needs to be regularly used by TSO operators, the design of the visual display and the layout of the OSRA should ensure that all of the information that needs to be used by a TSO operator can be seen from the normal working position for both the vertical and horizontal planes.
- Necessary information presented on shared overview visual displays shall be visible by personnel, with applicable 5th to 95th percentile body dimensions of the TSO operator population, from their normal working positions. There can be a requirement for safety critical information to be seen. Under these circumstances, the user percentile range to be accommodated may need to be greater.
- Operational information presented on the lowest part of an off-workstation shared visual display shall be visible to a 5th percentile, seated, non-upright TSO operator. The following formula may be used to determine this measurement:

$$H1 = Hc - (D + d)\frac{He - Hc}{Dc + d}$$

Where

H1 is the lowest height at which the visual display can be seen;

He is the design-eye-position, measured from the floor to the outer corner of the eye; 5th percentile shall be applied;

NOTE: He is a combination of the adjusted seat height and the anthropometric data of "eye height, sitting."

HC is the height of the console;

D is the horizontal distance between the front edge of the console and the surface of the wall panel;

Dc is the depth of the console;

d horizontal distance between the design-eye-position and the front edge of the console.

10.4.5.2 Relationship of Shared Visual Displays to Other Features

In particular, the following should be taken into account:

- Windows should not be located adjacent to off-workstation shared visual displays or within the same field of view.
- Artificial room lighting should not interfere with the visibility of any sections of the off-workstation, shared visual displays.

- Finishes around off-workstation, shared visual displays should be carefully controlled so as not to interfere with the visibility of parts of the shared visual display.
- Entrances and exits should not be located within the same field of view as major off-workstation shared visual displays.

10.4.6 Personnel Circulation and Custodial Services Access

The requirements and recommendations presented in this section concern the provision of appropriate space for general circulation.

Circulation of OSRA staff, maintenance staff, and all visitors should be achieved with minimum disruption to the work of TSO operators (see Section 10.4.6.1).

Where it is anticipated that the Supervisory/CI positions will give rise to additional circulation from outside the OSRA, it is recommended that these positions be located close to main entrances.

OSRA designs should incorporate a means of restricting thoroughfare access.

All aspects of OSRA layout shall take into account the requirements for maintenance and custodial services access as stated in Mil Standard 1472G Section 5.9.

10.4.6.1 Personnel Circulation

Planning for the circulation of personnel throughout the OSRA shall include the following:

- Adequate general circulation, such that OSRA operations are not interrupted by either visual or auditory distraction.
- Adequate circulation areas where shift changeover is protracted and two shifts are present in the OSRA at the same time.
- Orderly evacuation of the area via easily identifiable routes of egress in the event of an emergency, such as a fire alarm.
- OSRA circulation routes arranged to avoid cross-circulation.
- Restricted ceiling heights, where present, be indicated using ceiling-mounted warning.

10.4.6.2 Custodial Services Access

As with maintenance, the ability of custodial services staff to carry out their duties without interfering with the operations of the OSRA is very important to the day-to-day operations of the facility. Planning for regularly scheduled cleaning activities should rely on the following guidelines:

- Inadvertent activation of any safety-critical controls shall not be possible during cleaning tasks.
- An adequate number of power outlets should be provided which will enable cleaning appliances to be used without causing electrical interference or disturbing OSRA operations.
- Where gaps occur between items of equipment or furniture, adequate clearances should be allowed for proper cleaning task to be executed.
- Special provision is sometimes required where food and beverage are permitted to be consumed in the OSRA.
- The OSRA layout should not give rise to unsuitable working conditions or working movements or postures for cleaning staff.

10.5 Verification and Validation of OSRA Layout

Verification and validation should be integrated with the design process and should be performed in parallel with top-level design and detailed design. It is recommended that verification and validation be an iterative process during the development of the design. This process should give feedback to the designer in moving towards the best possible solution and may include a number of different methods and techniques.

Examples of these are:

- Guideline evaluations (or use of checklists), i.e., using human factor guidelines and standards to check the design.
- Different task analysis techniques such as link analysis or timeline analysis, where communication and coordination
- The use of “walk and talk through” techniques, where the idea is to work through scenarios/sequences in the new design.
- Evaluation criteria, compromises and decisions based on ergonomic principles should be documented and securely stored so that future modifications can take proper account of these factors.

In all cases, local, state, and Federal regulations regarding design and construction shall supersede the recommendations included in this chapter. This is especially relevant concerning the provision of allowances for the disabled as covered by the ADA.

CHAPTER 11:

CONTINGENCY PLANNING

REQUIREMENTS TABLE

Section	Requirement
11.1 Contingency Planning Process	The Project Sponsor shall include contingency plans for extraordinary circumstances when baggage demand exceeds CBIS capacity, whether as the result of the failure of CBIS (EDS and/or BHS) components or peak baggage flow that exceeds the maximum capacity of the CBIS, and for instances where alarm bags at the CBRA are defined as suspect bags (i.e., they cannot be cleared using directed search with ETD) and would need to be placed in the threat containment unit for further inspection by law enforcement (typically a bomb disposal squad).
11.1 Contingency Planning Process	The Project Sponsor, CBIS design teams, and other stakeholders, such as airports, airlines, TSA FSD, TSA Headquarters, and all other relevant Federal, state, and local authorities, shall mutually develop a set of agreeable mitigation measures within a comprehensive contingency plan during the design process.
11.3.2 Out-of-Gauge Diverter – Bypass to ETD	Engaging the "limited operation" mode shall only occur with concurrence from local TSA.

Contingency alternatives for a CBIS are critical to sustaining baggage operations at the airport and include provisions incorporated into the CBIS during the design process. Operational contingencies for sustaining baggage operations include the development of written Contingency Plans by the local stakeholders that focus on alternate methodologies for continuing baggage operations and may include portering of bags to another input belt in the event of a localized bag belt failure.

This chapter summarizes the contingency planning process, contingency plan development, and an evaluation of contingency alternatives. Appendix E provides a sample contingency plan, which illustrates how contingency design principles are applied during the CBIS design process.

11.1 Contingency Planning Process

The Project Sponsor shall include contingency plans for extraordinary circumstances when baggage demand exceeds CBIS capacity, whether as the result of the failure of CBIS (EDS and/or BHS) components or peak baggage flow that exceeds the maximum capacity of the CBIS, and for instances where alarm bags at the CBRA are defined as suspect bags (i.e., they cannot be cleared using directed search with ETD) and would need to be placed in the threat containment unit for further inspection by law enforcement (typically a bomb disposal squad).

The Project Sponsor, CBIS design teams, and other stakeholders, such as airports, airlines, TSA FSD, TSA Headquarters, and all other relevant Federal, state, and local authorities, shall mutually develop a set of agreeable mitigation measures within a comprehensive contingency plan during the design process. Design criteria associated with rapid recovery from a critical failure within the CBIS should be established within a range of technological and procedural solutions applicable at the individual screening zone level.

The preliminary contingency plan needs to be reviewed by the full ILDT and included in the 70% Design Phase submittal as stated in the requirements for Chapter 2. The contingency plan will be reviewed by TSA as part of the overall design review and approval process for that CBIS design.

11.2 General Considerations

When developing a contingency plan, the ILDT should consider the following elements:

- Roles and responsibilities of the various stakeholders regarding system operation during potential contingency scenarios (e.g., approval of various mitigation measures and approving entities).
- Overall processing capacity of the CBIS and expected occurrences of baggage flow demand exceeding CBIS capacity (e.g., during known peaks of the year that may exceed the 85^{th} percentile day, peak month flow).
- Set of eligible mitigation measures as approved by TSA and applicable for the particular CBIS design (taking into account relevant spatial and operational constraints at the particular airport).
- Maintenance of baggage screening and conveyance operations during critical EDS failures and/or mission critical components of the BHS within the context of the screening system automation continuum and the wide variation in associated costs, both capital and operational. Contingency planning should address critical failures along a continuum that ranges from the installation of additional automation to baggage screening mitigation processes. The trade-off between capital investment and O&M costs should be analyzed in detail.
- Other contingency plans that may affect or supersede checked baggage operations, such as the Airport Operations Emergency Response Plan, local SOPs for transportation security incidents, Airport Emergency/Incident Response Plan, and Airport Emergency/Incident Recovery Plan.
- Temporary alternative screening location for checked baggage.
- Procedures for manual handling unscreened bags in the event conveyors pre-CBIS are down. Procedures for handling screened/unclear bags pre-CBRA.
- Threat evacuation and associated impact on baggage screening.
- Natural disaster impact on the screening operation.

11.3 Design Recommendations to Facilitate Contingency Planning

Contingency plans should be customized to the specific CBIS design and terminal constraints. Several design features can be incorporated to provide for improved operation during failure events.

11.3.1 Programming Logic

One example of a design phase contingency plan that can be implemented into the CBIS may be that in the event of a failure of a component on the Clear Line between the EDS units and the CBRA, all bags can be sent down the Alarm Line and then cleared bags are diverted at the 2nd chance divert point.

Designers should specify programming scenarios for specific conditions that will automatically activate within the control system program to divert baggage to other locations as required to maintain throughput and avoid dieback. If programming logic is used for contingency operations, the control system should provide a visual alert to the operator when the diversion of bags is activated so that this function can be communicated to the TSA at both the OSR and CBRA locations.

11.3.2 Out-of-Gauge Diverter – Bypass to ETD

The CBIS should be configured with a BMA that will identify baggage with dimensional characteristics (height, width, or length) that the screening equipment does not have the capability to accommodate. OOG baggage should be automatically diverted to the CBRA for manual screening.

In the event that conveying or screening equipment failures occur down-line of the OOG diverter, the OOG diverter may be manually set to operate in a "limited operation" mode in which all baggage is conveyed directly to the CBRA for manual screening. Engaging the "limited operation" mode shall only occur with concurrence from local TSA.

11.3.3 Provision for Manual Conveyance of Baggage

CBIS design should allow for a clear, securable path for manual conveyance of baggage from the ticket lobby to the CBRA. As much as possible, designs should make use of dedicated conveyors, such as crossover conveyors and OOG conveyors. CBIS analysis and design must account for the likelihood of increased staffing levels (and the associated labor expense) necessary to maintain a system that lacks mechanical mitigation measures to accommodate equipment failures.

11.3.4 Emergency and Standby Power

If there is no access to standby power for manual screening (using ETD), baggage cannot be processed using conventional ETD screening protocols. The design team should consider, at a minimum, the provision of standby or emergency power to support full manual screening at CBRA using ETD with bags being portered to CBRA from the ticketing lobby and from CBRA to a nearby point for handoff to airline personnel for bag make-up operations. This only applies if the Airport intends to operate fully and process passengers and baggage during a power failure.

11.4 Alternative TSA Screening Measures

While the design recommendations above can be used to reduce the operational and security impact of equipment failures, certain long-duration failures or failures that occur during peak periods may necessitate the application of alternative TSA screening measures. The Project Sponsor should consult with TSA regarding the use of mutually agreeable alternative screening measures and document how such measures would be implemented, if used as part of the contingency plan.

11.5 Failure Types and Mitigation Measures

This section describes baggage handling and screening equipment failures along with examples of potential mitigation strategies that could be used based on the duration of the failure.

Two principal factors cause the failure of CBIS: power failures produced by external events and conveying and/or screening equipment failures. For the purposes of contingency planning, the cause of a failure is of less importance than its duration. Failures can be classified based on their duration or based on the recovery period during peak times or non-peak times.

Mitigation measures are used to overcome various CBIS failures by the application of mechanical and/or manual methods (for example additional conveyers to allow appropriate transfer of baggage or backup power sources for BHS components). In addition, as a last resort, alternative screening measures can be used with TSA approval to mitigate CBIS failures.

11.5.1 Short-Duration Failures

Short-duration failures are failures lasting less than 10 minutes. Typically, during this class of failure, a CBIS cannot perform its intended function, but the failure can be cured without maintenance personnel being called in. In the event of short-duration failures, airport and TSA protocols generally follow the logic that the CBIS will be returned to operation quickly.

Typical mitigation measures for short-duration failures include the following:

- **Freeze Situation until System Restarts**. In the event that the system could restart momentarily, cleared bags may remain in place, alarmed bags may remain in place (if the alarm status is positively maintained), and bags with unknown status are manually conveyed to the CBRA. Unscreened baggage would remain in place within the system. Checked baggage would be held for induction into the CBIS until after the system restarts.
- **Manual Conveyance**. In the event of uncertainty regarding short term restart or when freezing the situation is not an option (e.g., if the failure occurs in the middle of a peak period), cleared bags may be manually conveyed to bag make-up. Alarmed bags, as well as bags with unknown status, are manually conveyed to the CBRA. Unscreened baggage would remain in place within the system. Checked baggage would be held for induction into the CBIS until after the system restarts.

11.5.2 Medium-Duration Failures

Medium-duration failures are failures lasting longer than 10 minutes, but less than 2 hours. Typically, during this class of failure, critical components of a CBIS stop performing their function and maintenance personnel are necessary to fix the failed components. In the event of medium-duration failures, airport and TSA protocols will vary depending on the availability of power.

Typical mitigation measures for medium-duration failures include the following:

- **Manual Conveyance**. When the BHS is not operational, cleared baggage is manually conveyed to bag make-up. Unscreened baggage, alarmed baggage, and baggage with unknown status are sent to another EDS unit in a separate CBIS (if possible) or manually conveyed to an area designated by TSA for manual and/or alternative screening.
- **Use of Dedicated Conveyors with Standby Power**. If a limited-operation conveyance system exists, it can be used to convey baggage to the CBRA and/or another area designated by TSA for manual screening (e.g., OOG conveyor(s) and oversize conveyor(s)). When the limited operation conveyor system is available (temporary power-loss for entire BHS, but limited system can run using a standby power source), cleared baggage will stay within the system (until system restart) or may be conveyed to bag make-up. Alarmed or unknown baggage may be conveyed to another EDS unit within a separate CBIS (if possible) or the CBRA. Unscreened baggage is conveyed to another EDS unit in a separate CBIS (if possible) or to an area designated by TSA for manual and/or alternative screening.

11.5.3 Long-Duration Failures

Long-duration failures are failures lasting longer than two hours. Typically, during this class of failure, the entire CBIS is inoperable due to power outages or major failures of critical components for an extended duration. Long-Duration Failures may follow the same protocols described above for medium-duration failures. Alternate TSA screening protocols may be applied, as specified in the approved contingency plan.

Typically, mitigation measures for long-duration failures are similar to those for medium-duration failures. If it is the policy of CBIS stakeholders that the airport operates during extended-duration power outages, then the design team should include in its design the provision of a limited operation conveyance system(s) with access to standby power. Power failures may also be mitigated by the use of standby power with the capacity to enable operation of the entire CBIS.

11.6 Evaluation of Contingency Alternatives

When evaluating mitigation measures, planners and designers should consider a broad range of solutions. Common critical failures of system components (e.g., EDS unit, vertical sorter, optical scanner) within the CBIS should be analyzed to inform the selection of appropriate contingency measures. Catastrophic failures, which may involve total system failures of any duration or a component failure of long duration, should also be considered.

11.6.1 General Principles for Evaluation

The tradeoffs between providing for mechanical versus manual mitigation measures should be based on the complexity of the screening systems and the demand placed on that system. For smaller screening matrices, manual conveyance of bags to another nearby screening system or to a TSA-designated screening area for manual and/or alternative screening processes is likely to be the most cost-effective option.

For larger screening systems, mechanical measures are likely to be necessary to handle the high baggage volumes processed by the system. The exact measures implemented should be evaluated based on both operational and economic (life-cycle cost) considerations. In each case, the mutually developed and approved contingency plan should list the range of mitigation measures and the conditions that trigger those measures.

11.6.2 Mini In-Line System Example

As an example of the tradeoffs and options that should be evaluated, consider two mini in-line systems in close proximity to each other. Critical failure of either EDS unit or the BHS may be dealt with by relatively low-cost manual processes. The failure of a single EDS unit, however, could be mitigated by manually carrying bags to the in-feed belt serving the remaining operational EDS unit. Additionally, unscreened bags may be sent directly to the CBRA. In this manner, bags are screened by ETD, with the possibility that some level of mitigation may be applied.

In the event that both EDS units experience medium-duration failures simultaneously, sending bags to the CBRA would be the most effective option. A long-duration failure of the entire CBIS would require yet another mitigation process, such as increasing the number of ETD screenings and the number of screening personnel in the lobby or bag rooms prior to bag make-up for individual flights.

CHAPTER 12:

CYBERSECURITY REQUIREMENTS

REQUIREMENTS TABLE

Section	Requirement
12.1 Cybersecurity Requirement Assumptions	The CBIS and CBIS control system <u>shall</u> have appropriate cybersecurity measures to ensure the system: • Does not allow unauthorized access to any portion of the CBIS networks, controls systems or components. • Does not allow unauthorized access to data or unauthorized data extraction from the control system, inclusive of both SSI and non-SSI data. • Employs appropriate equipment and systems to isolate networks. • Has appropriate updates and patches applied throughout its lifecycle to ensure ongoing security.
12.1.1 User Accounts	Individual user accounts <u>shall</u> be employed and the use of generic or multi-user accounts <u>shall</u> be prohibited. User accounts <u>shall</u> be terminated within 24 hours for those no longer requiring access. User accounts <u>shall</u> be audited on a monthly basis to ensure only required accounts are active. These requirements <u>shall</u> apply to remote access users as well.
12.1.2 Incident Handling	The ILDT <u>shall</u> prepare an incident handling plan to deal with cybersecurity related attacks.

12.1.3 Deliverables	The following cybersecurity specific submittals <u>shall</u> be prepared by the Project Sponsor during the construction phase and be submitted to TSA:
	• Cybersecurity plan. The plan <u>shall</u> be specific to the CBIS and <u>shall</u> include the following sections, where applicable (not all sections apply to all systems, e.g. not all systems have remote access capabilities):
	  – System architecture drawings.
	  – User and account management controls.
	  – Remote access policy and procedures.
	  – Access log retention policy and procedures.
	  – External network connections and access controls.
	  – Disaster recovery plans and procedures.
	• Incident handling plan (as described above).
	• At TSA's request, cybersecurity measures <u>shall</u> be demonstrated to TSA.

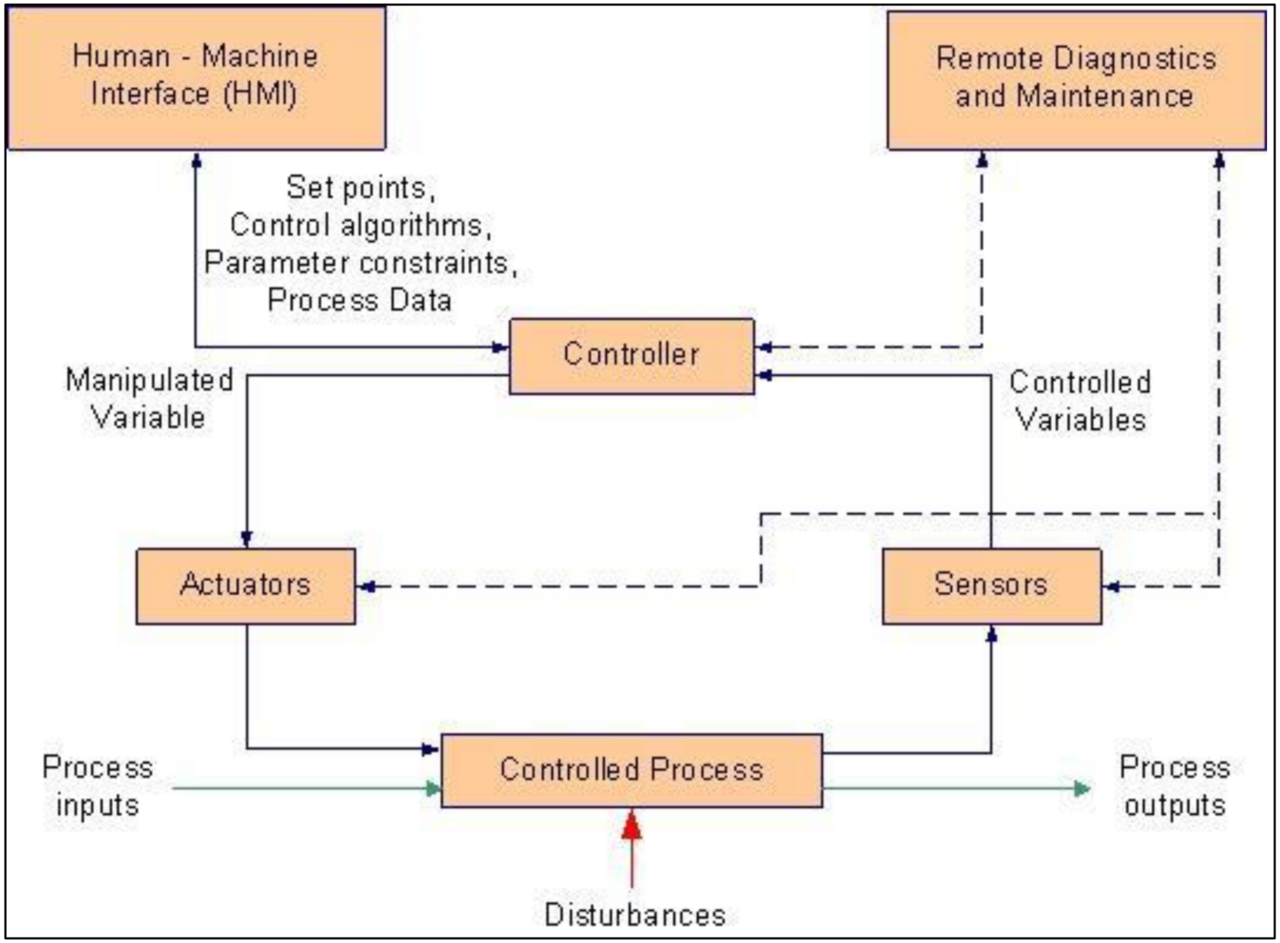
12.2 Firewalls	Network firewalls to control the flow of network traffic <u>shall</u> be employed. The firewalls <u>shall</u> restrict connectivity to and from internal and external networks to those with a need-to-know.
12.3 Remote Access	At a minimum, the system <u>shall</u> be secured as noted in *Configuring and Managing Remote Access for Industrial Control Systems*, April 2011, Centre for the Protection of National Infrastructure and the United States Department of Homeland Security.
12.3.1 Remote Access Logs	Remote access activities <u>shall</u> be logged and reviewed to ensure all access is by authorized personnel. At TSA's request, access logs <u>shall</u> be submitted to TSA within seven calendar days.
12.3.2 External Connections	Remote access <u>shall</u> be enabled only when required.

Section	Requirement
12.4 Software Maintenance and Updates	Appropriate software maintenance and patch management programs shall be employed to maintain the system security.
12.5 Network Segregation	The following networks shall be segregated, or "air-gapped" from all other networks: EDS image networks. Neither the BHS nor any other airport network shall be connected to the network used by the EDS for transmission of images e.g. the Morpho MUX or L3 NEDS. TSA data network. Neither the BHS nor any other airport network shall be connected to the TSA data network unless specifically directed and authorized by TSA.
12.5 Network Segregation	Wireless networks, should they be a part of the CBIS or its control system, shall adhere to the guidelines as noted in NIST Special Publication SP 800-153 Feb 2012 *Guidelines for Securing Wireless Local Area Networks (WLANs)*.

12.1 Cybersecurity Requirement Assumptions

This section assumes the CBIS has an Industrial Control System with discrete components similar to the model in Figure 12-1.

Figure 12-1: Industrial Control System High Level View



Source: National Institute of Standards and Technology, 2015

Industrial control systems of this type are often the target of cyber-attacks at both the computer and controller level. These cybersecurity requirements are set forth to ensure ongoing system integrity throughout the project lifecycle.

The CBIS and CBIS control system shall have appropriate cybersecurity measures to ensure the system:

- Does not allow unauthorized access to any portion of the CBIS networks, controls systems or components
- Does not allow unauthorized access to data or unauthorized data extraction from the control system, inclusive of both SSI and non-SSI data
- Employs appropriate equipment and systems to isolate networks
- Has appropriate updates and patches applied throughout its lifecycle to ensure ongoing security

As every project is unique, it is incumbent upon the ILDT to develop the appropriate cybersecurity procedures and processes.

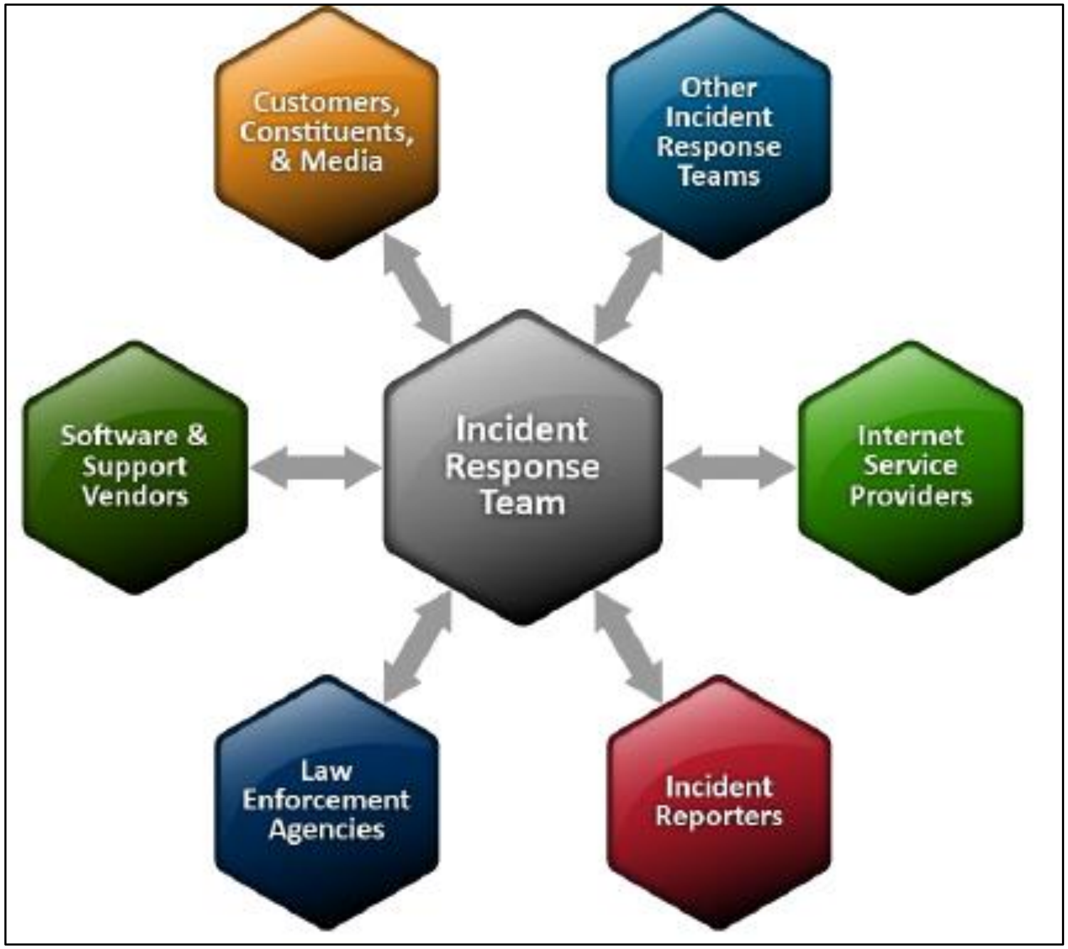
12.1.1 User Accounts

Individual user accounts shall be employed and the use of generic or multi-user accounts shall be prohibited. User accounts shall be terminated within 24 hours for those no longer requiring access. User accounts shall be audited on a monthly basis to ensure only required accounts are active. These requirements shall apply to remote access users as well.

12.1.2 Incident Handling

The ILDT shall prepare an incident handling plan to deal with cybersecurity related attacks. Figure 12-2 provides a basic framework for incidental handling and stakeholder engagement and communication.

Figure 12-2: Cybersecurity Incident Response Framework



Source: National Institute of Standards and Technology, 2012

The ILDT should consult the National Institute of Standards and Technology Special Publication 800-61R2, *Computer Security Incident Handling Guide, Recommendations of the National Institute of Standards and Technology,* when preparing the plan. TSA on both a local and national level should be included in the Incident Response Team.

12.1.3 Deliverables

The following cybersecurity specific submittals shall be prepared by the Project Sponsor during the construction phase and be submitted to TSA:

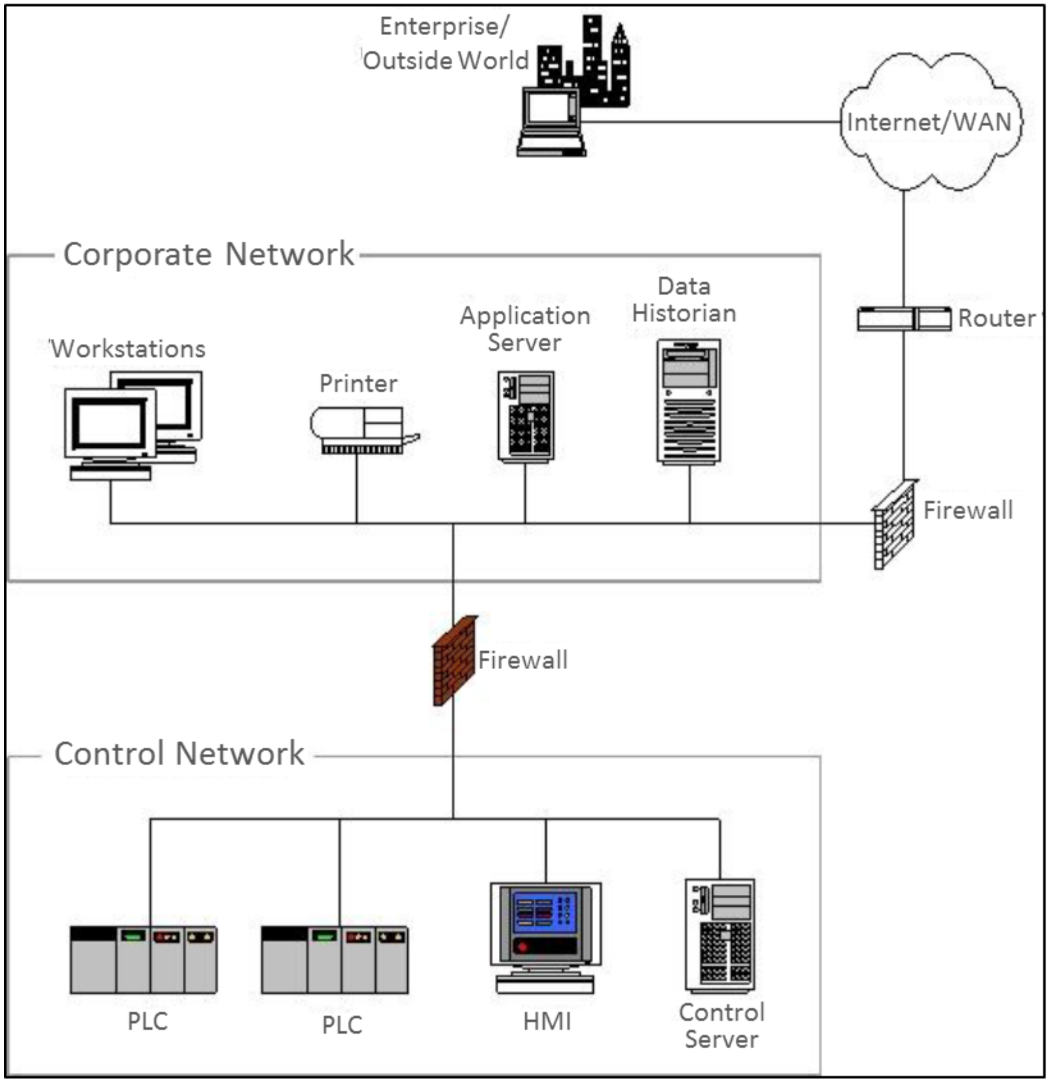
- Cybersecurity plan. The plan shall be specific to the CBIS and shall include the following sections, where applicable (not all sections apply to all systems, e.g. not all systems have remote access capabilities):
  - System architecture drawings.
  - User and account management controls.
  - Remote access policy and procedures.
  - Access log retention policy and procedures.
  - External network connections and access controls.
  - Disaster recovery plans and procedures.
- Incident handling plan (as described above).
- At TSA's request, cybersecurity measures shall be demonstrated to TSA.

12.2 Firewalls

Network firewalls to control the flow of network traffic shall be employed. The firewalls shall restrict connectivity to and from internal and external networks to those with a need-to-know. It is recommended that additional firewalls be employed to further restrict inter-subnetwork communications between functional security subnets and devices. Figure 12-3 represents a firewall separation of a control network at the most basic level. Additional guidance on firewalls can be obtained from:

- NIST Special Publication SP 800-82 Rev.2 May 2015 Guide to Industrial Control Systems (ICS) Security http://dx.doi.org/10.6028/NIST.SP.800-82r2
- NIST Special Publication SP 800-41 Rev. 1 Sep 2009 Guidelines on Firewalls and Firewall Policy http://dx.doi.org/10.6028/NIST.SP.800-41r1

Figure 12-3: Firewall Example

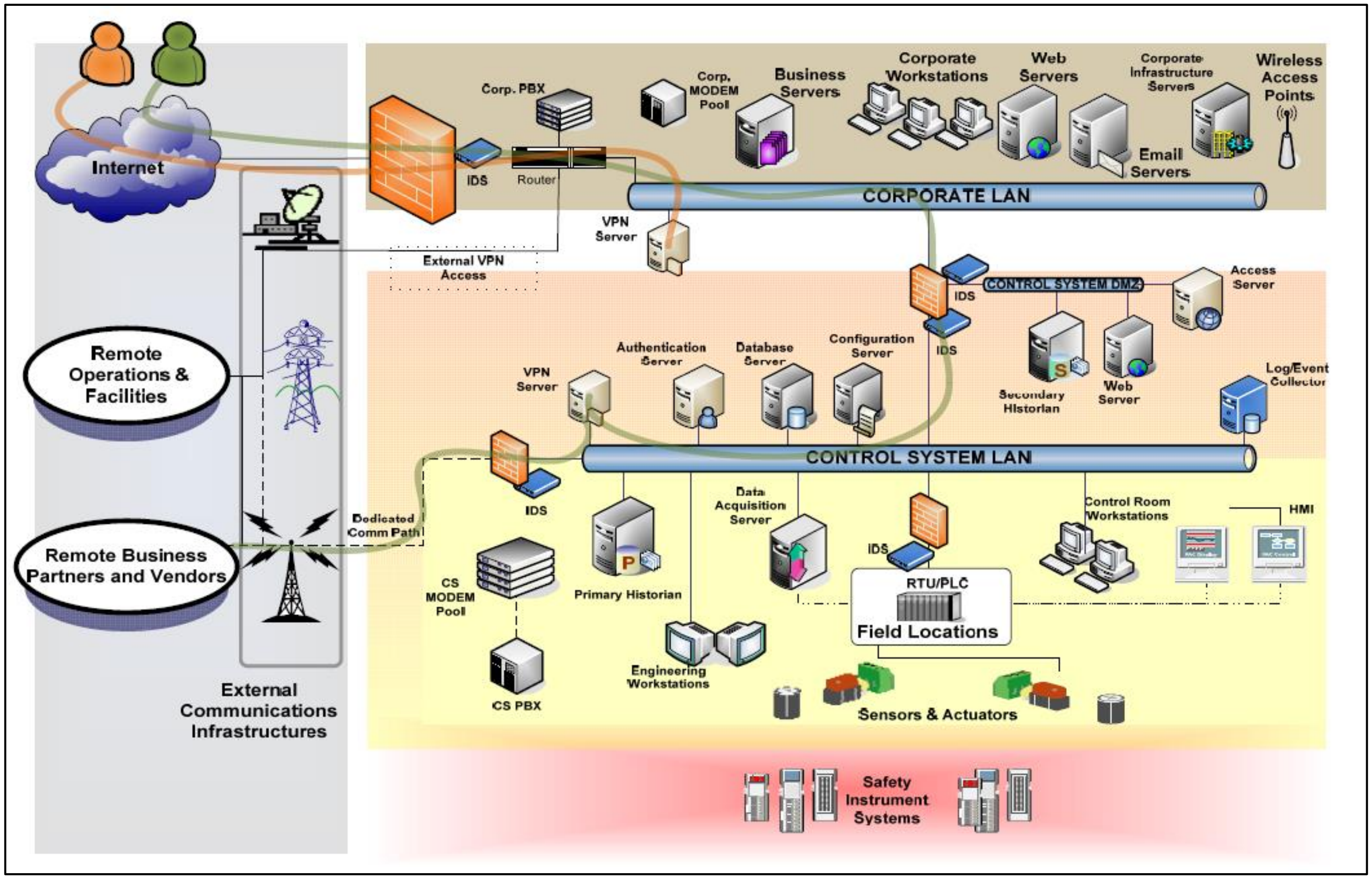


Source: National Institute of Standards and Technology, 2015

12.3 Remote Access

Systems allowing remote access need to employ appropriate security measures. At a minimum, the system shall be secured as noted in: *Configuring and Managing Remote Access for Industrial Control Systems*, April 2011, Centre for the Protection of National Infrastructure and the United States Department of Homeland Security. Figure 12-4 represents a secure remote access example at the most basic level.

Figure 12-4:Secure Remote Access Example



Source: United States Department of Homeland Security and Centre for the Protection of National Infrastructure, 2011

12.3.1 Remote Access Logs

Remote access activities shall be logged and reviewed to ensure all access is by authorized personnel. At TSA's request, access logs shall be submitted to TSA within seven calendar days.

12.3.2 External Connections

Remote access shall be enabled only when required. Normal users may require on-demand remote access, but vendor support may only require remote access rarely. Therefore, vendor user IDs should be disabled until they are required to be enabled and then disable them once again when they have completed their task. This technique can be applied to any group of users who require only intermittent access. Alternatively, external network connections can be physically disconnected or otherwise made inaccessible when not needed. The cybersecurity plan will document all external connections and both physical and logical access controls.

12.4 Software Maintenance And Updates

NIST Special Publication SP800-40R3, Guide to Enterprise Patch Management Technologies, notes the following:

"Patch management is the process for identifying, acquiring, installing, and verifying patches for products and systems. Patches correct security and functionality problems in software and firmware. From a security perspective, patches are most often of interest because they are mitigating software flaw vulnerabilities; applying patches to eliminate these vulnerabilities significantly reduces the opportunities for exploitation. Patches serve other purposes than just fixing software flaws; they can also add new features to software and firmware, including security capabilities."

Therefore, appropriate software maintenance and patch management programs shall be employed to maintain the system security.

12.5 Network Segregation

A typical in-line CBIS will have several network layers including some of the following:

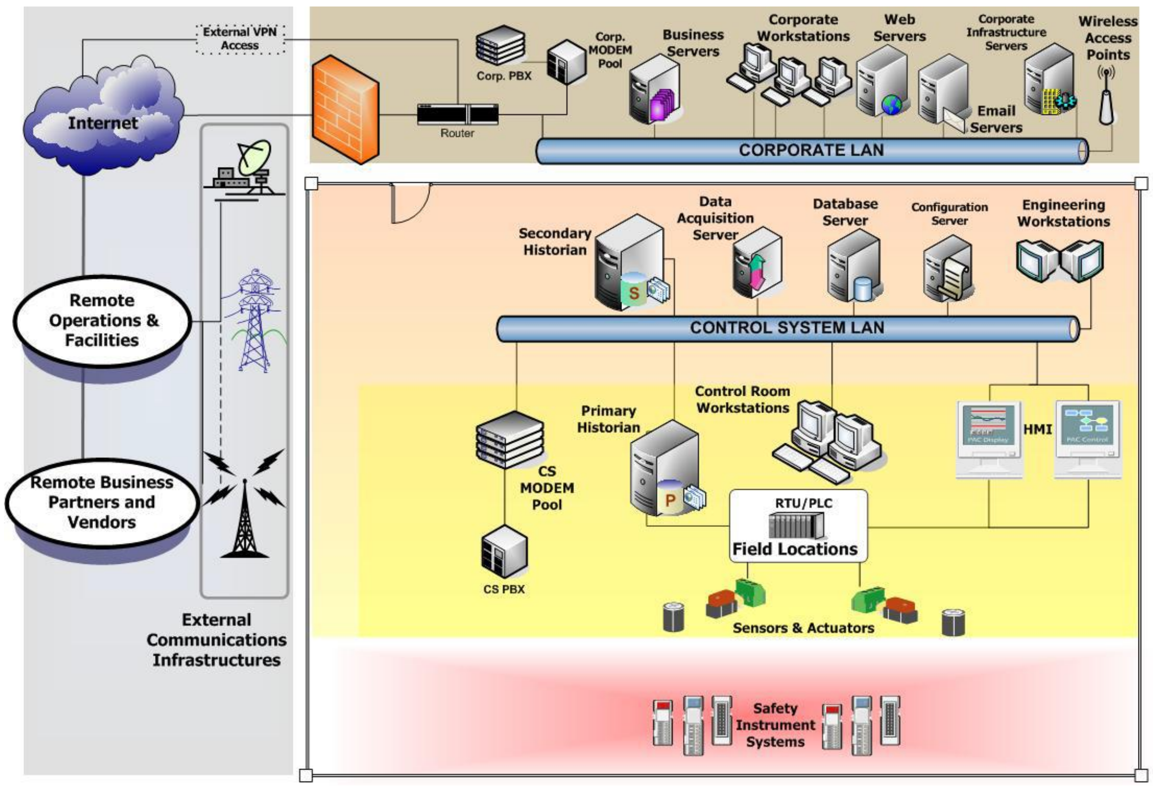
- Device level networks such as DeviceNet or Actuator Sensor Interface.
- Industrial control networks such as Ethernet IP, ControlNet or Profibus.
- High level networks such as Ethernet.

Each network should include only the equipment necessary for that network. The following networks shall be segregated, or "air-gapped" from all other networks:

- EDS image networks. Neither the BHS nor any other airport network shall be connected to the network used by the EDS for transmission of images e.g. the Morpho MUX or L3 NEDS.
- TSA data network. Neither the BHS nor any other airport network shall be connected to the TSA data network unless specifically directed and authorized by TSA.

Figure 12-5 shows an example of network segregation.

Figure 12-5:Network Segregation



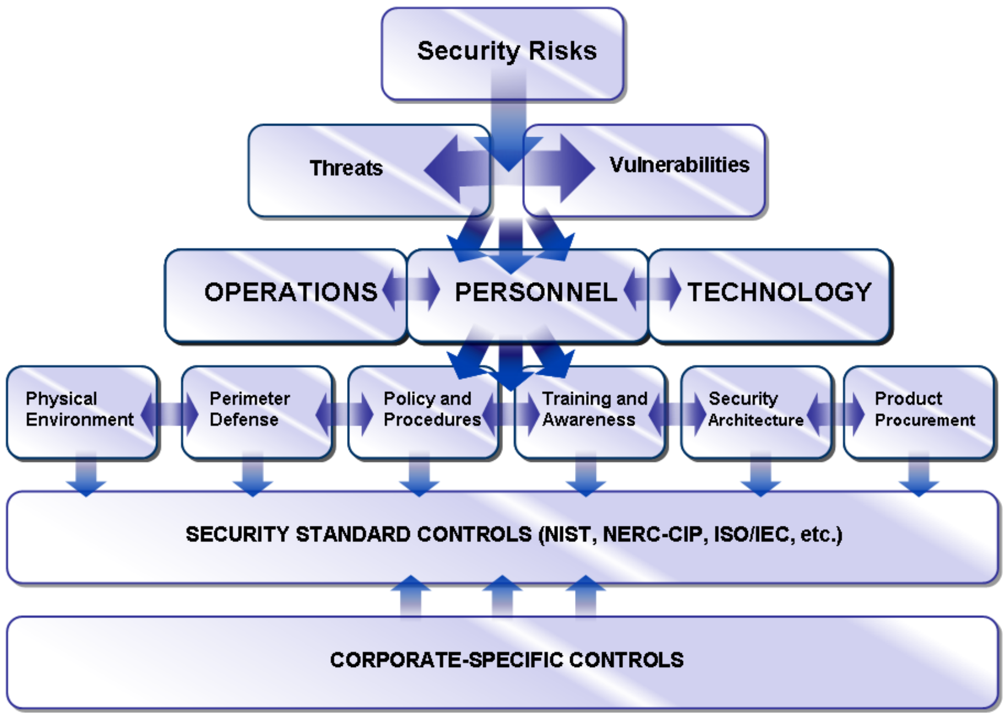
Source: (United States Department of Homeland Security and Centre for the Protection Of National Infrastructure, 2011)

Wireless networks, should they be a part of the CBIS or its control system, shall adhere to the guidelines as noted in NIST Special Publication SP 800-153 Feb 2012 *Guidelines for Securing Wireless Local Area Networks (WLANs)*.

12.6 Cybersecurity Best Practices

- Be aware of new and evolving threats. Ensure security updates are installed on a regular basis.
- Audit the system on a regular basis to ensure unauthorized changes have not been made.
- Maintain multiple backups in multiple locations.
- Utilize a defense-in-depth security approach, as shown in Figure 12-6.

Figure 12-6: Strategic framework for cyber defense-in-depth



Source: United States Department of Homeland Security, 2009

CHAPTER 13:

REFERENCES

The PGDS was developed with reference to several documents and models previously developed by the US government and its contractors, as well as other standards organizations as discussed below:

13.1 Transportation Security Administration

- *Recommended Security Guidelines for Airport Planning, Design and Construction*, Revised May 2011

  This revised document was issued by TSA in May 2011 and presents recommendations for incorporating sound security considerations into the planning, design, construction, and modification of security-related airport facilities and airport terminal buildings. It consolidates information developed through the participation of TSA and other government and aviation industry professionals. The Recommended Security Guidelines document is intended to help users ensure that security considerations and requirements are a component of the planning and design of airport infrastructure, facilities and operational elements. Intended users include aviation user-agencies (airport operators, aircraft operators and airport tenants), airport planners and consultants, designers, architects, and engineers engaged in renovation and new airport facility planning, design or construction projects.

- Integrated Deployment Model

  As part of the BSIS, TSA also developed the Integrated Deployment Model, which is an economic model based on a life-cycle cost approach to screening system selection. The model is used to conduct a top-down evaluation of various schematic concepts of EDS screening systems, based on the methodologies outlined in this document. These schematic concepts take into account high-level spatial constraints at airport terminals and are optimally sized according to the estimated checked baggage demand. The concepts were then evaluated on the basis of the life-cycle costs of developing, maintaining, and replacing the EDS screening systems. Though schematic in nature, these concepts may serve as a useful starting point for any airport or airline that plans to implement a checked baggage screening system and would be made available upon request.

  The Integrated Deployment Model is a working model that will be continuously updated as new technologies are developed and performance characteristics are updated.

- Advanced Surveillance Program (ASP), *TSA Baseline Video Surveillance Operational Requirements, Checked Baggage* (draft)
- *Checked Baggage Inspection System Interface Requirements Document* (IRD) for BHS and In-Line Screening Device (ISD)
- *Electronic Baggage Screening Program Policy – TSA Funding of Checked Baggage Inspection System Project Costs*: https://www.fbo.gov/index?s=opportunity&mode=form&id=5f27246b608d3914c43bb0dd2d11ebd9&tab=core&_cview=1
- *SSI Best Practices Guide for Non-DHS Employees and Contractors*: https://www.tsa.gov/for-industry/sensitive-security-information.

Checked Baggage Program Contacts and Resources

- Guidance and FAQs on the funding and application processes can be found on TSA's website at http://www.tsa.gov/research-center/airport-checked-baggage-guidance-materials.
- Requests for CBIS changes: submit to TSA SOS Engineering at OSTCBD@tsa.dhs.gov
- To obtain the most up to date information on qualified EDS, contact PGDS@tsa.dhs.gov.

13.2 Other Federal Agencies

- Centre for the Protection of National Infrastructure and the United States Department of Homeland Security, *Configuring and Managing Remote Access for Industrial Control Systems*, April 2011.
- Customs and Border Protection, Advance Passenger Information System (APIS), *Consolidated User Guide (CUG)*
- Department of Defense Design Criteria Standard: *Human Engineering* MIL-STD-1472G
- National Institute of Standards and Technology. NIST Special Publication SP 800-40 Rev. 3 Jul 2013 *Guide to Enterprise Patch Management Technologies* http://dx.doi.org/10.6028/NIST.SP.800-40r3
- National Institute of Standards and Technology. NIST Special Publication SP 800-41 Rev. 1 Sep 2009 *Guidelines on Firewalls and Firewall Policy* http://dx.doi.org/10.6028/NIST.SP.800-41r1
- National Institute of Standards and Technology. NIST Special Publication SP 800-61 Rev. 2 Aug 2012 *Computer Security Incident Handling Guide* http://dx.doi.org/10.6028/NIST.SP.800-61r2
- National Institute of Standards and Technology. NIST Special Publication SP 800-82 Rev.2 May 2015 *Guide to Industrial Control Systems (ICS) Security* http://dx.doi.org/10.6028/NIST.SP.800-82r2
- National Institute of Standards and Technology. NIST Special Publication SP 800-84 Sep 2006 *Guide to Test, Training, and Exercise Programs for IT Plans and Capabilities* http://dx.doi.org/10.6028/NIST.SP.800-84
- National Institute of Standards and Technology. NIST Special Publication SP 800-98 Apr 2007 *Guidelines for Securing Radio Frequency Identification (RFID) Systems* http://dx.doi.org/10.6028/NIST.SP.800-98
- National Institute of Standards and Technology. NIST Special Publication SP 800-100 Oct 2006 *Information Security Handbook: A Guide for Managers* http://dx.doi.org/10.6028/NIST.SP.800-100
- National Institute of Standards and Technology. NIST Special Publication SP 800-115 Sep 2008 *Technical Guide to Information Security Testing and Assessment* http://dx.doi.org/10.6028/NIST.SP.800-115

- National Institute of Standards and Technology. NIST Special Publication SP 800-153 Feb 2012 *Guidelines for Securing Wireless Local Area Networks (WLANs)* http://dx.doi.org/10.6028/NIST.SP.800-153
- National Institute of Standards and Technology. NIST Special Publication SP 800-167 Oct 2015 *Guide to Application Whitelisting* http://dx.doi.org/10.6028/NIST.SP.800-167
- United States Department of Homeland Security. (2009). *Recommended Practice: Improving Industrial Control Systems Cybersecurity with Defense-In-Depth Strategies.*
- United States Department of Homeland Security and Centre for the Protection Of National Infrastructure. (2011). *Configuring & Managing Remote Access For Industrial Control Systems.*
- United States Department of Labor, Occupational Safety & Health Administration Computer Workstations eTool, available at www.osha.gov/SLTC/etools/computerworkstations/index.html
- U.S. Department of Labor, Occupational Safety and Health Standards 29 CFR 1910

13.3 Industry Guidance Documents

- American National Standards Institute, ANSI/ISA-62443-1-1 (99.01.01)-2007 - *Security for Industrial Automation and Control Systems Part 1-1: Terminology, Concepts, and Models*
- American National Standards Institute, ANSI/ISA-62443-2-1 (99.02.01)-2009 - *Security for Industrial Automation and Control Systems: Establishing an Industrial Automation and Control Systems Security Program*
- American National Standards Institute, ANSI/ISA-TR62443-2-3-2015 - *Security for industrial automation and control systems Part 2-3: Patch management in the IACS environment*
- American National Standards Institute, ANSI/ISA-62443-3-3 (99.03.03)-2013 - *Security for industrial automation and control systems Part 3-3: System security requirements and security levels*
- American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE) Standard 62.1-2016 *Ventilation for Acceptable Indoor Air Quality*.
- Association for the Advancement of Cost Engineering (AACE) International, Recommended Practice No. 10S-90, *Cost Engineering Terminology,* copyright 2004.
- International Organization for Standardization (ISO) Standard ISO 11064-1: 1999, *Design of Control Centers. Part 1: Principles for the design of control centres*
- International Organization for Standardization (ISO) Standard ISO 11064-2: 1999, *Design of Control Centers. Part 2: Principles for the arrangement of control suites*

- International Organization for Standardization (ISO) Standard ISO 11064-3: 1999, *Design of Control Centers. Part 3: Control room layout*
- International Society of Automation and International Electro Commission, IEC TS 62443-1-1:2009 Industrial communication networks - Network and system security - Part 1-1: Terminology, concepts and models
- International Society of Automation and International Electro Commission, IEC 62443-2-1:2010 *Industrial communication networks - Network and system security - Part 2-1: Establishing an industrial automation and control system security program*
- International Society of Automation and International Electro Commission, IEC TR 62443-2-3:2015 *Security for industrial automation and control systems - Part 2-3: Patch management in the IACS environment*
- International Society of Automation and International Electro Commission, IEC 62443-2-4:2015 *Security for industrial automation and control systems - Part 2-4: Security program requirements for IACS service providers*
- International Society of Automation and International Electro Commission, IEC PAS 62443-3:2008 *Security for industrial process measurement and control - Network and system security*
- International Society of Automation and International Electro Commission, IEC TR 62443-3-1:2009 *Industrial communication networks - Network and system security - Part 3-1: Security technologies for industrial automation and control systems*
- International Society of Automation and International Electro Commission, IEC 62443-3-3:2013 Industrial communication networks - Network and system security - Part 3-3: System security requirements and security levels
- National Fire Protection Association (NFPA) 70, National Electrical Code and NFPA 101, Life Safety Code

13.4 Additional Cybersecurity Resources

National Institute of Standards and **Technology Information Technology Laboratory's** (ITL) two security divisions - Computer Security Division (CSD) and Applied Cybersecurity Division (ACD) – can be retrieved from: http://csrc.nist.gov/publications/index.html.

American National Standards Institute, International Society of Automation and International Electro Commission
The 62443 series publications can be obtained from one of the following:

- https://www.ansi.org/
- http://www.iec.ch/
- https://www.isa.org/

Department of Homeland Security Industrial Control Systems Cyber Emergency Response Team

The Department of Homeland Security Industrial Control Systems Cyber Emergency Response Team (ICS-CERT) works to reduce risks within and across all critical infrastructure sectors by partnering with law enforcement agencies and the intelligence community and coordinating efforts among Federal, state, local, and tribal governments and control systems owners, operators, and vendors. Additionally, ICS-CERT collaborates with international and private sector Computer Emergency Response Teams (CERTs) to share control systems-related security incidents and mitigation measures. The ICS-CERT provides many cybersecurity publications and resources. Publications can be viewed at:

- https://ics-cert.us-cert.gov/Recommended-Practices
- https://ics-cert.us-cert.gov/Standards-and-References

The ICS-CERT main page can be accessed at:

- https://ics-cert.us-cert.gov/

APPENDIX A:

SUBMITTAL OUTLINES, FORM TEMPLATES AND EXAMPLES

A.1 INTRODUCTION

This appendix provides resources to support implementation of guidance and requirements in the PGDS.

A.2 ALTERNATIVES ANALYSIS REPORT – SAMPLE OUTLINE

The following is a sample outline for the Alternatives Analysis Report, as introduced in Chapter 2, to be prepared in the Pre-Design Phase. This report will be incorporated in the Basis of Design Report, in the Schematic Design Phase. An example can be found in Appendix C. A detailed explanation of the life cycle cost analysis can be found in Chapter 8.

1 Alternatives Definition

2 Design Year Baggage Screening Demand Determination

2.1 Base Year Assumptions

2.2 Base Year Surged Average Day Peak Month (ADPM) Baggage Screening Demand Determination

2.2.1 Base Year Peak Month Determination

2.2.2 Base Year ADPM Determination

2.2.3 Base Year ADPM Flight Schedule

2.2.4 Base Year Surged Peak Hour ADPM Baggage Screening Demand Calculation

2.2.5 Design Year Surged Peak Hour ADPM Baggage Screening Demand Calculation

3 Proposed System Types Selection

4 Life-cycle Costs Estimation

4.1 Analysis Assumptions

4.2 Life Cycle Costs Calculation

5 Qualitative Evaluation and Selection of Feasible Alternatives

A.3 BASIS OF DESIGN REPORT – SAMPLE OUTLINE

The following outline should be followed by designers when preparing the Basis of Design Report in the Schematic Design Phase.

1 Background

2 Executive Summary

3 CBIS Alternatives

3.1 Identification of Initial Alternatives

3.1.1 Identification of Likely Screening Zones (Airline Grouping Assignments)

3.2.2 Identification of Likely Screening System Types

3.2 Qualitative Assessment of Preliminary Alternatives (Identification of Feasible Alternatives)

4 Quantitative Assessment of Feasible Alternatives – Design Year Baggage Screening Demand for Each Feasible Alternative

4.1 Feasible Alternative 1

4.1.1 Planning and Modeling Assumptions

4.1.1.1 List of Airlines for Alternative 1 Screening Zone

4.1.1.2 Average Day Peak Month

4.1.1.3 Airline Flight Schedule

4.1.1.4 Airline Load Factors

4.1.1.5 Passenger Arrival Profiles

4.1.2 Future Baggage Flow Projections

4.1.2.1 Design Year (DBU plus 5 Years)

4.1.2.2 Surged Flow

4.1.3 EDS Equipment Identification.

4.1.3.1 EDS Equipment Quantities

4.1.3.2 EDS Equipment Redundancy

4.1.3.3 OSR Station Requirements

4.1.3.4 ETD Screening Station Requirements

4.2 Feasible Alternative 2

4.2.1 Planning and Modeling Assumptions

4.2.1.1 List of Airlines for Alternative 2 Screening Zone

4.2.1.2 Average Day Peak Month

4.2.1.3 Airline Flight Schedule

4.2.1.4 Airline Load Factors

4.2.1.5 Passenger Arrival Profiles

4.2.2 Future Baggage Flow Projections

4.2.2.1 Design Year (DBU plus 5 Years)

4.2.2.2 Surged Flow

4.2.3 EDS Equipment Identification

4.2.3.1 EDS Equipment Quantities

4.2.3.2 EDS Equipment Redundancy

4.2.3.3 OSR Station Requirements

4.2.3.4 ETD Screening Station Requirements

4.3 Feasible Alternative 3

4.3.1 Planning and Modeling Assumptions

4.3.1.1 List of Airlines for Alternative 3 Screening Zone

4.3.1.2 Average Day Peak Month

4.3.1.3 Airline Flight Schedule

4.3.1.4 Airline Load Factors

4.3.1.5 Passenger Arrival Profiles

4.3.2 Future Baggage Flow Projections

4.3.2.1 Design Year (DBU plus 5 Years)

4.3.2.2 Surged Flow

4.3.3 EDS Equipment Identification.

4.3.3.1 EDS Equipment Quantities

4.3.3.2 EDS Equipment Redundancy

4.3.3.3 OSR Station Requirements

4.3.3.4 ETD Screening Station Requirements

5 Preferred Alternatives Analysis (Life-Cycle Analysis)

5.1 Feasible Alternative 1

5.1.2 Considered Costs

5.1.2.1 Capital costs

5.1.2.2 Operations and Maintenance Costs

5.1.2.3 Staffing Costs

5.2 Feasible Alternative 2

5.2.1 Analysis Assumptions

5.2.2 Considered Costs

5.2.2.1 Capital costs

5.2.2.2 Operations and Maintenance Costs

5.2.2.3 Staffing Costs

5.3 Feasible Alternative 3

5.3.1 Analysis Assumptions

5.3.2 Considered Costs

5.3.2.1 Capital costs

5.3.2.2 Operations and Maintenance Costs

5.3.2.3 Staffing Costs

5.4 Selection of Preferred Alternative

5.5 Preferred Alternative Description of System Operations

5.6 Preferred Alternative Phasing and Constructability Technical Memoranda

In addition, the following appendices should be included in the Basis of Design Report for the Preferred Alternative:

Appendix A: Documentation of Stakeholder Notification

Appendix B: Probable Construction Cost and O&M Cost

Appendix C: Preliminary Project Schedule

Appendix D: Sheet Index of Preliminary Concept Plans

A.4 CBIS USE AND LOGISTICS TRAINING

The following is an example outline for the required documentation for training TSA on the use and logistics of the CBIS as stated in Section 2.2.5:

- Startup and shut down procedures
- Overall bag flow from ticket counter to CBRA
  - Description of bag flow
  - Identify Conveyor subsystems
  - Conveyor subsystem nomenclatures
  - Listing of Photo eye identification numbers correlated to conveyor subsystems
- Bag hygiene for the ticket counter induction and the reinsertion line
- BMA settings
- Fail-safe procedures
- Bag jam clearing procedures including at a minimum:
  - Applicable activation of e-stop controls (this is not a requirement for the actual clearing of the logical fault)
  - Lock out/tag out procedures
  - Removal of article(s) from the affected jam location
  - Proper reinsertion of the affected articles either upstream or downstream of the jam location, depending on the specific zone (pre-EDS, post-EDS, fail-safe, etc.). In any tracked portion of the EDS, care should be taken to ensure proper bag spacing when placing articles back onto the respective conveyor(s) to ensure bags are not re-inserted into another bag's tracking window.
  - Restart of the affected conveyor subsystem via normal operating protocol

  - Safe personnel maneuvering in and around the jam area
  - Restrict bag jam clearance from an EDS to only authorized TSA personnel or other TSA designees
- E-stop procedures and zones
- BHS OSR settings
  - List the available travel time for OSR per EDS line
- CBRA Procedures
  - Defining the BHS BSD Statuses
  - Cross reference of BHS BSD Statuses to EDS disposition code (see SSTP mapping table)
  - Bag Removal from the BRP
  - Transfer of Bag Information from BRP to BIS
  - Search for Unknown bags
- BHS system reporting – specifically the Daily EDS reports as outlined in Section 7.2.13.3
  - How to retrieve
  - How to interpret
- Reintroduction Line procedures
- Appendix
  - Description of operations document for the CBIS
  - Bag handling policy
  - Fail-safe Procedures
  - Jam procedures
- BHS Interface
- OTK Mode for IQT
- Protocol for coordination aspects between OSR and CBRA
  - The Local TSA will supplement the BHS training manuals with the following information:

- Train the OSARP refresher course (recommended)
- Provide applicable documented policies and SOPs
  - Correct ETD protocol for Unknown Bags
  - Proper protocol for alarm resolution
- Develop and train OOG procedures (valid vs. invalid)
- Update Staff Allocation Model to ensure proper staffing levels
- Ensure proper inventory of inspection station equipment (i.e. keys, tape, bolt cutter, box cutter)
- Confirm EDS unit location and serial number information for reporting purposes (PMIS, etc.)
- Specialized Screening – weapons, pets, etc.

A.5 CBIS OPERATIONS GUIDE – SAMPLE OUTLINE

The outline provided follows industry standards.

Title page

- Three letter code of the airport in which the system is located
- Title of Project
- Date of System (based on actual date of beneficial use)
- Project Number (as appropriate)

Fore Matter

- Record of Revisions
- Table of Contents

Chapter 1 - Operational Terms and Definitions

- Chapter Index
- Glossary of operation-related terms and equipment identification/designations
  - Manufacturer codes and abbreviations

  - Operational terminology and abbreviations
  - Symbols
- Other related information, such as
  - Conveyor ID marking rules
  - Equipment information needed for maintenance calls

Chapter 2 - System Overview

- Chapter Index
- System overview – high level description, diagrams
- Inputs – locations, number of and types of inputs
- Outputs – locations, number of and type of sort areas
- Functional areas and system design
  - Ticket counter
  - Oversize and out-of-gauge processing
  - CBIS and CBRA
  - Sortation system – BMAs, ATRs, manual encoding, makeup
  - Control stations
- System and subsystem conveyor designations
- Processing rate of each subsystem and the total system

Chapter 3 - Baggage Weight and Size Limitations

- Chapter Index
- Normal Size Baggage
- Baggage that can be processed by system but requires special considerations/handling (i.e., skis and golf bags)
- Fragile Baggage
- Oddsize Baggage

Chapter 4 - Detailed Description of System Operation

- Chapter Index
- Detailed operational description for each system and subsystem, with sufficient detail to provide operational personnel such as ticketing agents, service baggage handlers, skycaps, and TSA agents a thorough understanding of how to operate the system, including:
  - System start-up, shut down, operational stop/start control stations, jam reset and emergency stop operational requirements
  - Baggage loading procedures relative to placement of bar coded bag tags
  - System fault annunciation
  - Sortation controllers, computers and workstations
  - All graphic display information systems
  - Specific sortation controller operation
  - Placing equipment "in" or "out" of service
  - ATRs
  - BDDs
  - Hand held bar code scanner guns
  - Bag status displays
  - Creation of flight/sort assignment tables
  - All operator initiated reports
  - All system automatically generated reports
  - All system fault alarm messages and reports
  - Explanation of interaction with system, including:
    - Thorough explanation and purpose of each command message or report
    - Required keyboard or operator response
    - All operator interface command entries
- Operator's troubleshooting guide
- Procedures and recommendations for alternative modes of system operation as may be required due to various equipment or subsystem failures

Chapter 5 - Operational Safety

- Chapter Index
- Safety information related to the proper and safe operation of the specified system and its equipment from an operator's point of view reflecting the most current OSHA, ANSI and local code, policies and standards and covering at minimum:
  - Pre-operating procedure
  - Start-up and shut-down procedure
  - Emergency stop and restart procedure
  - Jam detection, jam clearance and restart procedure
  - Equipment lockout/tag-out procedures

A.6 BAGGAGE AND DATA FLOW CHARTS – GENERIC AND SPECIFIC EXAMPLES

Figure A-1 through Figure A-5 show generic examples of EDS/BHS/CBRA data flows with no ATR, upstream ATR, and downstream ATR, respectively.

Figure A-1: Detailed EDS/BHS/CBRA Data Flow – No ATR

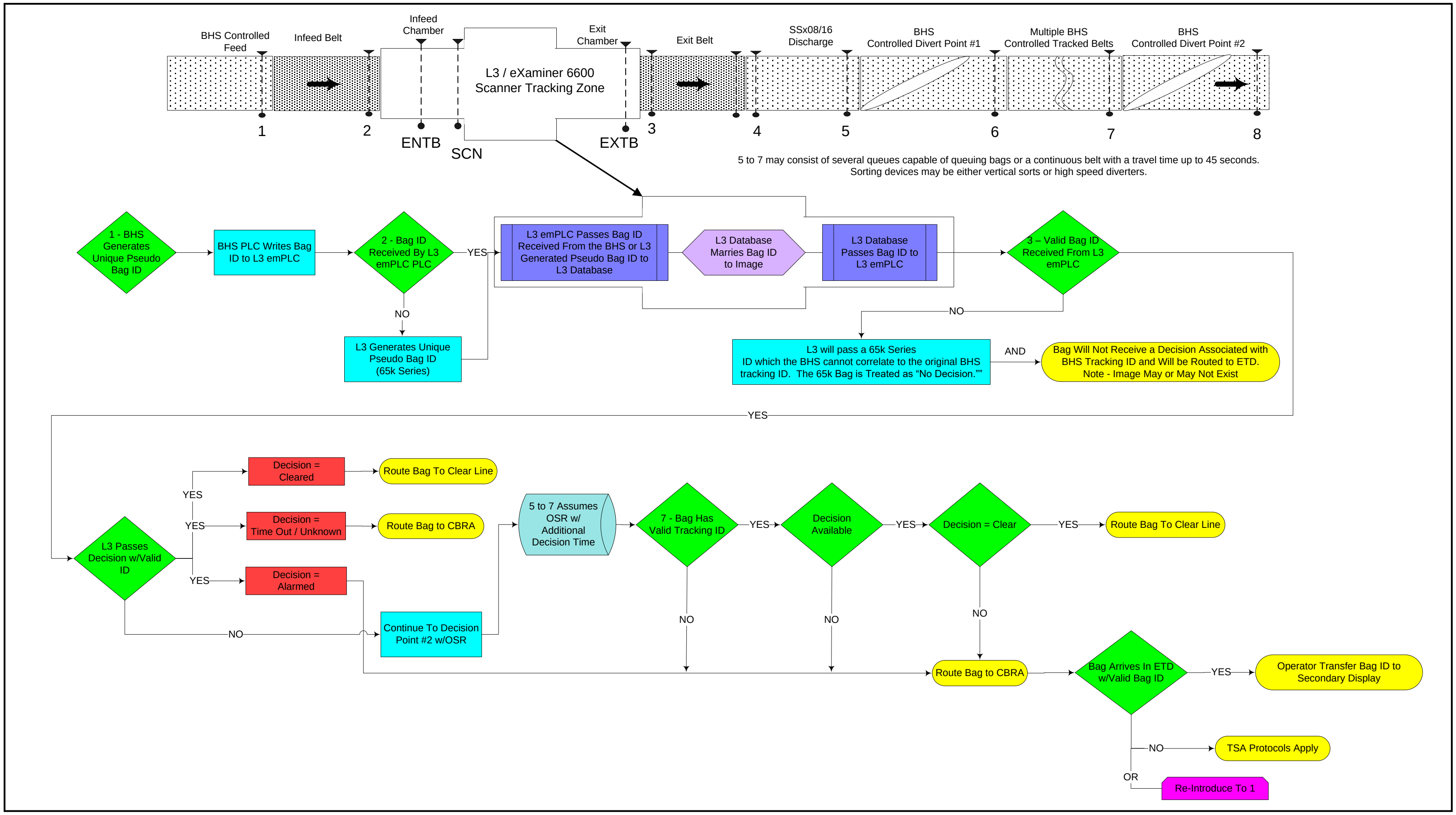


Figure A-2: Detailed EDS/BHS/CBRA Data Flow – Upstream ATR

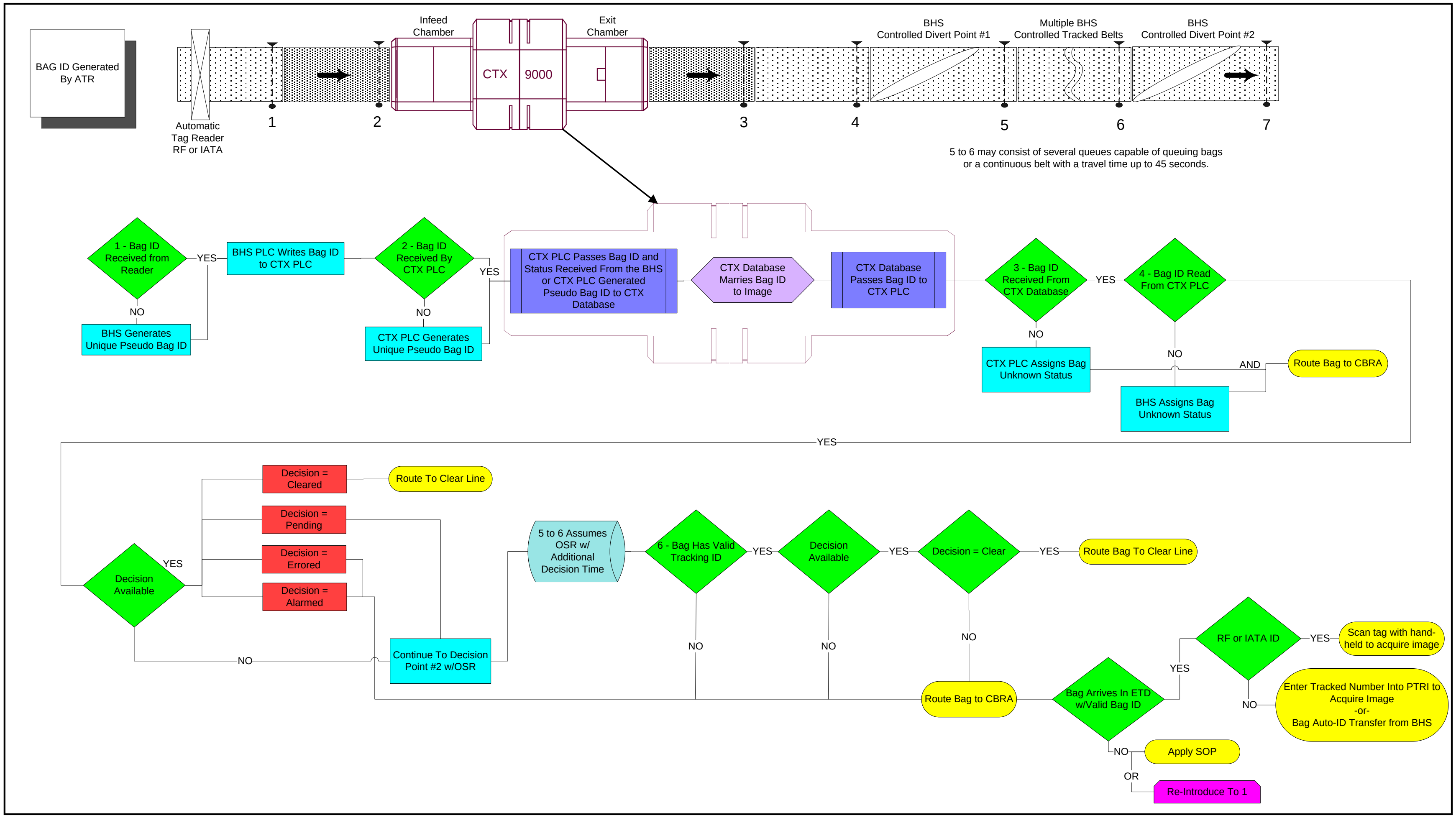


Figure A-3: Detailed EDS/BHS/CBRA Data Flow – Downstream ATR

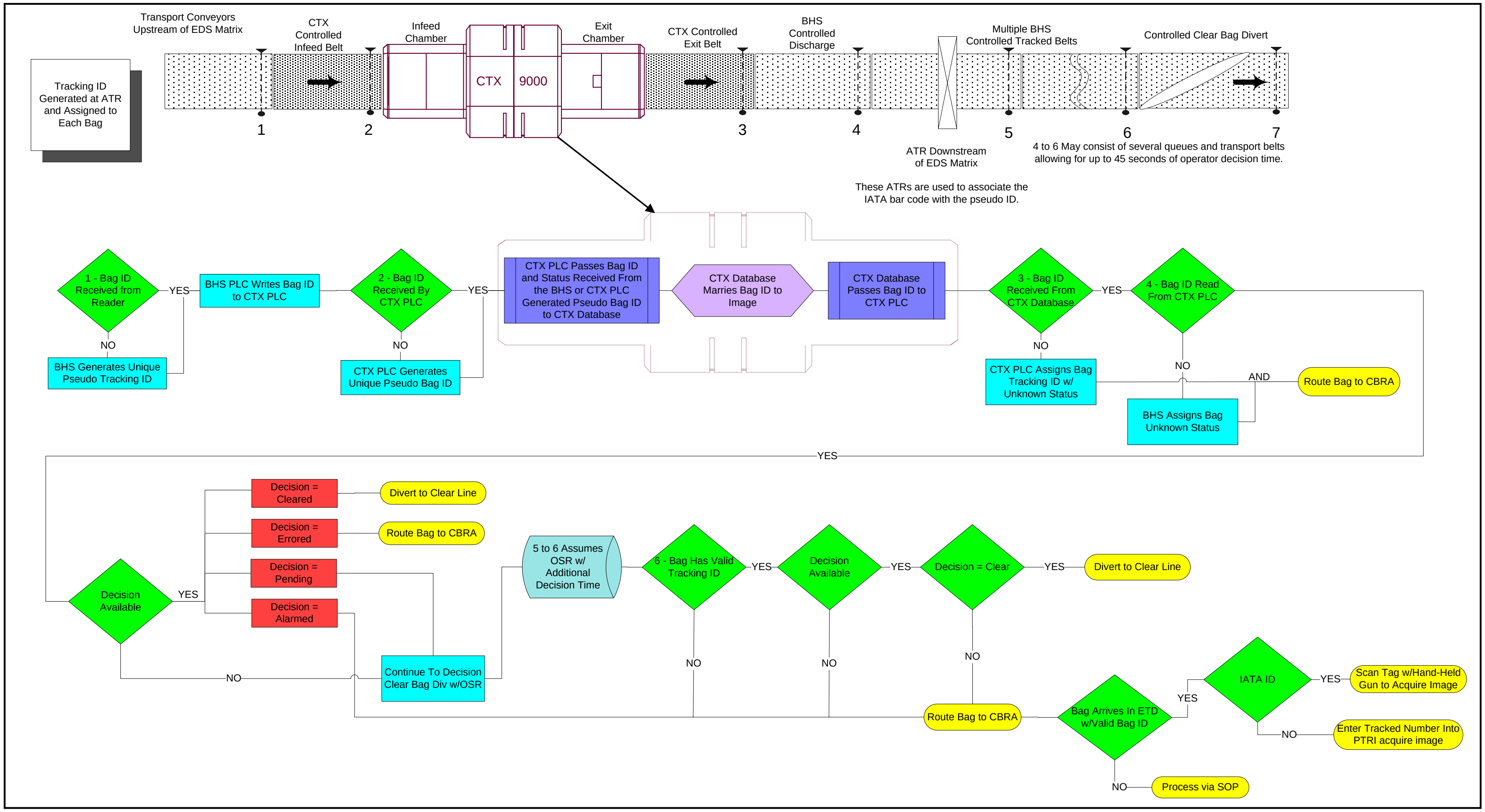


Figure A-4 shows the outbound baggage handling system flow chart for the International Terminal at San Francisco International Airport.

Figure A-4: Outbound BHS, International Terminal, San Francisco International Airport

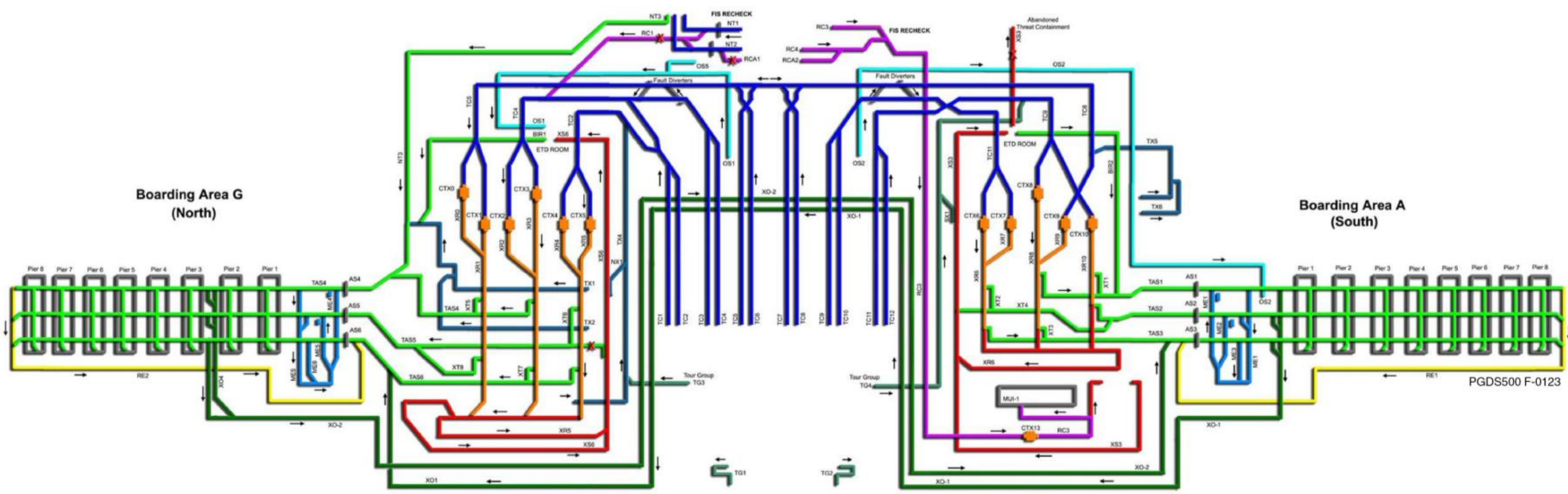
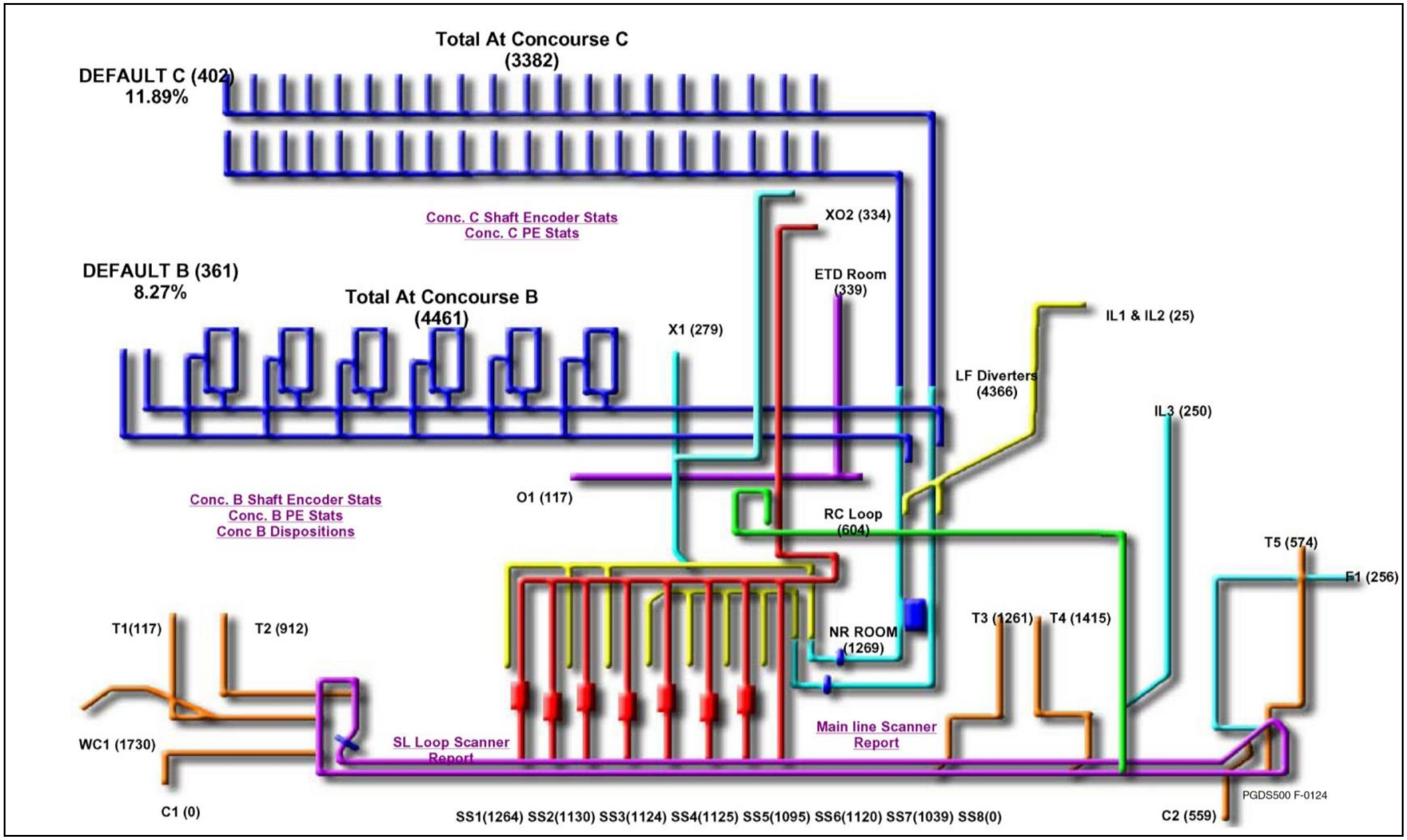


Figure A-5 shows the outbound baggage handling system flow chart for Terminal 8 at John F. Kennedy International Airport.

Figure A-5: Outbound BHS, Terminal 8, John F. Kennedy International Airport



A.7 CONFIGURATION MANAGEMENT PLAN OUTLINE

A configuration management plan is submitted following the outline below:

1 Introduction

1.1 Background

1.2 Purpose

1.3 Configuration Management Defined

2 Organizational Construct – Configuration and Organization Integration Baseline

2.1 Airport roles and responsibilities

2.2 TSA roles and responsibilities

2.3 Airlines roles and responsibilities

3 Configuration Control: Management, Organization, and Responsibilities

4 Configuration Control Board

4.1 Purpose

4.2 Organization and membership

4.3 Change Request Process and Protocol

4.4 Communications Management Plan

4.4.1 Post Commissioning Change Management

4.4.2 Documentation and Audit

A.8 DAILY CBIS REPORT EXAMPLES

The following report examples are intended to provide designers and programmers with formats and the level of detail necessary to meet the reporting requirements stated in Section 7.2.13.3. Reports that contain SSI will contain appropriate markings.

The Daily CBIS Summary Report – Peak Hour will be identical in layout to the Daily CBIS Summary Report in layout and metrics but the reporting period will be the rolling peak hour of each day.

Reports will include footers containing term definitions and any equations used for metric calculations to provide transparent data interpretation. These definitions and equations may differ from system to system and can depend on how the system is programmed to operate. Note that Figure A-6 and Figure A-9 show example footers with example definitions and calculations for illustrative purposes but are incomplete. Actual report footers will have definitions for each term on the report and all calculations. A separate page may be used if needed.

Figure A-6: Daily CBIS Summary Report

Transportation Security Administration

Daily CBIS Summary Report	
Screening System Name	[Text]
Terminal	[Text]
Airport	[Text]

Report Type	Daily	**Report Run Date**	**[Date/time]**
From	[Date/time]		
To	[Date/time]		

Total CBIS Baggage Throughput	0 bags
Average Time Bag in CBIS	0.0 minutes

1 Bag Volume		**In-Gauge**	**Out-of-Gauge**	**Oversize**	**Total**
Number of bags		0	0	0	0
Percentage of Total Bag Volume		0.00%	0.00%	0.00%	0.00%
2 CBIS/BHS Faults/Events		**Number**	**Down Time**	**Average Time to Clear**	
2A Faults					
	Pre-EDS Lost in Track	0	N/A	N/A	
	Post-EDS Lost in Track	0	N/A	N/A	
	Diverter/Door Failure	0	0:00:00	0:00:00	
	...	0	0:00:00	0:00:00	
2B Events					
	Jams	0	0:00:00	0:00:00	
	E-Stops	0	0:00:00	0:00:00	
	Fail-Safe	0	0:00:00	0:00:00	
	...	0	0:00:00	0:00:00	
	Total Faults/Events	0	0:00:00	0:00:00	
3 Bag Time in CBIS (Minutes)		**Average**	**Average**	**Average**	
		0.0	0.0	0.0	
4 Upstream tracking accuracy (%)		**Total**			
	IATA	0.0			
	OOG (Relative)	0.0			

Total CBIS Throughput = Total Bag Count of bags exiting the EDS machines during report time period

Bag time in CBIS = Single bag time from pre-EDS ATR to last chance diver or CBRA clear line

$$\text{Average Time Bag in CBIS} = \frac{\sum_{\text{Total CBIS Baggage Throughput}} \text{Bag time in CBIS}}{\text{Total CBIS Baggage Throughput}}$$

See Chapter 7 for reporting requirements

Pre-EDS Lost in Track is a bag lost between the pre-EDS ATR and the EDS. NO time is associated with this fault

Post-EDS Lost in Track is a bag lost between the EDS and the last chance divert or CBRA. No time is associated with this fault

A Diverter/Door Failure is recorded when...

...(to be completed for each category listed under Faults)

A Jam Event is recorded when a PEC is blocked for x seconds while the associated conveyor belt is running

An E-Stop event is recorded whenever an E-stop button is pressed (this can be further segmented based on e-stop location)

A Fail-Safe events recorded when the CBIS prevents the conveyance of any non-cleared bag to airside locations following a component failure

...(to be completed for each category listed under Faults)

Figure A-7: Daily CBIS Bag Volume Report

Transportation Security Administration

Daily CBIS Bag Volume Report

Screening System Name	[Text]
Terminal	[Text]
Airport	[Text]

Report Type	Daily	**Report Run Date**	**[Date/time]**
From	[Date/time]		
To	[Date/time]		

	Input Conveyors	**Number of Bags**	**Percentage**
1	TC1	0	
	TC2	0	
	Subtotal	0	0.00%
	CS	0	
	Subtotal	0	0.00%
	MIC	0	
	Subtotal	0	0.00%
	OS	0	
	Subtotal	0	0.00%
	Total	0	
2	**Sizing**		
	In-Gauge	0	0.00%
	Out-of-Gauge	0	0.00%
	Oversize	0	0.00%
	Total	0	

See Chapter 7
for reporting requirements

Figure A-8: CBIS Executive Summary Report

SENSITIVE SECURITY INFORMATION

Transportation Security Administration

CBIS Executive Summary Report

Screening System Name	TSIF CBSS
Airport	TSA Systems Integration Facility
Terminal	N/A

Report Type	Daily	**Report Run Date**	**2009-01-08 13:45**
From	2009-01-08 04:00		
To	2009-01-08 22:00		

EDS	Total	Machine Decisions					OSR Decisions					Bags tracked	Tracking
Machine	Bags	Total	Cleared	% Cleared	Alarmed	% Alarm	Total	Cleared	% Cleared	Alarmed	% Alarm	to CBRA	Accuracy %
EDS-SS1	2,056												99.85%
EDS-SS2	6,228												100.00%
EDS-SS3	6,302			SSI					SSI				99.94%
EDS-SS4	6,285												99.95%
EDS-SS5	6,283												100.00%
Total	27,154												99.96%

$$\text{Tracking accuracy} = \frac{\text{Total EDS Alarmed in the CBRA} + \text{Total OSR Alarmed in the CBRA}}{\text{Total EDS Alarmed} + \text{Total OSR Alarmed}}$$

See Chapter 7 for reporting requirements

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Figure A-9: CBRA Executive Summary Report

SENSITIVE SECURITY INFORMATION

Transportation Security Administration

CBRA Executive Summary Report

Screening System Name	TSIF CBSS
Airport	TSA Systems Integration Facility
Terminal	N/A

Report Type	Daily		**Report Run Date**	**2013-01-21 15:30**
From	2013-01-21	04:00		
To	2013-01-21	22:00		

Bag Status	**Total Bag**	
EDS Total Volume	27,154	
CBRA Total Volume	SSI	% of Total CBRA Volume
Cleared • Cleared (CLR) • PRE-Clear (P-CLR) • SEL-Clear (S-CLR) Alarmed • Alarmed (ALM) • PRE-Alarmed (P-ALM) • SEL-Alarmed (S-ALM) • No Decision • Purged • Queue Time Out (Q-TimeOut) • Operator Time Out (O-TimeOut) Lost in Tracking • Mistracked • Bag Length Tracking • Following Lost Bag • Too Close • Security Re-route Unscreened • OS • OOG	SSI	SSI
CBRA Bag totals	QTY	100%
CBRA Statistics	% of Total Bags to CBRA	CBRA Invalid Arrivals Rate
CBRA Error Rate	SSI	SSI

See Chapter 7 for reporting requirements

% of Total CBRA Volume for each category= Total # of Bags for each category arriving in CBRA/(Total CBRA Volume)
A Cleared Bag is a bag with either an EDS or Operator Clear decision that arrives in CBRA…*(to be completed for all categories listed)*
% of Total Bags to CBRA = Total CBRA Bags/(EDS Total Volume+OOG Bags+OS Bags)
CBRA Error Rate = (Sum of… *list all Invalid categories*)/(Total CBRA Volume)

WARNING: This record contains Sensitive Security Information that is controlled under 49 CFR parts 15 and 1520. No part of this record may be disclosed to persons without a "need to know" as defined in 49 CFR parts 15 and 1520, except with the written permission of the Administrator of the Transportation Security Administration, or the Secretary of Transportation. Unauthorized disclosure may result in civil penalty or other action. For U.S. Government agencies, public release is governed by 5 U.S.C. 552 and 49 CFR parts 15 and 1520.

Figure A-10: PEC Tracking Report

Transportation Security Administration

PEC TRACKING REPORT

Screening System Name	[Text]
Terminal	[Text]
Airport	[Text]

Report Type	Daily	**Report Run Date**	**[Date/time]**
From	[Date/time]		
To	[Date/time]		

Photocell	Bags	Unknown bags	Missing Bags	Jams	Missing Bag Jams	Purged Bags
PE_AL-01	0	0	0	0	0	0
PE_AL-02	0	0	0	0	0	0
PE_AL-03	0	0	0	0	0	0
PE_AL-04	0	0	0	0	0	0
PE_AL-05	0	0	0	0	0	0
PE_AL-06	0	0	0	0	0	0
PE_AL-07	0	0	0	0	[illegible]	[illegible]
PE_AL-08	0	0	0	0	[illegible]	[illegible]
PE_AL-09	0	0	0	0	[illegible]	[illegible]
PE_AL-10	0	0	0	0	0	0

See Chapter 7
for reporting requirements

Figure A-11: CBRA Bag Process Timer Report

Transportation Security Administration

CBRA Bag Process Timer Report

Screening System Name	[Text]
Airport	[Text]
Terminal	[Text]

Report Type	Daily	**Report Run Date**	**[Date/time]**
From	[Date/time]		
To	[Date/time]		

	BPT Statistics			BPT Distribution					
Bag Type	Total Bag Count	CBRA Bag Total %	Average Time	% 0-60 sec	% 60-120 sec	% 120-180 sec	% 180-240 sec	% 240 – 300 sec	% 300+sec
Alarm									
Clear									
Unknown				SSI					
Error									
OOG									

	BPT Statistics			BPT Distribution					
Operator	Total Bag Count	CBRA Bag Total %	Average Time	% 0-60 sec	% 60-120 sec	% 120-180 sec	% 180-240 sec	% 240 – 300 sec	% 300+sec
				SSI					

See Chapter 7
for reporting requirements

BPT Statistics percentages based on total number of bags sent to CBRA
BPT Distribution percentages based on total number of bags sent to CBRA for that Bag Type or processed by that Operator

Figure A-12: CBRA Bag Report

Transportation Security Administration

CBRA Bag Report

Screening system Name [Text]
Airport [Text]
Terminal [Text]

Report Type Daily
From Date/time]
To Date/time]

Report Run Date **[Date/time]**

Date	Start Time	End Time	Duration (sec)	IATA or Pseudo ID	Bag Type	Operator	Station
5/23/2015	8:15:23	8:17:11	108	1234567890	Alarm	SmithJ	1

See Chapter 7
for reporting requirements

A.9 CBIS CHANGE REQUEST

A.9.1 Change Request Parameters

A change request can be submitted for the following changes:

- Mechanical and electrical drawings
- PLC program pre-change
- PLC program post-change
- Configuration management process
- Testing procedures
- Mitigation/recovery/contingency plan
- Schedule
- Expected results

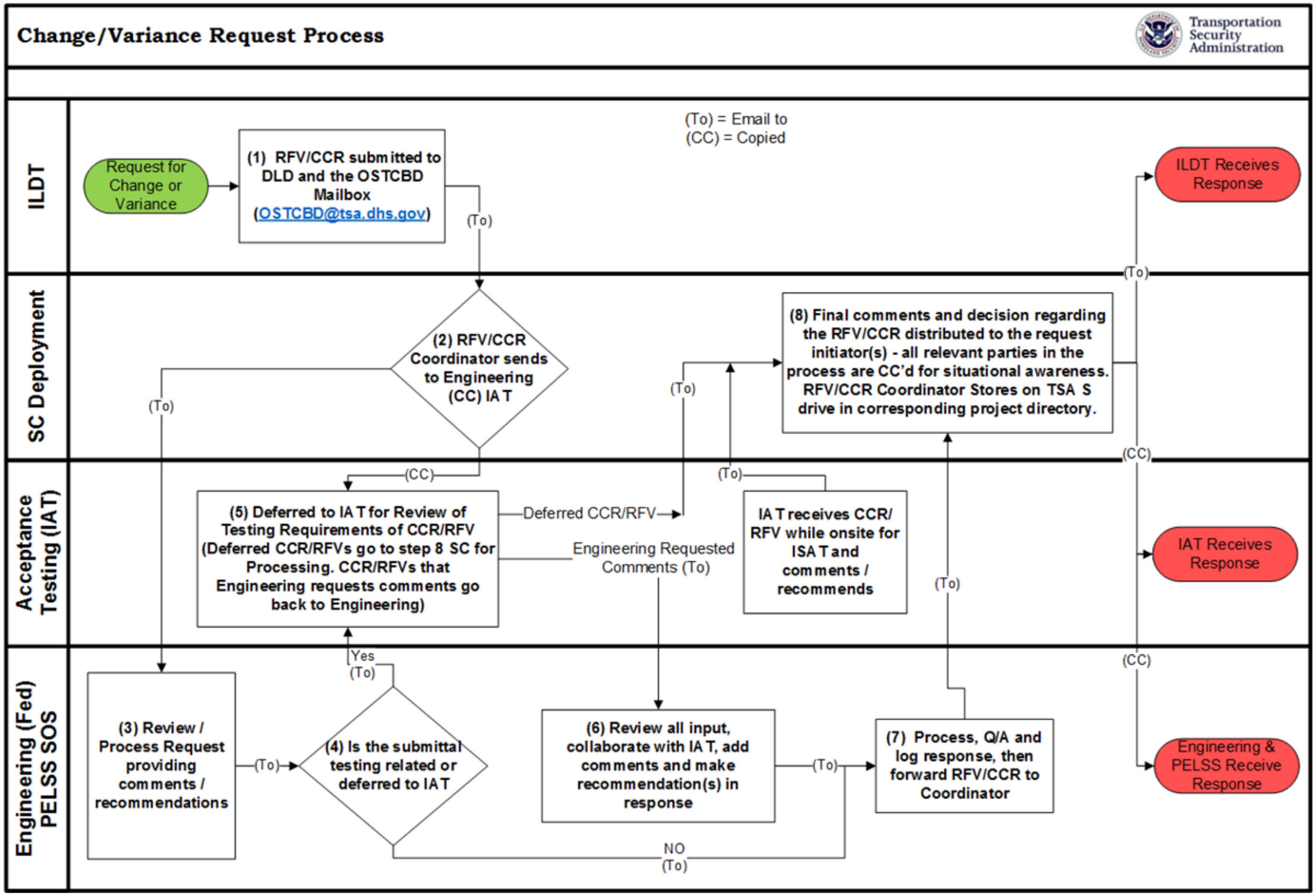
PLC or computer code changes to the CBIS are defined as:

- Any change that may affect any portion of the system throughput feeding either into or out of the CBIS
- Any change that may affect bag presentation to the EDS units (e.g., merges upstream too close causing double bags to enter)
- Any change to the EDS interface or to how the BHS handles the bag IDs and decisions
- Any change to the CBIS tracking model (i.e., shaft encoding pulses, merges downstream allowing one bag to encroach into another bag's tracking window)
- Any changes to the bag allocation method
- Any change of any type from the exit of the EDS unit to the last clear bag divert point
- Any change of any type after the last chance divert point into the CBRA including the CBRA

The request for changes is submitted to TSA SOS Engineering at OSTCBD@tsa.dhs.gov.

Figure A-13 contains a flow chart that illustrates the overall change request process.

Figure A-13: Change/Variance Request Process



A.9.2 CBIS Change Request Example

The following is an example of a Change Request document provided by Siemens. Designers should follow the same outline when they submit a design change request.

A.9.2.1 Introduction

The purpose of this document is to describe the changes of the PLC code to be reviewed and approved by TSA or authorized agent.

A.9.2.2 Proposed Change Description

A.9.2.2.1 Purging of the Reconciliation Lookup Table for IR Bag

A.9.2.2.1.1 Detected Problem

When a bag arrives at CBRA with Unknown status it can be reintroduced in the system through the RI line. At the RI, the 10-digit IATA bag tag is scanned using a hand scanner or entered using the station display. Once scanned, the bag is tracked to EDS2 line and handled just like a new bag introduced at the ticket counter and scanned by ATR.

BHS includes a reconciliation scanner ATR SB1. The purpose of this scanner is to reconcile bags with the EDS decision when a bag is lost between exit of EDS and ATR SB1.

Because of the reconciliation process, special attention has to be paid to the reinserted bags that are screened twice. Procedure has to include provisions to prevent conditions when the bag on the first pass is cleared, on the second pass is alarmed, is lost in tracking downstream from the EDS and reconciled to the first clear decision. Algorithm of the current program handles this issue correctly. However, in order to completely avoid possibility of the manual intervention in the reconciliation process, additional safeguards are introduced.

A.9.2.2.1.2 Corrective Action

The 10-digit IATA bag tag of the re-inducted bag will be purged from the reconciliation table in order to guarantee that the bag will never reconcile with data from the first screening process.

Procedure was added to re-induct functionality (FC98, Network 69) to search through the look up table and delete the record created by the first screening.

A.9.2.2.1.3 Testing Procedure

In order to validate the requested change the following test procedures will be performed:

1. Introduce a suspect bag upstream of ATR EDS2
2. Clear bag status from OSR after 10 sec to make sure that bag is routed to SB line
3. 3Delay bag at SB1-07 just after ATR SB1 to create loss of tracking
4. Re-induct bag from RI1-01
5. Verify that bag is Alarmed by EDS
6. Delay bag on SB1-02 to create loss of tracking
7. Verify that bag is reconciled on ATR SB1 to the Alarmed status and routed to CBRA

A.9.2.2.2 Adjustment of Tracking Parameters for SS3

A.9.2.2.2.1 Detected problem

During high volume baseline test bag ID exchange was detected on SS3-01. After analysis of the Bag History Report and CCTV recording it was determined that main reason was insufficient gap between bags created at the Ticket Counter merge leading to bag collisions.

Merge window parameters were adjusted and additional gapping introduced on the queue conveyors just downstream of the merge TC1-TC4.

A.9.2.2.2.2 Corrective Actions

In addition to already mentioned changes measures following adjustment are proposed:

1. Increase Run Time delay on EDS1-08 to allow downstream conveyors to clear before restarting EDS line and minimize possible tracking losses
2. Decrease Missing bag detection timer to improve tracking loss detection

A.9.2.2.2.3 Testing Procedure

Perform Added Bag Test on Zone 1A and 1B for the SS3 line.

Added bag test will be performed according to SSTP procedures.

A.9.2.3 EDS1-08 Stops When SS2 is Unavailable

A.9.2.3.1 Detected Problem

South Security Matrix consists of three lines SS1 – SS3. When SS2 becomes unavailable it also stops conveyor feeding all three lines - EDS1-08, even if SS3 is still available. A_Takeaway_Running parameter defines the name of the downstream conveyor in straight direction that needs to available for EDS1-08 to run. Parameter review showed that it was set to incorrect value.

A.9.2.3.2 Corrective Action

A_Takeaway_Running parameter needs to point to a conveyor downstream from EDS1_08. Replace the Current A_Takeaway_Running with the true A destination SS3_01.Running Forward. This will ensure that EDS1-08 will continue to run as long as SS3 is available.

A.9.2.3.3 Testing Procedure

1. Disable the SS2 line.
2. Place HSD-SS2 is in Automatic mode.

Expected Result: EDS1-08 to continue to run until SS3 become full.

A.9.3 CBIS Change Request Form

Figure A-14 contains the CBIS Change Request Form.

Figure A-14: CBIS Change Request Form

CBIS Change Request							
TRR ☐		iSAT ☐		Post Com. ☐			
Airport Code:			Bag Room / CBIS				
Requested By:	Name:			Company:			
	Phone:			Email:			
BHS Installer / Maintenance	Name:			Company:			
	Phone:			Email:			
BHS Controls Support:	Name:			Company:			
	Phone:			Email:			
Date of Request:							
Type of Integration:	Fully ☐		Semi ☐	Mini ☐		Other ☐	
Affected Area	Security Tracking Zone (STZ) ☐		Non-STZ ☐	Pre-EDS ☐		Post-EDS ☐	CBRA ☐
EDS Type, Model & Quantity							
Change Description:							
Detected Problem:							
Proposed Corrective Action/Change:							
Describe Testing to verify Change:							
Implementation Time (man hrs)							
Engineering Reviewer				Date:			
Engineering Comments							
Engineering Disposition	Approved ☐		Disapproved ☐	Deferred to IAT ☐		Deferred to DC ☐	
Change Validation Required (CVR)	DLD Site Lead ☐		TSA LOCAL ☐	TSA OSC ☐		Extended (Add to CRV Comments) ☐	
Validation Type	Remote Analysis ☐		Live Operations ☐	Non-Operational Hours ☐		Other (Add to CRV Comments) ☐	
CRV Comments							
Deployment Coordinator (DC)				Date:			
DC Comments							
DC Disposition	Approved ☐		Disapproved ☐	Deferred ☐			

The approval to implement the changes noted above does not constitute a change in the contract, or commit additional funding to the project. Contract modifications can only be made by the TSA Contracting Officer.

(If a response or additional information is requested from the TSA and not received within 48 hours the CCR will be returned as rejected due to insufficient information)

A.10 MIA CBIS PLC CODE CHANGE PROPOSAL EXAMPLE

The following section showing an example of a Siemens CBIS Change Request Form has been reproduced and reformatted with permission.

A.10.1 Introduction

A.10.1.1 Contributors

Name/Function	Company	Department
Dave Suarez	Siemens	Controls Lead
Keith Oliver	Siemens	SR. System Engineer
Ramdas Kulal	Siemens	Controls Engineer
Rodney Maynard	Siemens	SR. System Engineer

A.10.1.2 Purpose

The purpose of this document is to submit change request to TSA to modify locked down MIA PLC code for items found during pre-ISAT, ISAT, final system testing, or by new change request issued to Siemens. This document includes changes to all screening matrixes contained within the MIA BHS system. The content of this document include changes that are needed to correct issues and to add functionality that is required per the contract for the MIA BHS system. These change requests are the result of punch list items or observed conditions that are not functionally correct or base scope requirements of the contract. The Additional Faults for the T1, T2 and T3 Doors is scope that has been added to Siemens via change request to allow the airport to meet security requirements needed prior to live operations.

A.10.2 Remove Bit from X5 Door Clear Fault Logic

A.10.2.1 Area controlled by Change Requested PLC

PLC	MCP	CONV	Area Controlled
32	MCP-14	X5-1, X5-2	East Matrix/Central Matrix

A.10.2.2 Executive Summary of Changed Impact

Effect on SSTP tested Area	None
Effect on Tracking in the SSTP Tested Area	None
Effected PLC	PLC-32
Tested with Battelle (with current code)	Yes

A.10.2.3 Problem Detected

The door clear fault does not come on until the discharge conveyor of X5-2 is running which is down stream of the door X5-1.

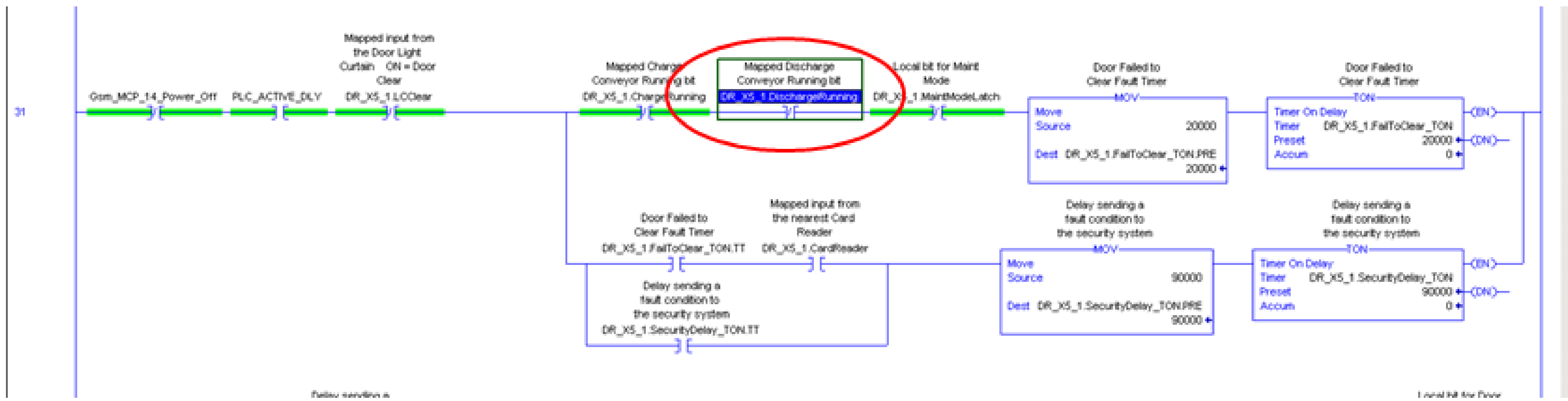
A.10.2.4 Corrective Action

The contact of "DR_X5_1.DischargeRunning" needs to be removed from the logic for the door clear fault.

NOTE: All A & B PLC's will need to be updated with the same changes.

A.10.2.5 Current PLC Code

The screen shot below shows the PLC code in its current configuration in Routine "MCP_14_X5_Door" rung 31.



A10.2.6 Proposed Change

The contact of "DR_X5_1.DischargeRunning" needs to be removed from the logic for the door clear fault.

A.10.3 Remove Temporary Logic from the C1 Door

A.10.3.1 Area controlled by Change Requested PLC

PLC	MCP	CONV	Area Controlled
19	MCP-92	C1 Door Logic	East Matrix/Central Matrix

A.10.3.2 Executive Summary of Changed Impact

Effect on SSTP tested Area	None
Effect on Tracking in the SSTP Tested Area	None
Effected PLC	PLC-19
Tested with Battelle (with current code)	Yes

A.10.3.3 Problem Detected

Temporary bit signal disables the proper functionality of the door for the door faults. This bit was used for the testing and was never removed.

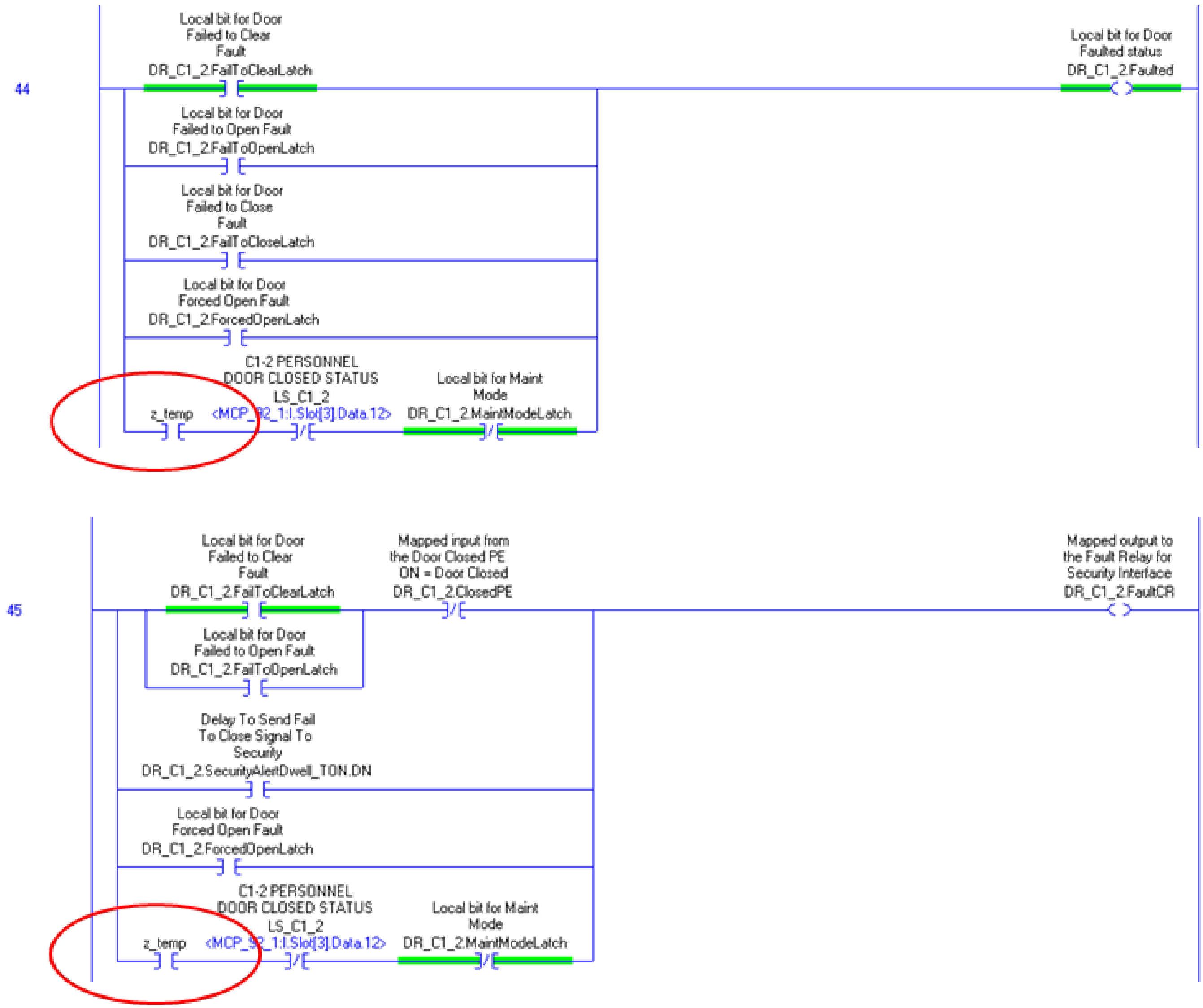
A.10.3.4 Corrective Action

Remove the “Z_temp” signal bit from the logic for the door fault. No other graphics changes required, as well this change is not going to affect the tracking in this PLC.

NOTE: All A & B PLC’s will need to be updated with the same changes.

A.10.3.5 Current PLC Code

The screen shot below shows the PLC code in its current configuration in Routine “MCP_92_C1_2_Door” rung 44 and 45.


44
Local bit for Door Failed to Clear Fault
DR_C1_2.FailToClearLatch
Local bit for Door Failed to Open Fault
DR_C1_2.FailToOpenLatch
Local bit for Door Failed to Close Fault
DR_C1_2.FailToCloseLatch
Local bit for Door Forced Open Fault
DR_C1_2.ForcedOpenLatch
z_temp
C1-2 PERSONNEL DOOR CLOSED STATUS
LS_C1_2
<MCP_32_1:I.Slot[3].Data.12>
Local bit for Maint Mode
DR_C1_2.MaintModeLatch
Local bit for Door Faulted status
DR_C1_2.Faulted
45
Local bit for Door Failed to Clear Fault
DR_C1_2.FailToClearLatch
Local bit for Door Failed to Open Fault
DR_C1_2.FailToOpenLatch
Mapped input from the Door Closed PE ON = Door Closed
DR_C1_2.ClosedPE
Delay To Send Fail To Close Signal To Security
DR_C1_2.SecurityAlertDwell_TON.DN
Local bit for Door Forced Open Fault
DR_C1_2.ForcedOpenLatch
z_temp
C1-2 PERSONNEL DOOR CLOSED STATUS
LS_C1_2
<MCP_32_1:I.Slot[3].Data.12>
Local bit for Maint Mode
DR_C1_2.MaintModeLatch
Mapped output to the Fault Relay for Security Interface
DR_C1_2.FaultCR

A.10.3.6 Proposed Change

Remove the “Z_temp” bit from both rungs 44 and 45.

A.10.4 Remove AFI from T5 Door Logic

A.10.4.1 Area controlled by Change Requested PLC

PLC	MCP	CONV	Area Controlled
40	MCP-21	T5-4	East Matrix/Central Matrix

A.10.4.2 Executive Summary of Changed Impact

Effect on SSTP tested Area	Yes
Effect on Tracking in the SSTP Tested Area	No
Effected PLC	PLC-40
Tested with Battelle (with current code)	Yes

A.10.4.3 Problem Detected

The T5-4 door failed to open fault did not work during testing with MDAD and it was found that the fault had been disabled with an AFI in the logic.

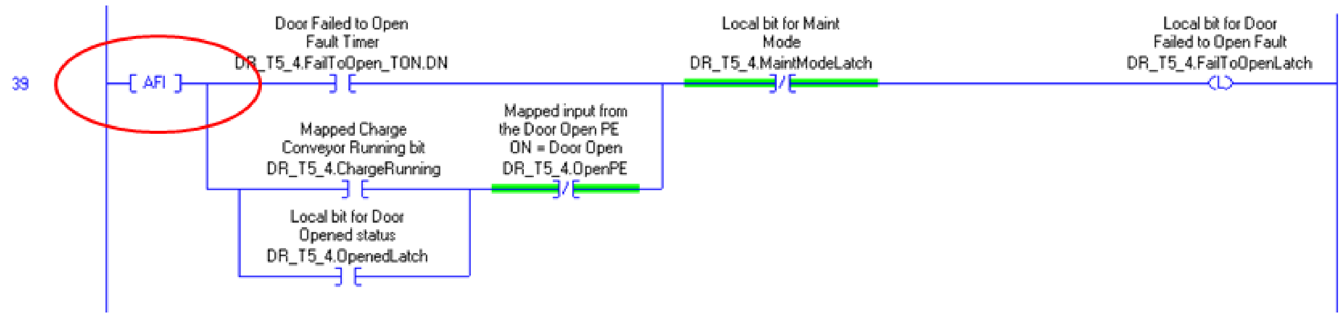
A.10.4.4 Corrective Action

Remove the AFI in the PLC logic. No other graphics changes required, as well this change is not going to affect the tracking in this PLC.

NOTE: All A & B PLC’s will need to be updated with the same changes.

A.10.4.5 Current PLC Code

The screen shot below shows the PLC code in its current configuration in Routine “MCP_21_T5_4_Door” rung 39.



A.10.4.6 Proposed Change

Remove the "AFI" from rung 39.

A.10.5 Change First Scan Delay Timer Preset

A.10.5.1 Area Controlled by Change Requested PLC

PLC	MCP	CONV	Area Controlled
PLC-32B, PLC-11B, PLC-13B, PLC-19B, PLC-22B, PLC-24B, PLC-27B, PLC-28B, PLC-33B, PLC-34B, PLC-37B, PLC-38B, PLC-39B, PLC-40B, PLC-42B, PLC43B, PLC-44B, PLC-45B	NA	NA	East Matrix/ Central Matrix/West Matrix/Cruise Matrix

A.10.5.2 Executive Summary of Changed Impact

Effect on SSTP tested Area	Yes
Effect on Tracking in the SSTP Tested Area	No
Effected PLC	PLC-32B, PLC-11B, PLC-13B, PLC-19B, PLC-22B, PLC-24B, PLC-27B, PLC-28B, PLC-33B, PLC-34B, PLC-37B, PLC-38B, PLC-39B, PLC-40B, PLC-42B, PLC43B, PLC-44B, PLC-45B
Tested with Battelle (with current code)	Yes

A.10.5.3 Problem Detected

The PLC pairs have a minor issue during the process of synchronizing the PLC's. The B set of all PLC's are to be set .5 seconds longer on the First_Scan_Delay Timer so that the A PLC will always become the active primary.

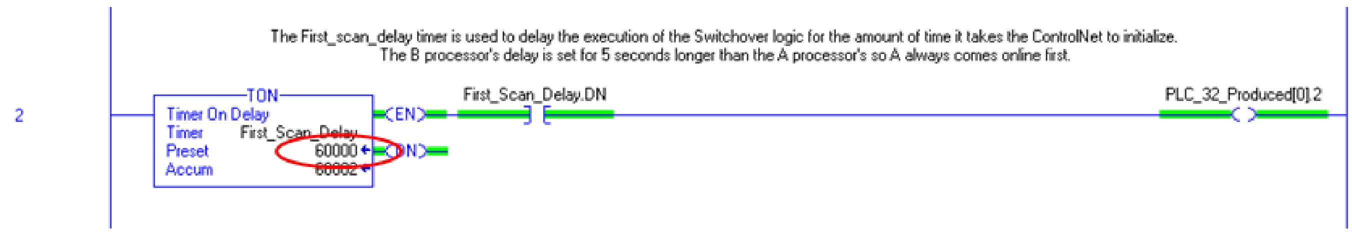
A.10.5.4 Corrective Action

Change the preset of the First_Scan_Delay Timer from 60000 to 65000 (6 seconds to 6.5 seconds).

NOTE: All A & B PLC's will need to be updated with the same changes.

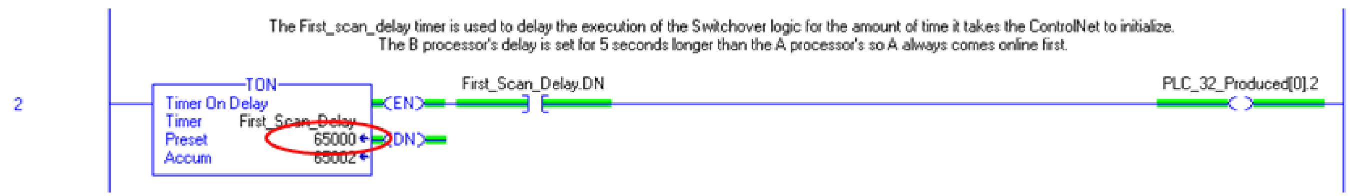
A.10.5.5 Current PLC Code

The screen shot below shows the PLC code in its current configuration in Routine "Switch_Over_Logic" rung 2.



A.10.5.6 Proposed Change

Changed timer preset to 65000.



A.10.6 Add Additional Faults for the T1, T2 and T3 Doors

A.10.6.1 Area controlled by Change Requested PLC

PLC	MCP	CONV	Area Controlled
19	108, 3, 4	T1, T2, and T3 door	East Matrix Central Matrix

A.10.6.2 Executive Summary of Changed Impact

Effect on SSTP tested Area	Yes
Effect on Tracking in the SSTP Tested Area	No
Effected PLC	PLC-19
Tested with Battelle (with current code)	Yes

A.10.6.3 Problem Detected

The fire doors of T1, T2, and T3 are existing doors and do not have the functionality required to support live operations. Under a change request issued by MDAD to Siemens the door faults “Failed to Clear” and “Forced Open” are to be added.

A.10.6.4 Corrective Action

Add the logic for the door faults of “Failed to Clear” and “Forced Open.”

NOTE: All A & B PLC’s will need to be updated with the same changes.

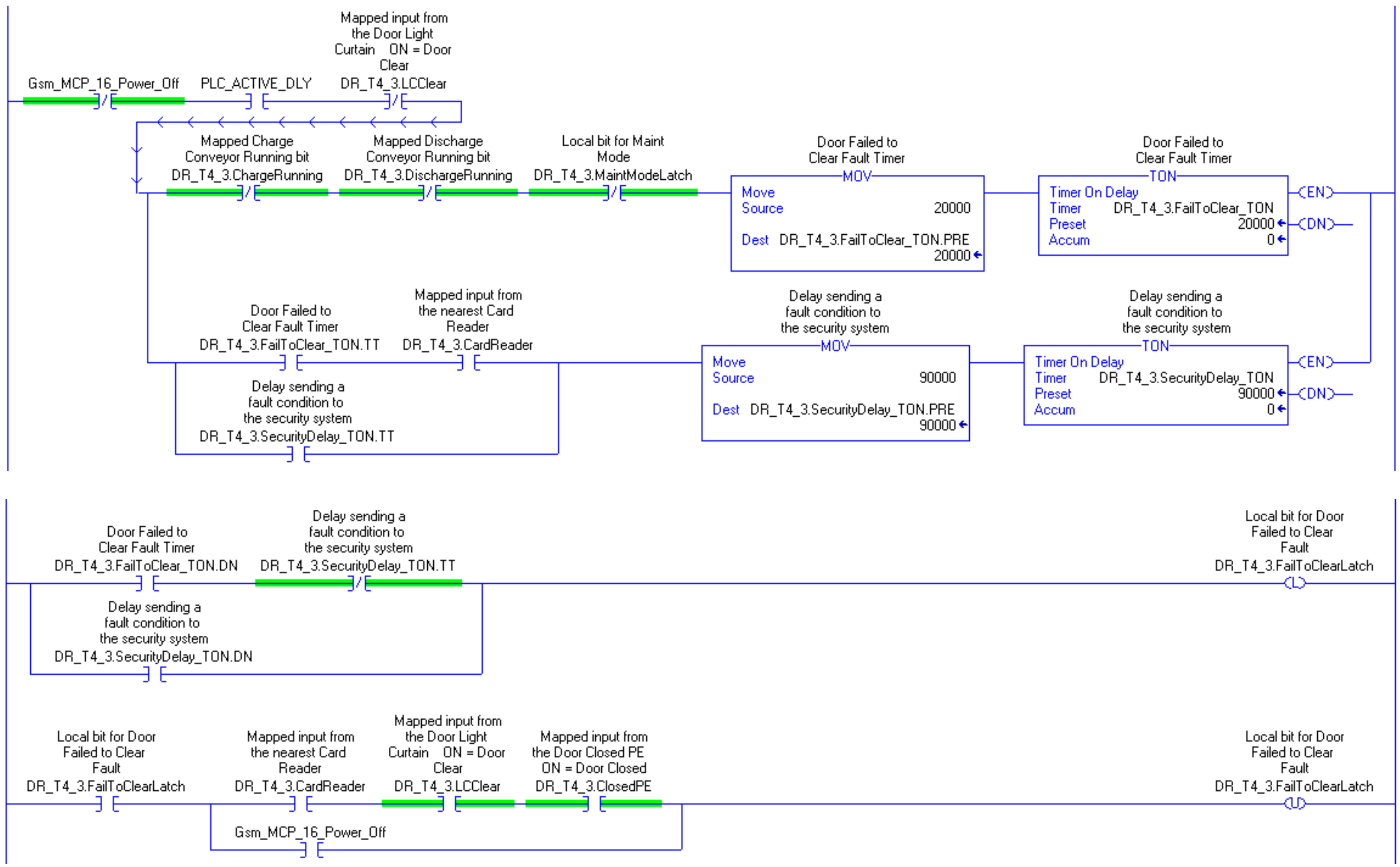
A.10.6.5 Current PLC Code

Current PLC code for these faults do not exist for these doors and will have to be added. Logic from other doors such as T4 will be used to create the logic for these new faults. Section A.10.6.6 represents the changes that will be required and is used as an example for the logic to be implemented.

A.10.6.6 Proposed Change

The below screen shots are from PLC 32 T4-3 door logic and represents the logic that will be used to implement the new faults that will be used on the T1, T2, and T3 doors.

Door Failed to clear logic.



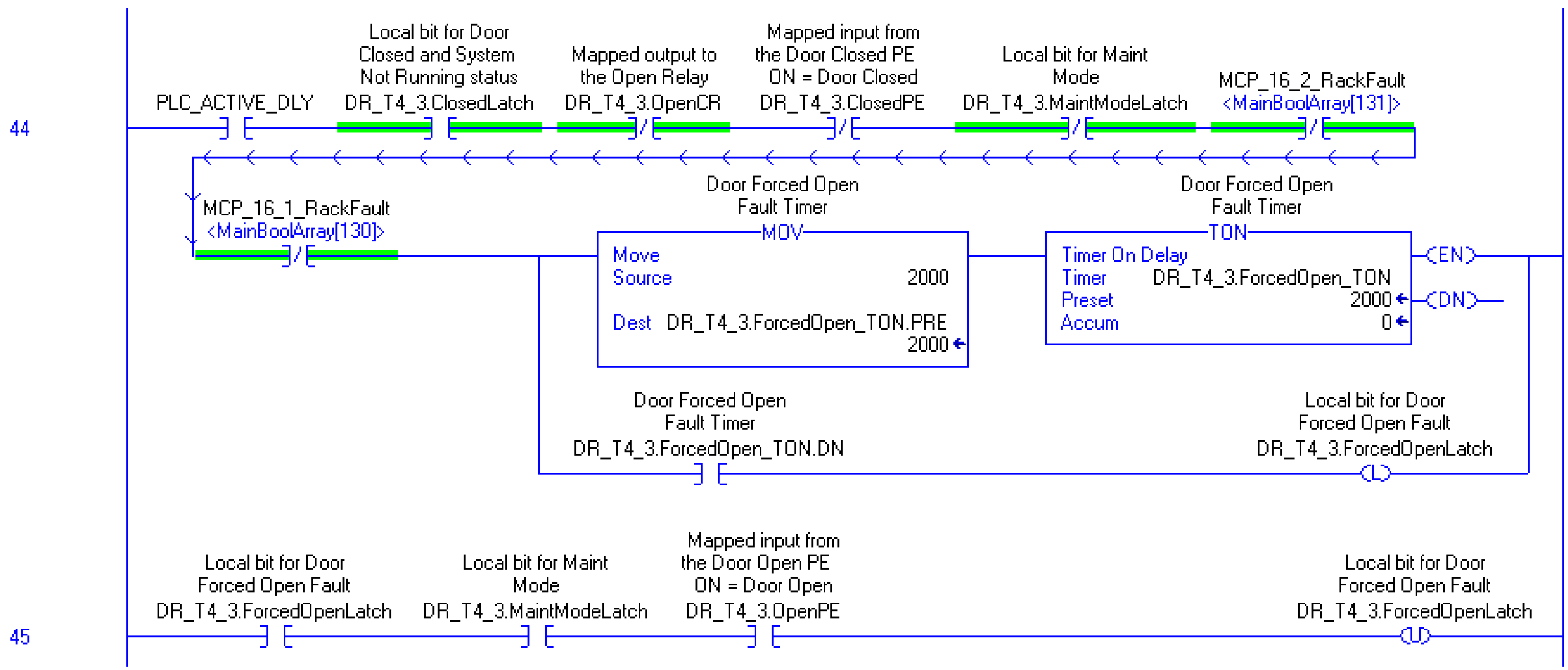
Mapped input from the Door Light Curtain ON = Door Clear
Gsm_MCP_16_Power_Off
PLC_ACTIVE_DLY
DR_T4_3.LCClear
Mapped Charge Conveyor Running bit
DR_T4_3.ChargeRunning
Mapped Discharge Conveyor Running bit
DR_T4_3.DischargeRunning
Local bit for Maint Mode
DR_T4_3.MaintModeLatch
Door Failed to Clear Fault Timer
MOV
Move
Source 20000
Dest DR_T4_3.FailToClear_TON.PRE
20000
Door Failed to Clear Fault Timer
TON
Timer On Delay
Timer DR_T4_3.FailToClear_TON
Preset 20000
Accum 0
EN
DN
Door Failed to Clear Fault Timer
DR_T4_3.FailToClear_TON.TT
Mapped input from the nearest Card Reader
DR_T4_3.CardReader
Delay sending a fault condition to the security system
DR_T4_3.SecurityDelay_TON.TT
Delay sending a fault condition to the security system
MOV
Move
Source 90000
Dest DR_T4_3.SecurityDelay_TON.PRE
90000
Delay sending a fault condition to the security system
TON
Timer On Delay
Timer DR_T4_3.SecurityDelay_TON
Preset 90000
Accum 0
EN
DN
Door Failed to Clear Fault Timer
DR_T4_3.FailToClear_TON.DN
Delay sending a fault condition to the security system
DR_T4_3.SecurityDelay_TON.TT
Delay sending a fault condition to the security system
DR_T4_3.SecurityDelay_TON.DN
Local bit for Door Failed to Clear Fault
DR_T4_3.FailToClearLatch
L
Local bit for Door Failed to Clear Fault
DR_T4_3.FailToClearLatch
Mapped input from the nearest Card Reader
DR_T4_3.CardReader
Mapped input from the Door Light Curtain ON = Door Clear
DR_T4_3.LCClear
Mapped input from the Door Closed PE ON = Door Closed
DR_T4_3.ClosedPE
Gsm_MCP_16_Power_Off
Local bit for Door Failed to Clear Fault
DR_T4_3.FailToClearLatch
U

The Failed to clear latch is used in multiple places in the program and the screen shot below represents all locations.

Name: DR_T4_3.FailToClearLatch   Refresh

Element	Container	Routine	Location	Reference	BaseTag	Destructive	Description
OTL	MainProgram	MCP_16_T4_3_Door	Rung 35	DR_T4_3.FailToClearLatch		Y	Local bit for Door Failed to Clear Fault
OTU	MainProgram	MCP_16_T4_3_Door	Rung 36	DR_T4_3.FailToClearLatch		Y	Local bit for Door Failed to Clear Fault
XIC	MainProgram	MCP_16_T4_3_Door	Rung 36	DR_T4_3.FailToClearLatch		N	Local bit for Door Failed to Clear Fault
XIC	MainProgram	MCP_16_T4_3_Door	Rung 46	DR_T4_3.FailToClearLatch		N	Local bit for Door Failed to Clear Fault
XIC	MainProgram	MCP_16_T4_3_Door	Rung 47	DR_T4_3.FailToClearLatch		N	Local bit for Door Failed to Clear Fault
XIC	MainProgram	MCP_16_T4_3_Door	Rung 50	DR_T4_3.FailToClearLatch		N	Local bit for Door Failed to Clear Fault
OTE	Software_Redundancy	Sync_Status	Rung 236	DR_T4_3.FailToClearLatch		Y	Local bit for Door Failed to Clear Fault
XIC	Software_Redundancy	Write_Status	Rung 236	DR_T4_3.FailToClearLatch		N	Local bit for Door Failed to Clear Fault

Door Forced Open logic.



Forced Open latch is used in multiple places in the program and the screen below shot represents all locations.

Name: DR_T4_3.ForcedOpenLatch   Refresh

Element	Container	Routine	Location	Reference	BaseTag	Destructive	Description
OTL	MainProgram	MCP_16_T4_3_Door	Rung 44	DR_T4_3.ForcedOpenLatch		Y	Local bit for Door Forced Open Fault
OTU	MainProgram	MCP_16_T4_3_Door	Rung 45	DR_T4_3.ForcedOpenLatch		Y	Local bit for Door Forced Open Fault
XIC	MainProgram	MCP_16_T4_3_Door	Rung 45	DR_T4_3.ForcedOpenLatch		N	Local bit for Door Forced Open Fault
XIC	MainProgram	MCP_16_T4_3_Door	Rung 46	DR_T4_3.ForcedOpenLatch		N	Local bit for Door Forced Open Fault
XIC	MainProgram	MCP_16_T4_3_Door	Rung 47	DR_T4_3.ForcedOpenLatch		N	Local bit for Door Forced Open Fault
XIC	MainProgram	MCP_16_T4_3_Door	Rung 50	DR_T4_3.ForcedOpenLatch		N	Local bit for Door Forced Open Fault
OTE	Software_Redundancy	Sync_Status	Rung 239	DR_T4_3.ForcedOpenLatch		Y	Local bit for Door Forced Open Fault
XIC	Software_Redundancy	Write_Status	Rung 239	DR_T4_3.ForcedOpenLatch		N	Local bit for Door Forced Open Fault

A.10.7 VFD Faults Using MCP Power Off Bit

A.10.7.1 Area controlled by Change Requested PLC

PLC	MCP	CONV	Area Controlled
All Security Line PLC's 27, 28, 35, 36, 37, 39, 45	NA	All Security Lines	East Matrix Central Matrix

A.10.7.2 Executive Summary of Changed Impact

Effect on SSTP tested Area	Yes
Effect on Tracking in the SSTP Tested Area	No
Effected PLC	All Security Line PLC's, 27, 28, 35, 36, 37, 39, 45
Tested with Battelle (with current code)	Yes

A.10.7.3 Problem Detected

During system testing it was observed that an intermittent issue would occur with the VFD operated conveyors that they would become idle and upstream conveyors would cascade and no fault would be present on the graphics. During the commissioning of the system an issue occurred that when the MCP was powered off that contained VFD's all the faults for the VFD's would be displayed on the graphics. A rung was created to prevent this however if there is a fault on the C-Net card of the VFD the graphics will not display the fault. Normally the Comm Ok bit would be used in parallel with the MCP Power Off bit so that if the C-Net card of the VFD faulted without a VFD fault it would still be indicated on the graphics as a VFD fault. A separate change request has been submitted to MDAD to add C-Net node faults to the graphics.

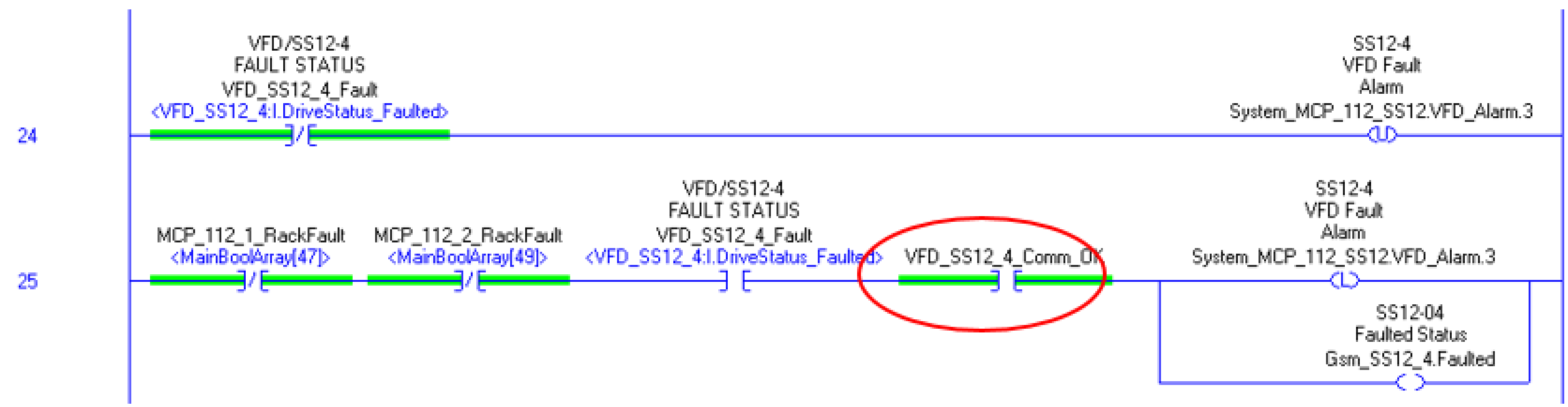
A.10.7.4 Corrective Action

The VFD_xxx_Comm_OK bit should be replaced with the MCP Power Off bit. The MCP Power Off logic was added later to the PLC's to indicate the loss of control power within each MCP. The corresponding MCP bit should be used with the corresponding VFD's.

NOTE: All A & B PLC's will need to be updated with the same changes.

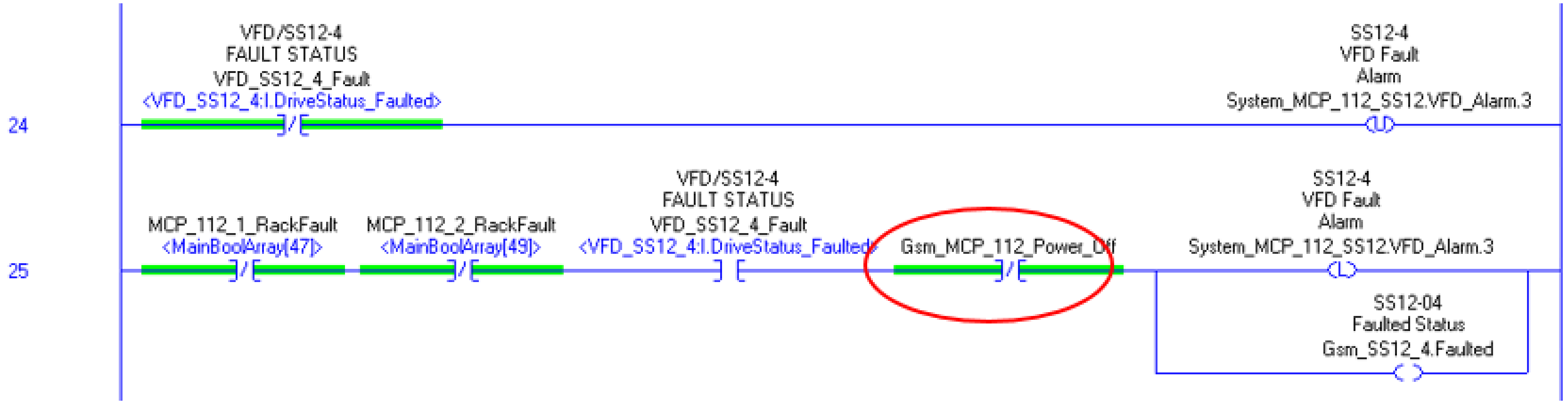
A.10.7.5 Current PLC Code

All faulted logic for the VFD's is the same in all matrix PLC's so only one is used in this example. The below screen shot is for the VFD fault on SS12-4.



A.10.7.6 Proposed Change

The below screen shot is the example for the VFD fault of SS12-4 using the MCP-112 Power Off bit. Using this instead of the Comm Ok bit will prevent the fault from showing on the graphics if the MCP is powered off but allow the fault if the C-Net card of the VFD is faulted.


VFD/SS12-4
FAULT STATUS
VFD_SS12_4_Fault
<VFD_SS12_4:I.DriveStatus_Faulted>
24
SS12-4
VFD Fault
Alarm
System_MCP_112_SS12.VFD_Alarm.3
MCP_112_1_RackFault
<MainBoolArray[47]>
MCP_112_2_RackFault
<MainBoolArray[49]>
VFD/SS12-4
FAULT STATUS
VFD_SS12_4_Fault
<VFD_SS12_4:I.DriveStatus_Faulted>
Gsm_MCP_112_Power_Off
25
SS12-4
VFD Fault
Alarm
System_MCP_112_SS12.VFD_Alarm.3
SS12-04
Faulted Status
Gsm_SS12_4.Faulted

A.11 REQUEST FOR PGDS VARIANCE TEMPLATE

Figure A-15 contains a Request for PGDS Variance template.

Figure A-15: Request for PGDS Variance Template

Transportation Security Administration

PGDS Request For Variance

The PGDS Request for Variance (PRFV) form is used by the CBIS ILDT to request a variance from the requirements set forth in the PGDS. The RFV is used prior to TSA's Acceptance Testing, and should be submitted to the TSA Project Coordinator for review and acceptance.

(If a response or additional information is requested from the TSA and not received within 48 hours the RFV will be returned as rejected due to insufficient information)

RFV #:
SUBJECT:

FROM: | **TO:** TSA Project Coordinator
ADDRESS: | **ADDRESS:**

PGDS REFERENCE: | **AIRPORT CODE:**
MOA/LOI/OTA NO: | **CB PROJECT NO:**
ATTACHED DWGS: Yes ☐ No ☐ | **DOCUMENTS ATTACHED:** Yes ☐ No ☐
DWG LISTING: | **DOCUMENTS LISTING:**

REQUESTED VARIANCE:

PROPOSED ALTERNATIVE METHOD FOR MEETING PGDS COMPLIANCE:

REQUESTOR: | **DATE REQUEST SUBMITTED:**
PRINT NAME:

SIGNATURE:

TSA RESPONSE TO VARIANCE: | **RFV #:**

Preliminary Disposition - Engineering: Accepted ☐ Rejected ☐

Final Disposition – DLD/CBTD: Accepted ☐ Rejected ☐

PRINT NAME: ____________ **DATE RESPONSED:** ____________
SIGNATURE: ____________

Cc:

CBIS_RFV_R07 1

A.12 GOVERNMENT FURNISHED INFORMATION REQUESTS

TSA often has historical and forecasted data that may prove beneficial to designers and planners of BHSs that incorporate a CBIS. GFI is information supplied by the TSA's engineering department and is intended to aid in the design of BHS projects, specifically projects that involve the CBIS portion of a BHS.

This data, offered at the preliminary stages of the design process, is contingently applicable, and is very dependent upon the scope of the project. In order for us to supply GFI, we need to gain a perspective about the overall scope of the project and a general understanding of the project's intent. The attached form is used for this purpose. Once we receive the form, we will endeavor to supply the following:

FDRS data: this is the historical data of the quantity of the bags that go through the EDS units. If specific EDS unit numbers are supplied:

- The TSA can supply the 10 minute peaks of every day for the most recent year's span, by EDS grouping. This will be represented by two graphs, indicating the peaks chronologically and in ascending order. We'll also indicate the ADPM day, as well as the day that corresponds to the 85 percentile for a year's sampling.
- We'll also supply a graph of the baggage rate for the 85% day and the peak day. These graphs will show the average of 10 minutes, in one minute increments (rolling 10 minute bins), for the 85% and peak days. They do not include the Surge Factor.
- If available, we'll supply the baggage rate graphs of the individual EDS units for the 85% day. These graphs will indicate the baggage rate for each minute, by the minute (no averaging, no Surge Factor).

Utilizing the FAA's Terminal Area Forecast, we'll supply the anticipated Overall Growth and the Average Compounded Yearly Growth. We'll need to know the overall span of the project, from date of design to Date of Beneficial Use plus five years (DBU+5). This span is typically seven to ten years.

Utilizing the TSA's Enhanced Staffing Model, we may be able to supply a Baggage rate profile based on Airlines and/or specific bag zones. (Knowledge of both the bag zones and the Airlines within each zone, and the correlation of each to a proposed design, are requisite. This information is usually obtainable by coordinating with the local TSA and the Airline representatives).

Utilizing the TSA – Operations Improvement Branch's "ESM(year) – OIB Bag Zone Analysis" we may be able to offer some airline specific values for "Bags per Passenger" that are useful as approximate values.

If appropriate, we can supply recommendations for the False Alarm (FA) rate and the OSR rate. Note that these values are influenced by the type of flights (International or Domestic), as well as the location and size of the Airport.

We can often suggest CBRA baggage processing times which are national averages and would need adjustment based on location of project.

TSA encourages participation in Technical Interchange Meetings throughout the design review process to allow for open lines of communication and a vehicle to resolve issues or concerns as they arise. Figure A-16 and Figure A-17 illustrate the overall GFI Request process for TSA- and airport-funded designs respectively. Figure A-18 contains a copy of the GFI request form.

Figure A-16: GFI Request Process - TSA Funded Designs

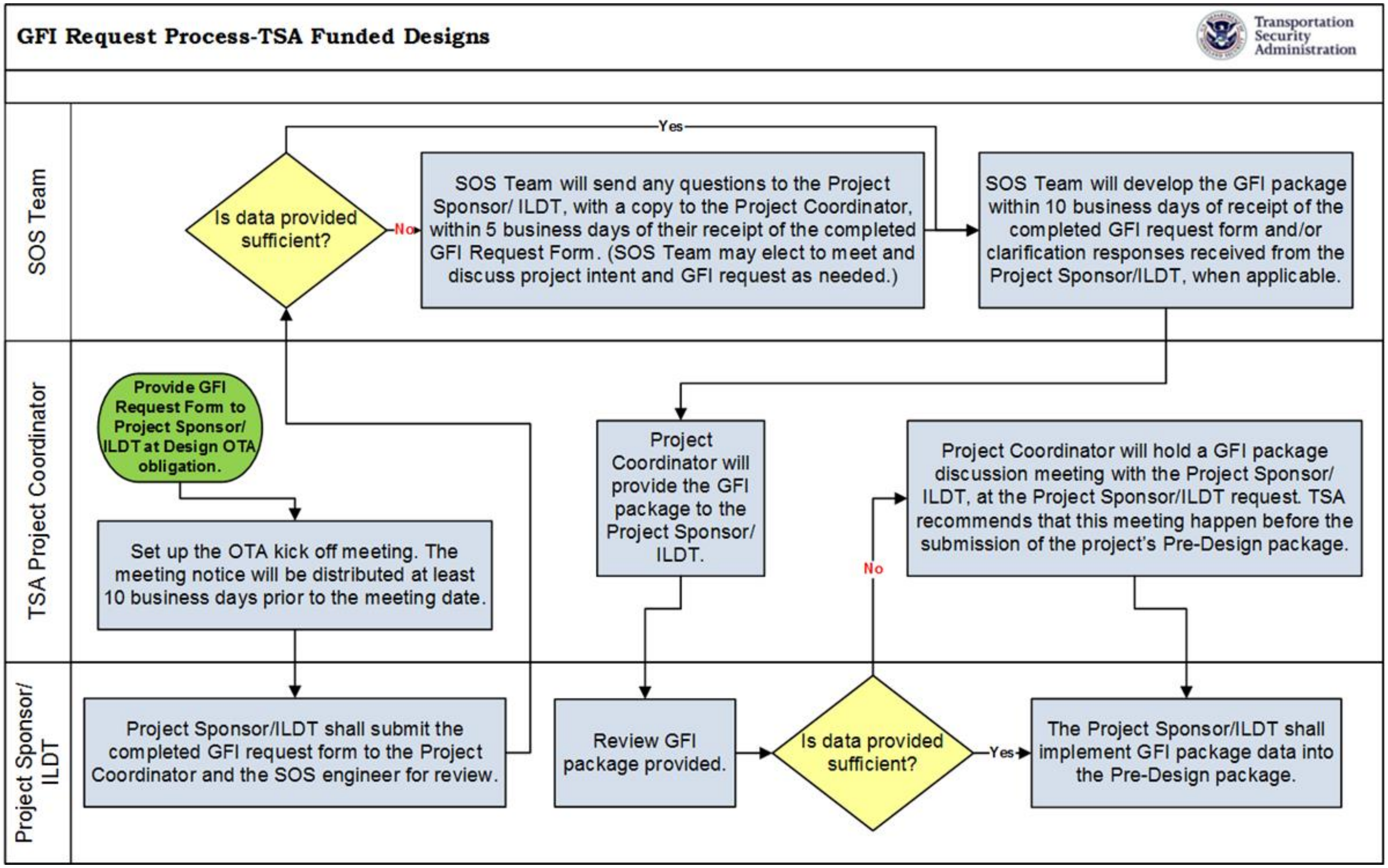


Figure A-17: GFI Request Process - Airport Funded Designs

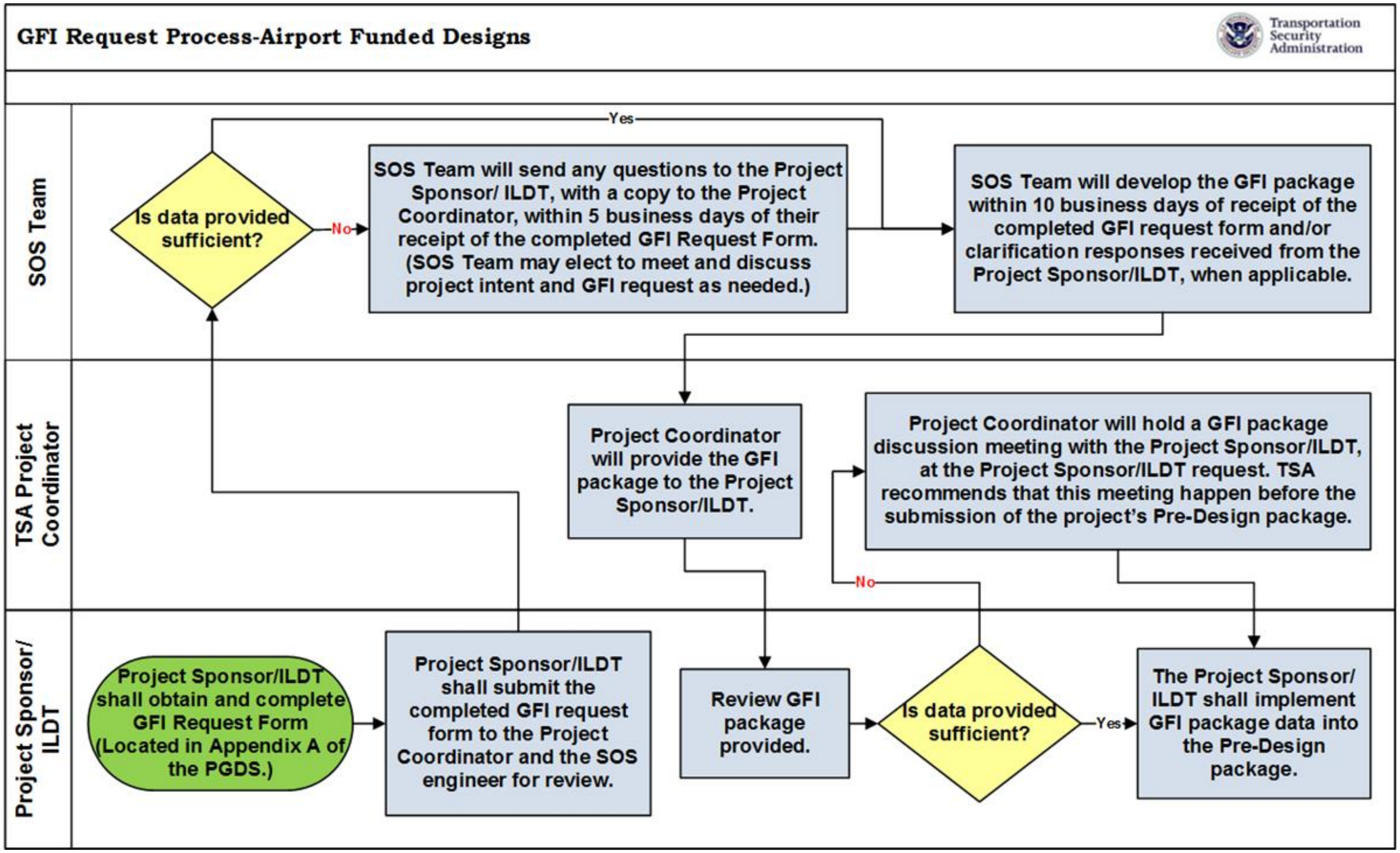


Figure A-18: GFI Request Form

Government Furnished Information (GFI) Request Form				
Airport Code:		Terminal/Area/CBIS:		
Requestor:	Name:		Company:	
	Phone:		Email:	
Request Date:				
Local TSA (FSD/AFSD) POC:	Name:		Email:	
	Phone:			
Project Scope: *Please detail the proposed CBIS changes.*				
Request Type (Check all that apply):	☐	FDRS	☐	CBRA processing rates
	☐	Baggage Rate Profiles	☐	Terminal Area Forecast (TAF)
	☐	Bags Per Passenger (BPP)	☐	
	☐	False Alarm/OSR Rates	☐	
Request Type Explanation area:				
Airline/Airport Zone(s)				
EDS Serial Nos.:				
Date of Expected Pre-Design Submittal to TSA:				
Other Comments:				

A.13 INDUSTRY COMMENT TEMPLATE

The TSA Office of Acquisition Program Management(OAPM) will be the recipient of all comments regarding proposed updates to the PGDS. All comments will be reviewed and considered in a timely manner. The TSA values comments and input from industry stakeholders, but only those comments and input determined to enhance and improve the PGDS will be incorporated in the next release of the PGDS. An example of the standard form for comments is provided in Figure A-19 below.

Figure A-19: Standard Form for Industry Comments

Transportation Security Administration

Checked Baggage Inspection Systems Planning Guidelines and Design Standards (PGDS) V6.0
Comment Form

Comment ID	Status	Disposition	Chapter	Section	Paragraph No.	Page No.	Author	Comment/Rationale	Suggested Revision	TRC Decision

Comments should be submitted to the pgds@dhs.gov mailbox, through the comment form at the following address:

https://www.fbo.gov/index?s=opportunity&mode=form&id=5f27246b608d3914c43bb0dd2d11ebd9&tab=core&_cview=1

APPENDIX B:

GENERIC EXAMPLES OF CHECKED BAGGAGE INSPECTION SYSTEMS

APPENDIX B: GENERIC EXAMPLES OF CHECKED BAGGAGE INSPECTION SYSTEMS

This appendix provides generic examples of various design concepts of CBISs, relevant operational assumptions for those examples, and specific best practices related to the CBIS examples to supplement the information contained in Chapter 7 of the PGDS.

The high-level generic examples (i.e., examples that are not highly detailed, but rather convey a conceptual screening system) are provided to assist planners at the Pre-Design Phase of CBIS design with the development of conceptual alternatives. The examples are not site-specific and should not be used as is. These examples are intended to serve as a starting point for planners to provide ideas on different concepts of CBISs, some of the pros and cons of each concept, and some of the best practices that relate to specific CBIS design concepts. When developing design concepts, planners should consider local operational and spatial conditions, which are likely to significantly influence the actual CBIS design concepts developed.

The following generic examples of CBIS concepts are presented in this appendix:

- Two variations of linear CBIS design concepts (A, B)
- One ICS CBIS design concept (C)

B.1 METHODOLOGY FOR DEVELOPING GENERIC EXAMPLES

The three examples of linear CBIS or ICS designs were developed and evaluated based on in-line system types using Type I EDS units as the basis of design. Higher throughput could be accomplished in most cases by a substitution of the EDS units. This substitution may require changing the layout of the main EDS processing system (i.e., changing BHS conveyors in the immediate vicinity of the EDS units, resizing of the CBIS, and CBRA), but may not require changes to ticketing/curbside belts and bag makeup/sortation conveyors.

In some examples, other minor layout revisions may be required to provide a better match between BHS conveying capacity and EDS design throughput, but these revisions are unlikely to have much effect on BHS capital costs or building area requirements. Planners should consider such modifications when developing specific CBIS design concepts. The substitution of a higher capacity EDS unit will likely result in revised values for OSR and ETD screener staffing requirements and for the associated equipment/space requirements for this equipment and personnel.

A useful strategy may be to design a system based initially on the use of Type I EDS units and subsequent replacement by higher throughput EDS units as demand increases. This strategy may provide a convenient method of achieving a 35% to 40% increase in system throughput capacity. There is a chance that significant changes to the OSR and CBRA areas will be required due to these capacity increases as stated above.

The following assumptions were the basis for developing the generic CBIS examples:

- A separate line is used for OS bags. These bags are too large to be loaded on the ticketing/curbside belts (e.g., surfboards, skis, and golf clubs) and are screened using ETD for primary screening.

- A bypass belt is used (except in mini in-line applications) to divert OOG bags that will not fit the aperture dimensions of the EDS tunnel. The diverter directs OOG bags directly to the CBRA, bypassing the EDS units.
- A minimum of 45 seconds of travel time is provided after the bag has been screened by an EDS unit for OSR processing in in-line CBIS designs. Mini In-line systems will be required to have at least 30 seconds of travel time.
- Chapter 3 provides screening throughputs for EDS and ETD units.
- Mainlines will be capable of delivering bags to the EDS units to equal the capacity of the total non-redundant EDS units at a minimum. Mainlines taking bags away from the EDS unit will be capable of transporting bags equal to or greater than the capacity of the non-redundant EDS units.

B.2 GENERIC EXAMPLES OF LINEAR CBIS DESIGN CONCEPTS

Linear CBIS design concepts typically have a relatively straight forward linear conveyor system transporting baggage from ticketing/curbside take-away belts to the screening zones and from the screening zones to the CBRA zone(s) and bag makeup device(s).

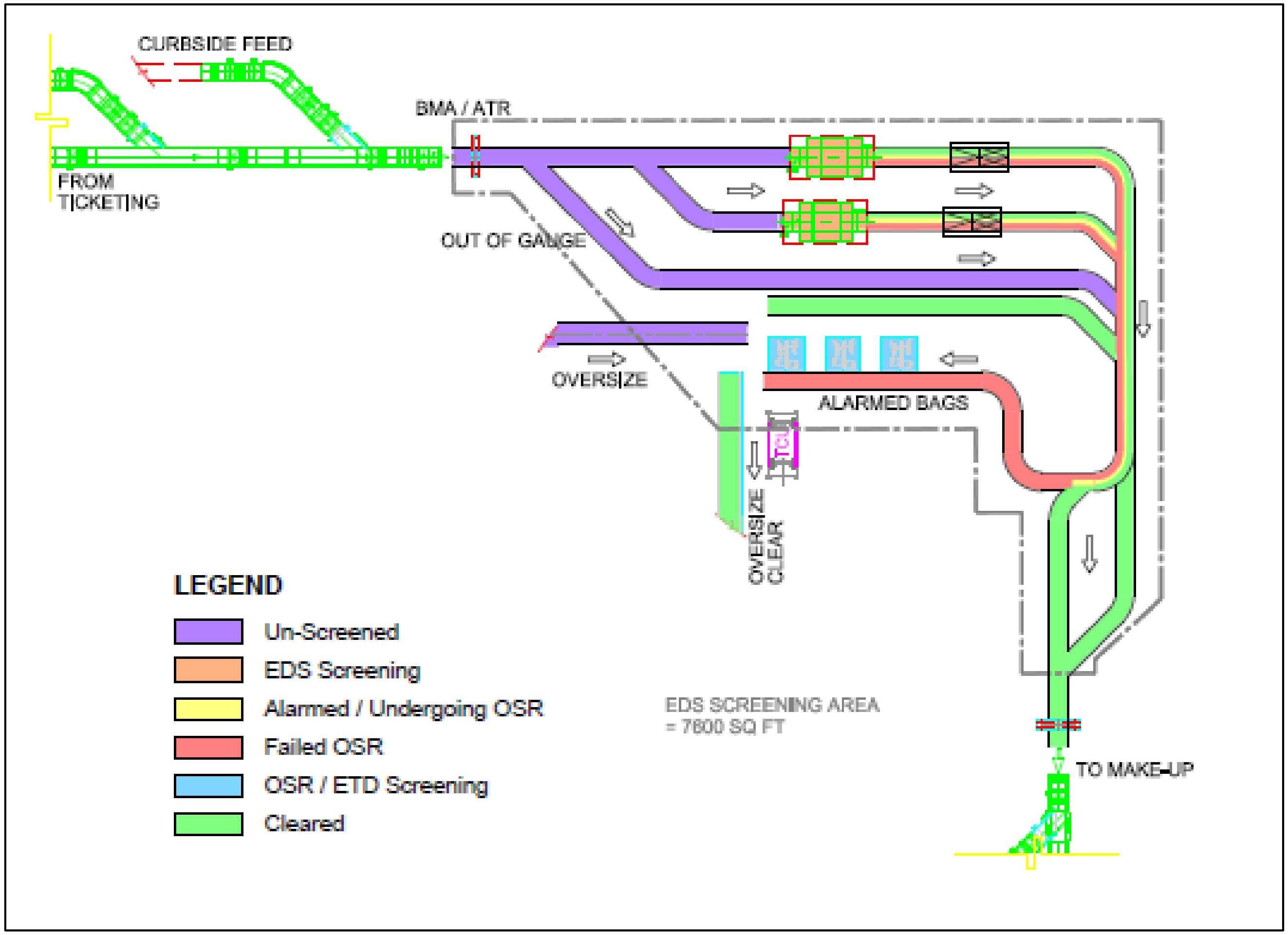
Two variations of linear CBIS design concepts are described below:

- **Linear CBIS Design Concept A** – Baggage is transferred from ticketing on a single conveyor to the EDS, and vertical sorters or 45-degree diverters separate clear/alarmed bags soon after the bags exit the EDS units.
- **Linear CBIS Design Concept B** – Similar to design Concept A, but intended to handle a higher volume of bags transferred from the induction lines.

B.2.1 Linear CBIS Design Concept A

An example layout of linear CBIS design Concept A is shown in Figure B-1.

Figure B-1: Linear CBIS Design Concept A



B.2.1.1 Description of Linear CBIS Design Concept A

Ticketing and curbside take-away belts are merged into a single mainline conveyor belt leading to the security screening and bag makeup area. A BMA is used to identify OOG bags that exceed the available cross-sectional area that can be accommodated by the EDS units. OOG bags are diverted to a conveyor leading directly to the CBRA for manual inspection and clearance. All other bags proceed to a diverter that allocates bag flow between the two EDS units. After screening by EDS equipment, bags proceed to a vertisorter (a 45-degree diverter with parallel conveyors could also be configured) where alarmed bags are transported to an accumulation conveyor, pending OSR inspection by TSA personnel.

Bags that are cleared by the EDS units are immediately segregated from alarmed bags and diverted to a single clear bag line leading to the baggage makeup area. There is a subsequent merge point for bags cleared by OSR or ETD. Upon reaching the end of the OSR conveyor, bags that have been cleared by TSA personnel are diverted (vertisorter or 45-degree diverter) to a cleared bag belt, which, in turn, merges with the clear bag line leading to the baggage makeup area, as described above. Bags that are not cleared by TSA personnel (including bags for which no clearance decision has been reached by the time the bag reaches the decision point) will default to the CBRA for manual inspection.

Positive bag tracking controls are used to monitor the locations of all bags processed by the EDS units and to enable EDS images of screened bags sent to the CBRA to be accessed by TSA screening personnel. EDS images are transferred to the corresponding ETD inspection position to assist with directed ETD screening of the bag. Bags that are cleared after ETD screening and search are loaded onto a return conveyor, which merges with the clear bag line leading to the bag makeup area. Any “threat” bags identified during the ETD screening and search process are either resolved or disposed of per the current TSA checked baggage SOP, which typically involves the local law enforcement officer.

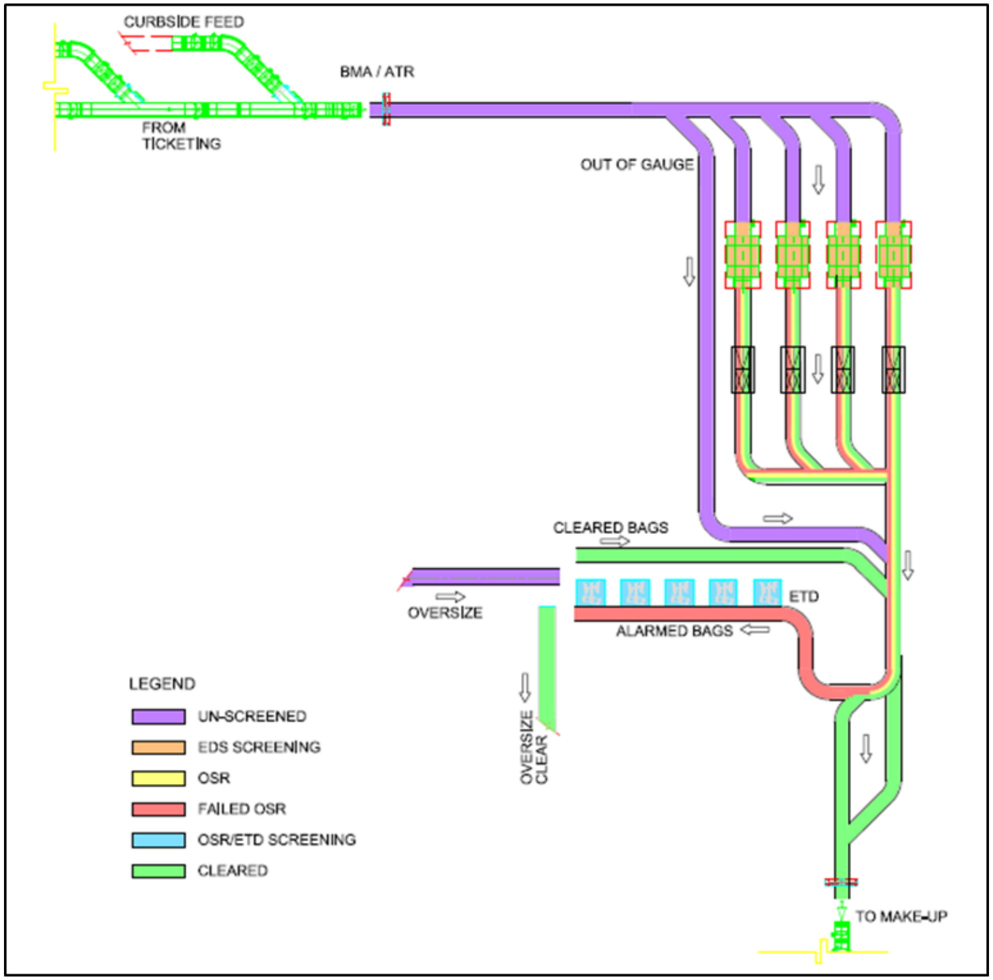
B.2.1.2 Evaluation of Linear CBIS Design Concept A

This design concept is well suited for a moderately sized application. However, the concept may involve a high cost for EDS units because a redundant unit may be necessary to maintain operations in the event of unit failure, resulting in average unit utilization of about 50% during peak period operations when both units are operational. CBRA space and equipment requirements should be identified in light of the agreed-upon contingency plan developed by the Project Sponsor (see Chapter 11). Separation of alarmed and cleared bags immediately downstream of the EDS units minimizes the risk of bag mistracking by diverting the majority of bags to an untracked conveyor environment, but involves some system complexity (PLC programming due to a larger tracking zone) and cost.

B.2.2 Linear CBIS Design Concept B

An example layout of linear CBIS design Concept B is shown in Figure B-2.

Figure B-2: Linear CBIS Design Concept B



B.2.2.1 Description of Linear CBIS Design Concept B

Ticketing and curbside take-away belts are merged into a single mainline conveyor belt leading to the security screening and bag makeup area. A BMA is used to identify OOG bags that exceed the available cross-sectional area that can be accommodated by the EDS units. The OOG bags are diverted directly to a conveyor leading to the CBRA for manual inspection and clearance. All other bags proceed to a diverter zone, typically consisting of three 45-degree diverters, which divide bag flow among four EDS units. After EDS screening, bags proceed to a vertisorter (a 45-degree diverter with parallel conveyors could also be configured), where alarmed bags are transported onto an accumulation conveyor pending OSR screener decision.

Bags cleared by the EDS units are diverted onto a clear bag line leading to the bag makeup area to be discharged to a sort system. Upon reaching the end of the OSR accumulation conveyor, bags that have been cleared by TSA personnel are diverted (vertisorter or 45-degree diverter) to a cleared bag belt, which, in turn, merges with the cleared bag line leading to the bag makeup area.

Bags that are not cleared by TSA personnel (including bags for which no clearance decision has been reached by the time the bag reaches the decision point) default to the CBRA for manual inspection. Positive belt tracking controls are used to monitor the location of all bags processed by the EDS units and to enable images of screened bags sent to the CBRA to be accessed by TSA screening personnel who perform directed ETD screening of the bag. Bags cleared after ETD screening and search are manually transferred onto a return conveyor, which merges with the cleared bag line leading to the bag makeup area. Any “threat” bags identified during the CBRA process are either resolved or disposed of per the current TSA checked baggage SOP, which typically involves the local law enforcement officer.

In most systems with this throughput capacity, the cleared bag line conveyor leading to the bag makeup area leads to a separate sortation area, where bags are typically distributed among a number of makeup loops or piers for final sort to individual flights. This process usually requires an ATR and manual encode spur upstream of the makeup loops or piers. Sortation to individual loops or piers is typically via vertisorters or 45-degree diverters, as appropriate. The sortation component of the BHS is not included in this analysis

B.2.2.2 Evaluation of Linear CBIS Design Concept B

The use of multiple EDS units increases the average peak period use of each unit (compared with Concept A) from about 50% to about 75%, as redundant screening equipment represents a smaller percentage of the system. However, the baggage conveying systems serving the EDS units in this concept are more complex and costly. Linear CBIS design Concept B depends on a single mainline conveyor feeding bags to the EDS unit array and a single mainline conveyor feeding bags to the makeup/sort area. The bag throughput rate on these single conveyors is also relatively high during peak periods. This concept generally requires a separate sortation system downstream of the EDS/ETD screening area to sort bags by flight or by airline.

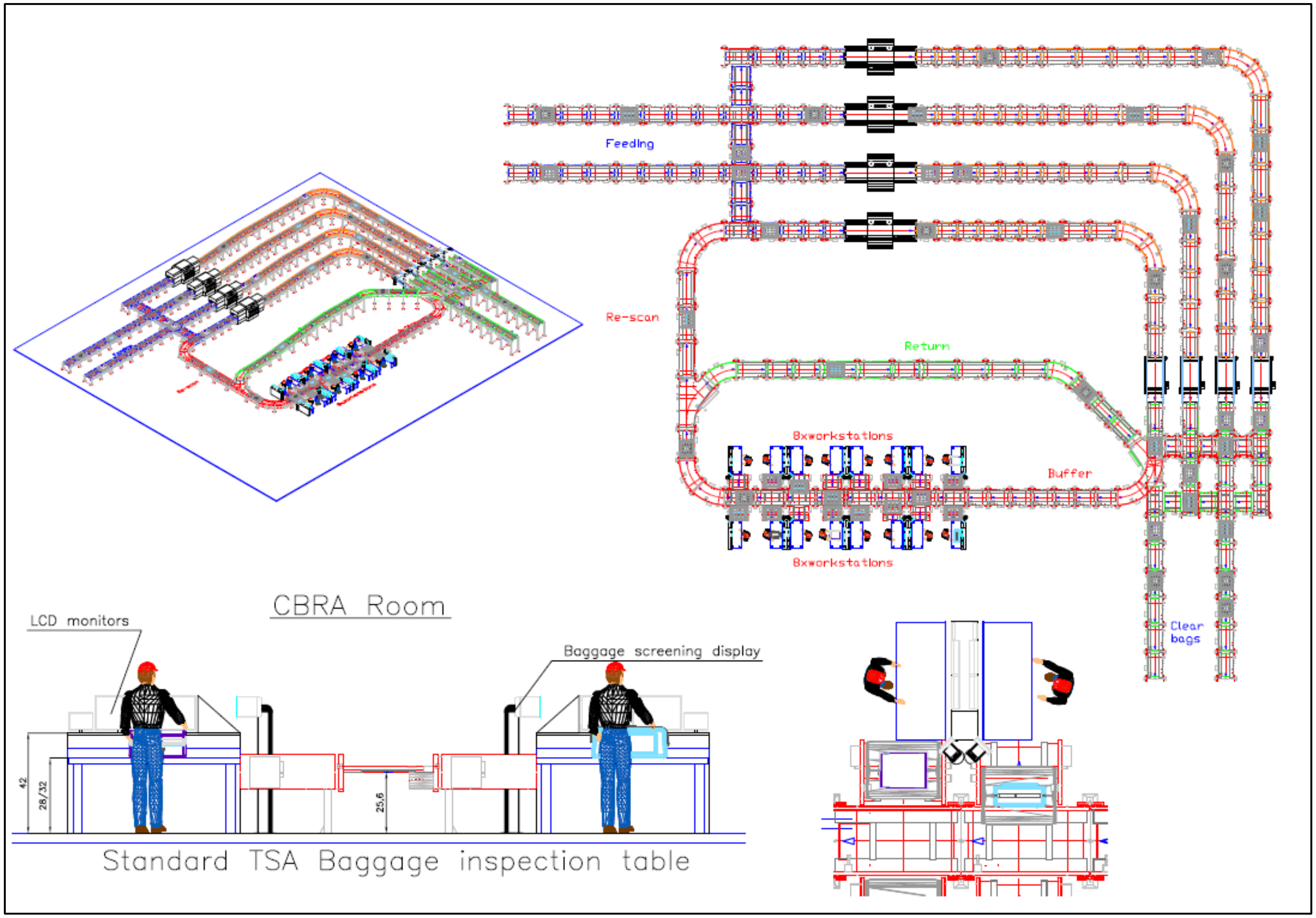
As with linear CBIS design Concept A, the design for Concept B maintains the separation of cleared/alarmed bags; Concept B potentially has higher reliability compared with Concept A because the additional conveyors leading to a higher number of EDS units can compensate for an EDS unit failure.

B.3 GENERIC EXAMPLES OF INDIVIDUAL CARRIER SYSTEM-BASED CBIS DESIGN CONCEPTS

An ICS-based CBIS design concept typically uses individual carriers to carry baggage through a transport and sortation system, which allows for the distribution of bags to the EDS units as well as to the CBRA, and if so designed, for the automated sortation of bags to multiple makeup devices. ICSs typically consist of a closed-loop conveying system on which special-purpose carriers (each accommodating a single bag and possessing a unique RFID tag) are transported to the EDS. In this type of system, the bag remains in the carrier throughout the screening and sortation processes. Alarmed baggage is transported to the CBRA (in the carrier) while cleared baggage is conveyed to the sortation system. The ICS concept is presented to provide planners with a potential CBIS concept for consideration during the Pre-Design Phase.

This concept is illustrated schematically on Figure B-3, which is not representative of a physical equipment layout and does not show upstream ATRs. While this concept is unconventional, it is nonetheless presented to provide planners with a potential CBIS concept for consideration during the Pre-Design Phase.

Figure B-3: Individual Carrier System-Based CBIS Design Concept C



B.3.1 Description of Individual Carrier System-based CBIS Design Concept C

Bags from the ticketing/curbside take-away belts are delivered to three delivery belts and pass a combined BMA/ATR position where they are measured and identified. OOG bags are immediately diverted to a bypass line leading to a combined OS/OOG CBRA. Standard bags are transported under tracking control to a carrier loading and induction unit, where they are loaded onto a vehicle or carrier and a destination is assigned to the carrier. The carrier and bag then proceed to one of four EDS units, with automatic flow balancing to equalize the use of available EDS units. Bags that clear EDS screening are directed to a specific carrier unload position where they are discharged to a delivery belt leading to one of the bag makeup loops or piers. Bags that alarm circulate on the closed-loop system until an OSR decision has been made. Subsequently, cleared bags are diverted to one of the carrier unload positions feeding the bag makeup area and alarmed bags are diverted to the CBRA. After ETD/search bag clearance, the bag is returned to an empty carrier and redirected to the appropriate makeup sort output. In this concept, it is usually necessary to provide storage lines for empty carriers (for use in off-peak periods when only a small number of carriers is needed). These empty carrier storage lines can also be used for storing early check-in bags to reduce the makeup cart/container requirement for the terminal.

B.3.2 Evaluation of Individual Carrier System-based CBIS Design Concept C

By keying the unique carrier number to bag identity, it is possible to accurately track bags and transfer images to TSA personnel in the CBRA. Bag orientation can also be maintained from the EDS unit to the inspection table. It is possible to subdivide the carrier distribution system in this concept into two or more independent but connected subsystems, so that a single point of failure condition can be avoided. This concept generally avoids the need for a separate sortation system downstream of the EDS/ETD screening area, and permits the same system to be used for both security screening purposes and for sorting bags by flight or by airline. In ICS-based design Concept C, it is relatively easy to add EDS units to accommodate future growth. In light of the complexity of the system, it is likely to be most suitable for a large installation of a complete baggage system in a new or extensively renovated terminal, for a major hub airline, or for a large terminal with multiple airlines sharing a common EDS screening facility.

APPENDIX C:

BASIS OF DESIGN REPORT CASE STUDY

Oakland International Airport

C.1 EXECUTIVE SUMMARY

This Basis of Design Report case study focuses on the Port of Oakland's recent study to identify an optimally scaled checked baggage inspection system (CBIS) for Terminal 1 at Oakland International Airport (referred to in this case study as “the Airport”).

At the time this recent study was conducted, Terminal 1 served a mix of domestic airlines and their affiliated regional/commuter airlines, and the majority of bags were screened using explosives trace detection (ETD) instead of explosives detection system (EDS) machines. To improve customer service and support Airport growth opportunities, the Port was interested in evaluating in-line baggage screening alternatives. Key study objectives included: (1) minimizing the number of manual baggage screening inspections and (2) improving overall customer service at the Airport while screening 100% of checked bags.

Several conceptual alternatives for in-line screening, ranging from highly centralized systems with Type I EDS machines to more decentralized systems using lower-speed Type II EDS machines (a mini in-line CBIS), were considered.

As Terminal 1 was designed to serve a mix of domestic and international airlines, a high-throughput in-line CBIS was not feasible because of the spatial requirements and additional complexity associated with assigning bags to specific airlines after screening at a centralized location. Therefore, only four mini in-line CBIS alternatives were found to be operationally and spatially feasible for Terminal 1. For the mini in-line alternatives, Reveal CT-80 and L-3 eXaminer SX EDS machines were evaluated based on life-cycle cost, potential screening capacity, customer level of service, and other qualitative factors.

To support the evaluation, two models were developed. The first was a life-cycle-cost (LCC) model to determine the cost-effectiveness of each alternative over a 20-year period, and the second was a simulation model to evaluate screening capacity, level of service, and operational performance.

After all constraints were evaluated, Alternative 3, a mini in-line system consisting of seven L-3 eXaminer SX EDS machines, was deemed to be the best CBIS alternative for Terminal 1 at the Airport.

C.2 BACKGROUND

In spring 2004, the Port initiated a design study for the replacement of an existing baggage screening system using ETD technology with a set of automated EDS machines to serve Southwest Airlines (the sole airline tenant at the Airport's Terminal 2). The design concept called for a conveyor system to transfer baggage from ticket counters to an in-line EDS screening area adjacent to the terminal where EDS machines automatically screen baggage for explosives and divert false alarm and oversize baggage to a checked baggage resolution area (CBRA). Baggage cleared by the EDS machines proceeds to Southwest’s outbound baggage makeup carousel. The Terminal 2 in-line system became operational in February 2006; the in-line design study for that system is not included in this case study.

Terminal 1 serves a mix of domestic airlines and affiliated commuter operators. Currently, three EDS machines are used for screening checked baggage at Terminal 1.

United Airlines uses one stand-alone EDS machine (MD CTX 2500) located behind the airline ticket counter. Bags moving along the conveyor to the United Airlines' baggage makeup area are manually removed and sent through the EDS machine for security screening.

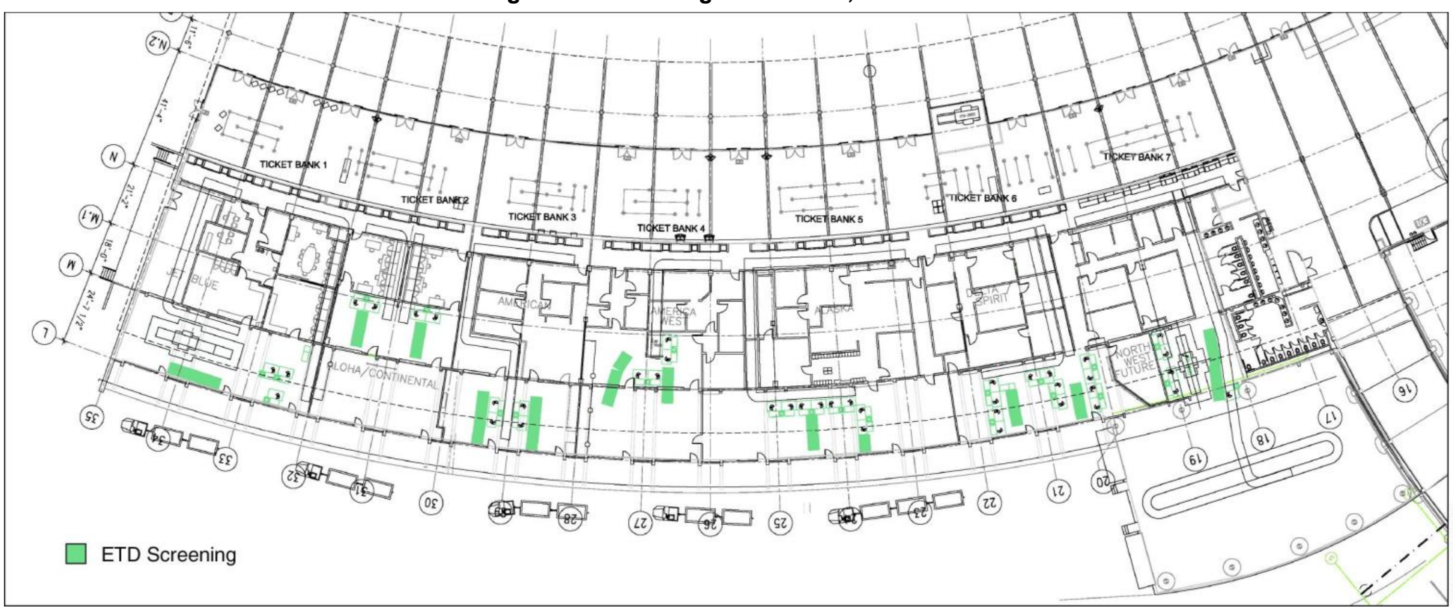
JetBlue Airways uses a semi-integrated EDS machine (MD CTX 5500) located behind the JetBlue ticket counter. A conveyor connects the ticket counters to the EDS machine. All JetBlue bags are first screened by the MD CTX 5500. Cleared bags are sent to the baggage makeup area and alarmed bags are sent to a CBRA, where alarms are resolved by Transportation System Administration (TSA) agents.

The remainder of the Terminal 1 airlines use manual ETD screening located in the baggage makeup rooms. In addition, bags that belong to passengers with a high-risk profile (referred to as "selectees") are manually carried to the third EDS machine (MD CTX 5500) located in the lobby, where they are screened, sorted, manually placed on the conveyor, and sent to the appropriate airline baggage makeup room.

The Airport is achieving 100% checked bag screening; however, the process is labor intensive, with the majority of the bags undergoing ETD screening instead of being screened by EDS machines. The Port wants to move ahead with an in-line EDS to improve customer service, scalability, and Airport growth opportunities.

Existing conditions at Terminal 1 are shown in Figure C-1.

Figure C-1: Existing Conditions, Terminal 1



C.3 CBIS ALTERNATIVES

C.3.1 Zoning Schemes

As explained in Chapter 5, checked baggage can be combined in the screening systems in several ways. Taking into consideration spatial and operational constraints, two zone hierarchy schemes were developed for Terminal 1, as shown in Figure C-2 and Figure C-3.

For Terminal 1, the "F3 Zones" correspond to each baggage take-away belt, while the "F1 Zone" consists of the entire terminal. At the intermediate "F2 Zones," several options are available to combine checked baggage into screening systems. For the purpose of this case study, two options were considered for F2 Zone groupings: Option A (Figure C-2) divides the ticket counters into three groups combining checked baggage into three screening systems, while Option B (Figure C-3) divides the ticket counters into two groups combining checked baggage into two screening systems.

Figure C-2: Zoning Schemes, Option A, Terminal 1

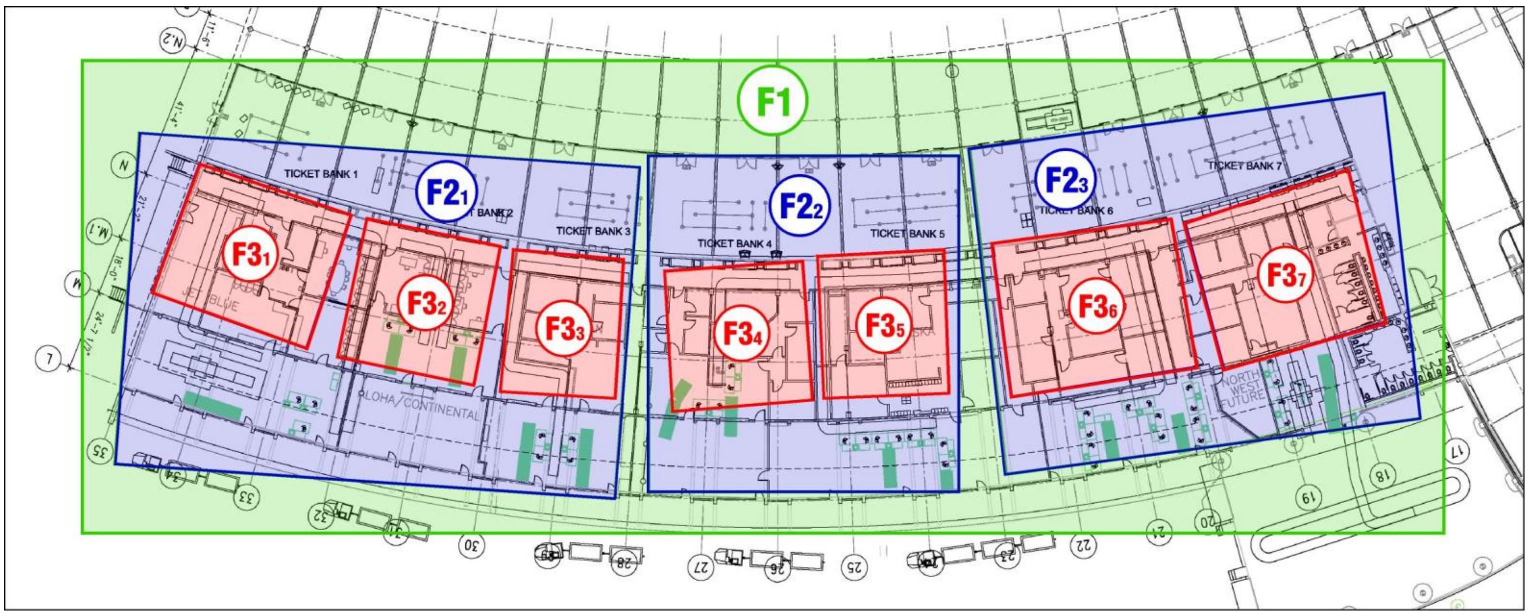
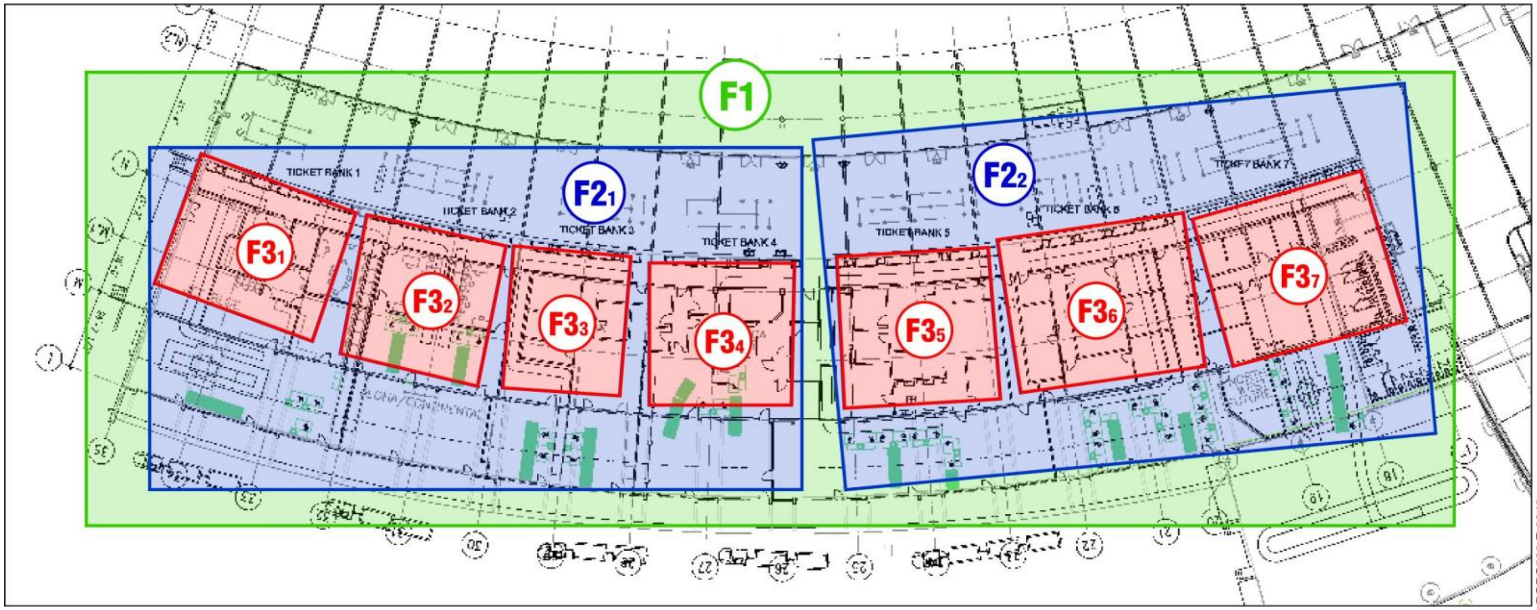


Figure C-3: Zoning Schemes, Option B, Terminal 1



C.3.2 Screening System Types

As explained in detail in Chapter 3, several system types and EDS equipment are available for in-line systems, ranging from highly centralized systems using High speed EDS machines to very decentralized systems using Low speed EDS machines. As the zoning schemes, the system type selection, and the estimated demand are inter-related, several iterations were necessary to determine an optimally scaled solution. Thus, at this early stage of analysis, all spatially feasible system options were considered and carried forward in the evaluation.

The following is a general description of potential system types for three zoning levels at Terminal 1 that were considered initial candidates for screening alternatives:

- **Terminal 1, F3 Zone Groupings** – Decentralized screening systems are recommended for F3 Zone groupings. Thus, at the F3 Zone level, mini in-line systems are acceptable options. Stand-alone EDS machines were not considered because they would present spatial constraints to any expansion that would be necessary to accommodate growth beyond the design year.
- **Terminal 1, F2 Zone Groupings** – At the F2 Zone level, depending on the expected checked baggage demand volumes, high-throughput centralized systems, such as in-line systems, or lower-throughput systems, such as mini in-line systems, are acceptable options.

- **Terminal 1, F1 Zone Grouping** – A centralized system is recommended at the F1 Zone level. Thus, both high-volume and medium-volume in-line systems are acceptable options for Terminal 1. The choice between high-volume and medium-volume system types depends on the date of beneficial use (DBU), since that will dictate the type of EDS equipment expected to be certified by that date. Since DBU is expected to be after 2008, both high-volume and medium-volume in-line systems would be viable. If a medium-volume system is ultimately selected, all necessary steps should be taken to make the system flexible enough to accommodate high-speed EDS machines when they become available.

C.3.3 Qualitative Assessment of Preliminary Alternatives

An initial assessment of a relatively large number of alternatives was performed and all alternatives that were clearly not feasible were immediately eliminated without further consideration. In this initial assessment, it was determined that structural and spatial constraints would render any expansion or major building modification required to accommodate the in-line systems cost prohibitive. Accordingly, at Terminal 1, all of the full in-line concepts were found to be infeasible. Only the mini-in-line system type layouts designed for the F3 Zone were found to be operationally and spatially feasible at Terminal 1.

For the F3 Zone alternatives, the Reveal CT-80 and L-3 eXaminer SX EDS machines were considered to be better options for the Airport compared to the L-3 eXaminer 3DX 6000 and MD CTX 5500 machines with ViewLink. The Reveal CT-80 and L-3 eXaminer SX machines are considered superior products because they are newer, have better performance capabilities, and have strong upgrade possibilities for the future. Therefore, the L-3 eXaminer 3DX 6000 and MD CTX 5500 with ViewLink were also eliminated from further consideration.

Table C-1 provides a list of all preliminary alternatives considered and brief reasons for rejecting the initial alternatives.

Table C-1: Initial Evaluation of Alternatives, Terminal 1

System Type	Accepted/Rejected	Alternative name/reason for rejection
F3 ZONE - MINI-IN-LINE SYSTEM TYPE		
Reveal CT-80	Accepted	Alternative 1
L-3 eXaminer SX	Accepted	Alternatives 2 and 3
L-3 eXaminer 3DX 6000	Rejected	Inferior performance and limited upgrade opportunities
MD CTX 5500 (with View Link)	Rejected	Inferior performance and limited upgrade opportunities
F2 ZONE OPTION 1 – MINI IN-LINE SYSTEM TYPE		
Reveal CT-80	Rejected	Spatial constraints
L-3 eXaminer SX	Rejected	Spatial constraints
L-3 eXaminer 3DX 6000	Rejected	Spatial constraints
MD CTX 5500 (with View Link)	Rejected	Spatial constraints
F2 ZONE OPTION 2 – MEDIUM THROUGPUT IN-LINE SYSTEM TYPE		
MD CTX 9800 DSi	Rejected	Spatial constraints
L-3 eXaminer 3DX 6000	Rejected	Spatial constraints
L-3 eXaminer 3DX 6600	Rejected	Spatial constraints
F1 ZONE – MEDIUM THROUGHPUT IN-LINE SYSTEM TYPE		
MD CTX 9800 DSi	Rejected	Spatial constraints
L-3 eXaminer 3DX 6000	Rejected	Spatial constraints
L-3 eXaminer 3DX 6600	Rejected	Spatial constraints

C.3.4 Feasible Alternatives

The list of preliminary alternatives was reduced to three feasible alternatives based on F3 zoning and the following mini in-line system types. Each of the alternatives incorporates the same F3 zoning, i.e., the ticket counters are divided into seven ticket counter groups, one for each take-away belt, creating seven F3 Zones. These feasible alternatives are investigated further in the following sections.

1. Alternative 1: Each F3 Zone is served by the required number of CT-80 EDS machines and one CBRA where the on-screen resolution (OSR) process is combined with ETD alarm resolution.
2. Alternative 2: Each F3 Zone is served by the required number of in-line L-3 eXaminer SX machines. This alternative was split into two parts, Alternative 2a and Alternative 2b. Alternative 2a incorporates a combined OSR/ETD screening function, similar to Alternative 1. Alternative 2b incorporates dedicated OSR screening, which would be conducted in a separate screening room.

3. Alternative 3: Each F3 Zone is served by the required number of in-line L-3 eXaminer SX machines. ETD screening and baggage makeup functions are partially consolidated as there would be a common CBRA and baggage makeup area for every two EDS machines. In addition, OSR would be performed remotely, while ETD screening functions would be performed in the CBRA, as this more staff-efficient screening method can effectively be used when the CBIS design incorporates common use CBRAs.

C.4 NONSTANDARD DETERMINATION OF DESIGN DAY BAGGAGE DEMAND

Using the methodology outlined in Chapter 5, a baseline baggage demand is calculated from the most recent flight schedule data available. The flight schedule data are used to calculate the checked baggage volume for the average day of the peak month (ADPM) for each screening zone. This baseline checked baggage demand is then surged and projected to the design day, which is the DBU of the CBIS plus 5 years. Flight schedules for 2006 were used for this analysis with a projected DBU of 2008 and subsequent DBU of 2013. In projecting future demand, the capacity of the functional components at the Airport must be considered. The ultimate terminal or Airport capacity should be treated as the upper limit for projected demand for the purposes of CBIS design.

Based on the Port's strategy for the Airport, it is unlikely that the capacity of Terminal 1 will be increased substantially in the foreseeable future. The reasons for this slowdown in growth at Terminal 1 include:

1. The Terminal 2 expansion plan is under way and, once completed, all international flights and Southwest Airlines flights will be accommodated at Terminal 2 (making the current four Southwest gates at Terminal 1 available).
2. It is expected that either a new entrant airline will begin service at Terminal 1 or a current airline located at Terminal 1 will expand at the Airport in subsequent years, requiring two of the four Terminal 1 gates currently used by Southwest. This new service is represented by flights of a fictitious future airline, “XX Airlines”.

Therefore, to ensure that the screening system alternatives were designed based on a realistic growth rate given the constraints on the terminal, two design days were considered, as described below. For this analysis, the entire Terminal 1 was treated as a single F1 screening zone.

1. Standard methodology – This design day was constructed based on the methodology outlined in Chapter 5. The ADPM flight schedule for Terminal 1 was identified, and using the forecast growth rates in the then-current Federal Aviation Administration's (FAA’s) Terminal Area Forecast (TAF), increased to reflect 2013 passenger volumes (2013 is DBU+5 years for the proposed in-line system). According to the TAF, total enplaned passengers at the Airport are expected to grow from 7.12 million annual passengers (MAP) in 2006 to 9.90 MAP in 2013. This represents an average annual growth rate of 4.82%. Using this method, baggage flows for the ADPM were increased by 4.82% annually to 2013.
2. Strategy-oriented methodology – This design day was constructed based on the Port’s future strategy that no additional gates will be built at Terminal 1 and that Southwest will move completely to Terminal 2. Two of the four vacated gates at Terminal 1 would be used by a future airline (XX Airlines). The remaining two gates could be used to accommodate growth of airlines currently serving the Airport. To properly reflect Terminal 1 capacity, the design day flight schedule was based on the 2006 peak day of the peak month (PDPM) flight schedule. This schedule was sent to the airlines for verification, and new flights were added to the schedule in accordance with the

airlines' requests. In line with the Port's strategy for the Airport, Southwest was eliminated from the flight schedule and was replaced by XX Airlines. The flight schedule for XX Airlines was based on Southwest's gating schedule for two of Southwest's four gates at Terminal 1. Gate utilization was analyzed based on gating information provided by Airport staff. For gates with low utilization, flights were added to create the design day flight schedule. Using this method, a design day flight schedule based on the detailed information provided by the airlines and Airport staff was created and baggage flows were generated from this flight schedule.

C.4.1 Terminal 1 ADPM and PDPM

Determination of the ADPM and PDPM design day values were based on Terminal 1 flight schedules to determine the peak month (August) and the ADPM (August 26) and PDPM (August 25). Load factors, origin and destination (O&D) percentages, earliness distributions, and checked bags per passenger for those days were applied to the maximum seat capacities for the ADPM and PDPM flight schedules to arrive at the base ADPM and PDPM baggage flows.

Two design days were then created. The design days were based on the standard and strategy-oriented methodologies described above. One design day was created by increasing the ADPM baggage flows to 2013 levels based on the TAF growth rates (standard methodology). The other design day was created by using the PDPM flight schedule and adding flights based on the Port's future strategy (strategy-oriented methodology).

The following sections provide details of the design-day selection process.

C.4.1.1 Peak Month

Table C-2 shows the monthly totals and daily averages for all flights in Terminal 1 used to identify August as the peak month.

Table C-2: Terminal 1 Peak Month Available Seats 2007

Month	Monthly seats	Average daily seats
January	279,034	9,001
February	254,786	9,100
March	286,400	9,239
April	271,707	9,057
May	309,719	9,991
June	320,829	10,694
July	324,051	10,802
August	335,573	10,825
September	293,789	9,793
October	299,965	9,676
November	279,911	9,330
December	288,890	9,319

C.4.1.2 Terminal 1 ADPM and PDPM

The ADPM and PDPM were determined by analyzing the numbers of Terminal 1 daily seats calculated from the Official Airline Guide (OAG) flight schedules for the peak month (August). The day closest to the peak month's average daily load determines the ADPM. The day closest to the peak month's daily peak determines the PDPM. Table C-3 and Table C-4 show the daily seat totals, their variance from the monthly average and the ADPM and PDPM, respectively, for Terminal 1. This analysis determined that August 26 is the ADPM and that August 25 is the PDPM.

Table C-3 shows the total number of daily departing seats for all domestic Terminal 1 flights (excluding those of Southwest Airlines) obtained from the OAG.

Table C-3: Average Day and Peak Day of the Peak Month: August 2006

Daily Available Seating
Average day seats: 10,387

Day	Available seats	Variance from average
1	10,368	-19
2	10,368	-19
3	10,368	-19
4	10,492	105
5	10,388	1
6	10,244	-143
7	10,492	105
8	10,368	-19
9	10,368	-19
10	10,368	-19
11	10,492	105
12	10,388	1
13	10,244	-143
14	10,492	105
15	10,368	-19
16	10,368	-19
17	10,368	-19
18	10,492	105
19	10,388	1
20	10,244	-143
21	10,492	105
22	10,368	-19
23	10,368	-19
24	10,368	-19
25 (a)	10,492	105
26 (b)	10,388	1
27	10,244	-143
28	10,492	105
29	10,368	-19
30	10,368	-19
31	10,368	-19

(a) August 25 is the PDPM. (b) August 26 is the ADPM. Source: Official Airline Guide.

The ADPM flight schedule is provided in Table C-4. This flight schedule was used in the standard methodology.

Table C-4: Oakland Terminal 1 ADPM Schedule

Published carrier	Operator	Flight number	Departure time	Destination	Aircraft type	Number of seats
AA	AA	1008	6:26	DFW	M80	136
AA	AA	1612	8:09	DFW	M80	136
AA	AA	1092	12:43	DFW	M80	136
AA	AA	2256	15:06	DFW	M80	136
AQ	AQ	473	8:00	OGG	73W	124
AQ	AQ	441	9:00	HNL	73W	124
AS	AS	372	6:40	SNA	734	144
AS	AS	355	9:05	SEA	734	144
AS	AS	340	12:17	SNA	734	144
AS	AS	346	13:40	SNA	734	144
AS	AS	365	16:17	PDX	734	144
AS	AS	541	17:10	SEA	734	144
AS	AS	446	17:20	SNA	734	144
AS	AS	459	20:15	SEA	734	144
AS	AS	321	21:14	PDX	734	144
AS	AS	351	6:00	SEA	739	172
AS	AS	343	7:55	SEA	739	172
AS	AS	573	10:01	SEA	739	172
AS	AS	85	15:33	SEA	739	172
AS	AS	378	18:55	SNA	73G	124
AS	AS	579	7:20	PDX	M80	140
AS	AS	357	12:24	SEA	M80	140
AS	QX	2468	9:10	PDX	CR7	70
AS	QX	2534	19:10	PDX	CR7	70
B6	B6	241	6:30	LGB	320	156
B6	B6	94	7:10	JFK	320	156
B6	B6	474	7:40	BOS	320	156
B6	B6	100	8:50	JFK	320	156
B6	B6	312	9:20	IAD	320	156
B6	B6	472	10:05	BOS	320	156
B6	B6	96	11:05	JFK	320	156
B6	B6	302	12:05	IAD	320	156

Published carrier	Operator	Flight number	Departure time	Destination	Aircraft type	Number of seats
B6	B6	102	13:30	JFK	320	156
B6	B6	247	13:30	LGB	320	156
B6	B6	82	15:30	JFK	320	156
B6	B6	253	17:25	LGB	320	156
B6	B6	317	19:20	LGB	320	156
B6	B6	249	20:30	LGB	320	156
B6	B6	110	21:35	JFK	320	156
B6	B6	476	22:35	BOS	320	156
B6	B6	318	22:45	IAD	320	156
B6	B6	270	23:30	FLL	320	156
CO	CO	284	0:20	IAH	733	124
CO	CO	758	6:30	IAH	738	155
CO	CO	231	12:14	IAH	739	167
DL	DL	800	7:10	ATL	738	150
DL	DL	494	12:05	ATL	738	150
DL	DL	709	22:30	ATL	738	150
DL	DL	715	13:20	SLC	M90	150
DL	OO	3796	6:15	SLC	CRJ	50
DL	OO	3957	9:41	SLC	CRJ	50
DL	OO	3998	16:02	SLC	CRJ	50
DL	OO	3928	18:30	SLC	CRJ	50
HP	HP	855	9:00	PHX	319	124
HP	HP	567	6:00	PHX	320	150
HP	HP	721	13:46	LAS	320	150
HP	HP	191	15:40	PHX	320	150
HP	HP	611	20:20	LAS	320	150
HP	HP	753	12:29	PHX	733	134
HP	YV	6617	9:25	PHX	CR9	80
HP	YV	6557	18:22	PHX	CR9	80
TZ	TZ	4627	9:35	OGG	73H	175
TZ	TZ	4625	10:55	HNL	73H	175
TZ	TZ	4517	17:20	HNL	73H	175
TZ	TZ	4523	19:35	ITO	73H	175

Published carrier	Operator	Flight number	Departure time	Destination	Aircraft type	Number of seats
UA	A296	6515	12:37	LAX	CRJ	49
UA	A296	6505	16:34	LAX	CRJ	49
UA	A296	6507	17:35	LAX	CRJ	49
UA	A296	6501	19:56	LAX	CRJ	49
UA	UA	1193	6:30	LAX	319	120
UA	UA	1230	13:50	ORD	319	120
UA	UA	388	22:55	IAD	319	120
UA	UA	644	23:00	ORD	319	120
UA	UA	1122	6:00	DEN	320	138
UA	UA	242	6:20	ORD	320	138
UA	UA	386	8:10	DEN	320	138
UA	UA	808	15:34	DEN	733	120
UA	UA	364	11:05	DEN	735	116
UA	UA	738	14:00	DEN	735	116
UA	UA	328	16:45	DEN	735	116

Source: Official Airline Guide.

The PDPM flight schedule is provided in Table C-5 below. Additional flights, as indicated in the table, were added to the PDPM based on the Port's future strategy for Terminal 1. Specifically, flights were added based on feedback from the airlines regarding their future flight strategies as well as flights for XX Airlines, the new entrant airline that would use two of Southwest Airlines' four vacated Terminal 1 gates.

Table C-5: Oakland Terminal 1 PDPM Schedule

Published carrier	Operator	Flight number	Departure time	Destination	Aircraft type	Number of seats	Added to PDPM
AA	AA	1008	6:26	DFW	M80	136	
AA	AA	1612	8:09	DFW	M80	136	
AA	AA	9992	10:00	DFW	M80	136	*
AA	AA	1092	12:43	DFW	M80	136	
AA	AA	2256	15:06	DFW	M80	136	
AA	AA	9993	17:00	DFW	M80	136	*
AQ	AQ	473	8:00	OGG	73W	124	
AQ	AQ	441	9:00	HNL	73W	124	
AQ	AQ	477	10:40	KOA	73W	124	
AS	AS	351	6:00	SEA	739	172	

Published carrier	Operator	Flight number	Departure time	Destination	Aircraft type	Number of seats	Added to PDPM
AS	AS	372	6:40	SNA	734	144	
AS	AS	579	7:20	PDX	M80	140	
AS	AS	343	7:55	SEA	739	172	
AS	QX	2468	9:00	PDX	CR7	70	
AS	AS	355	9:05	SEA	734	144	
AS	AS	573	10:01	SEA	739	172	
AS	AS	340	12:17	SNA	734	144	
AS	AS	357	12:24	SEA	M80	140	
AS	AS	346	13:40	SNA	734	144	
AS	AS	9991	14:00	PDX	734	144	*
AS	AS	85	15:33	SEA	739	172	
AS	QX	2409	16:10	SUN	DH4	74	
AS	AS	365	16:17	PDX	734	144	
AS	AS	541	17:10	SEA	734	144	
AS	AS	446	17:20	SNA	734	144	
AS	AS	378	18:55	SNA	73G	124	
AS	QX	2534	19:10	PDX	CR7	70	
AS	AS	459	20:15	SEA	734	144	
AS	AS	9990	20:30	SNA	734	144	*
AS	AS	321	21:14	PDX	734	144	
B6	B6	241	6:30	LGB	320	156	
B6	B6	94	7:10	JFK	320	156	
B6	B6	474	7:40	BOS	320	156	
B6	B6	100	8:50	JFK	320	156	
B6	B6	312	9:20	IAD	320	156	
B6	B6	472	10:05	BOS	320	156	
B6	B6	96	11:05	JFK	320	156	
B6	B6	302	12:05	IAD	320	156	
B6	B6	102	13:30	JFK	320	156	
B6	B6	247	13:30	LGB	320	156	
B6	B6	82	15:30	JFK	320	156	
B6	B6	253	17:25	LGB	320	156	
B6	B6	317	19:20	LGB	320	156	

Published carrier	Operator	Flight number	Departure time	Destination	Aircraft type	Number of seats	Added to PDPM
B6	B6	249	20:30	LGB	320	156	
B6	B6	110	21:35	JFK	320	156	
B6	B6	476	22:35	BOS	320	156	
B6	B6	318	22:45	IAD	320	156	
B6	B6	270	23:30	FLL	320	156	
CO	CO	284	0:20	IAH	CO 733	124	
CO	CO	284	0:20	IAH	CO 733	124	
CO	CO	758	6:30	IAH	CO 738	155	
CO	CO	231	12:14	IAH	CO 739	167	
DL	OO	3796	6:15	SLC	CRJ	50	
DL	DL	800	7:10	ATL	738	150	
DL	OO	3957	9:41	SLC	CRJ	50	
DL	DL	9994	10:30	ATL	738	150	*
DL	DL	494	12:05	ATL	738	150	
DL	DL	1743	13:20	SLC	M90	150	
DL	DL	9995	16:00	ATL	738	150	*
DL	OO	3998	16:02	SLC	CRJ	50	
DL	OO	3928	18:30	SLC	CRJ	50	
DL	DL	709	22:30	ATL	738	150	
HP	HP	567	6:00	PHX	320	150	
HP	HP	381	7:40	SJD	733	134	
HP	HP	855	9:00	PHX	319	124	
HP	YV	6617	9:25	PHX	CR9	80	
HP	HP	753	12:29	PHX	733	134	
HP	HP	721	13:46	LAS	320	150	
HP	HP	626	15:40	PHX	733	134	
HP	YV	6557	18:22	PHX	CR9	80	
HP	HP	539	20:20	LAS	319	124	
TZ	TZ	4627	9:35	OGG	73H	175	
TZ	TZ	4625	10:55	HNL	73H	175	
TZ	TZ	4517	17:20	HNL	73H	175	
TZ	TZ	4523	19:35	ITO	73H	175	
UA	UA	1122	6:00	DEN	UA 320	138	

Published carrier	Operator	Flight number	Departure time	Destination	Aircraft type	Number of seats	Added to PDPM
UA	UA	242	6:20	ORD	UA 320	138	
UA	UA	281	7:30	IAD	UA 320	138	
UA	UA	386	8:10	DEN	UA 320	138	
UA	UA	9980	9:40	LAX	UA 733	137	*
UA	UA	9981	12:00	ORD	UA 73G	137	*
UA	A296	6515	12:37	LAX	CRJ	49	
UA	UA	1230	13:50	ORD	UA 319	120	
UA	UA	9982	14:50	LAX	UA 73G	137	*
UA	UA	808	15:34	DEN	UA 733	120	
UA	UA	9983	16:20	ORD	UA 733	137	*
UA	A296	6505	16:34	LAX	CRJ	49	
UA	A296	6507	17:35	LAX	CRJ	49	
UA	A296	6501	19:56	LAX	CRJ	49	
UA	UA	9996	22:00	ORD	UA 320	138	*
UA	UA	388	22:55	IAD	UA 319	120	*
XX	XX	398	6:05	SAN	73G	137	*
XX	XX	1380	6:30	LAX	733	137	*
XX	XX	825	6:55	ONT	73G	137	*
XX	XX	2432	7:25	BUR	733	137	*
XX	XX	1233	7:40	SAN	733	137	*
XX	XX	1474	7:40	RNO	733	137	*
XX	XX	1215	7:50	SEA	73G	137	*
XX	XX	997	9:00	MDW	73G	137	*
XX	XX	1726	9:35	BUR	733	137	*
XX	XX	493	11:00	LAX	733	137	*
XX	XX	622	11:10	BOI	733	137	*
XX	XX	1409	11:35	LAS	733	137	*
XX	XX	1041	11:40	BUR	73G	137	*
XX	XX	1284	13:35	BUR	733	137	*
XX	XX	530	13:55	LAS	733	137	*
XX	XX	1790	14:40	ONT	73G	137	*
XX	XX	1385	16:00	LAX	733	137	*
XX	XX	907	17:30	LAX	73G	137	*

Published carrier	Operator	Flight number	Departure time	Destination	Aircraft type	Number of seats	Added to PDPM
XX	XX	1853	17:35	SNA	73G	137	*
XX	XX	1055	18:10	ONT	733	137	*
XX	XX	1735	18:15	BUR	733	137	*
XX	XX	1381	19:20	SLC	733	137	*
XX	XX	1834	19:55	SAN	73G	137	*
XX	XX	1795	20:05	ONT	73G	137	*
XX	XX	1776	22:00	LAX	73G	137	*
XX	XX	530	13:55	LAS	733	137	*
XX	XX	1790	14:40	ONT	73G	137	*
XX	XX	1385	16:00	LAX	733	137	*
XX	XX	907	17:30	LAX	73G	137	*
XX	XX	1853	17:35	SNA	73G	137	*
XX	XX	1055	18:10	ONT	733	137	*
XX	XX	1735	18:15	BUR	733	137	*
XX	XX	1381	19:20	SLC	733	137	*
XX	XX	1834	19:55	SAN	73G	137	*
XX	XX	1795	20:05	ONT	73G	137	*
XX	XX	1776	22:00	LAX	73G	137	*

Source: Official Airline Guide.

C.4.1.3 Terminal 1 Demand Estimation

C.4.1.3.1 Design Load Adjustment Factors

Table C-6 summarizes the factors used to determine the baggage load profiles for each of the ADPM and PDPM flight schedules. Load factors and O&D percentages were directly obtained from the airlines for the month of August. Typical earliness distributions for the domestic airlines were assumed and later confirmed by the airlines. The number of checked bags per passenger was provided by the airlines. If the airlines were unable to provide these data, then the data were derived from surveys conducted at the airport in summer 2002.

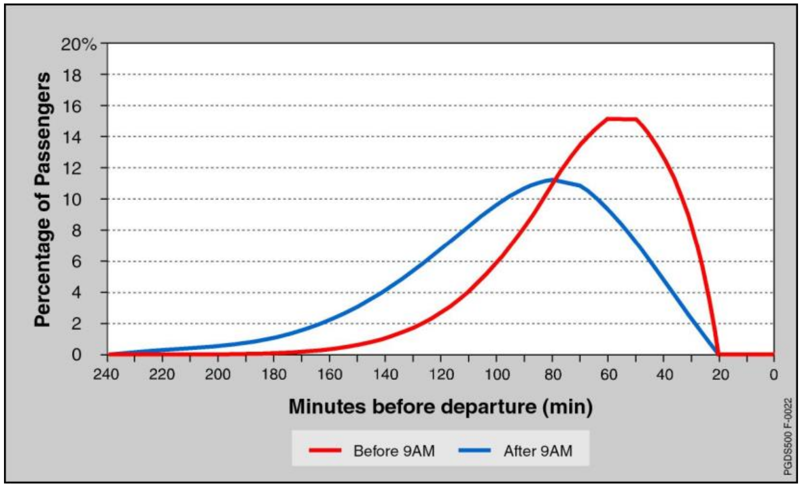
Table C-6: Design Load Adjustment Factor Per Airline

Operator name	Operator code	Load factor	Percent originating before 9 a.m.	Percent originating after 9 a.m.	Percent of parties checking pre-gate	Average number of checked bags per passenger
Continental Airlines	CO	96%	100%	100%	75%	0.79
Alaska Airlines	AS	98	100	100	80	0.71
America West Airlines (domestic destinations)	HP	83	100	100	84	0.68
United Airlines	UA	85	100	100	45	0.87
XX Airlines	XX	77	100	85	34	0.92
SkyWest Airlines	OO	91	100	100	79	0.91
American Airlines	AA	98	100	100	90	0.71
JetBlue Airways	B6	90	100	100	90	0.90
Delta Air Lines	DL	89	100	100	92	0.98
America West Airlines (Mexican destinations)	HP	83	100	100	100	1.30
Aloha Airlines	AQ	85	100	100	97	1.30
Horizon Air	QX	60	100	100	77	0.95
Mesa Airlines	YV	85	100	100	51	0.96
ATA Airlines	TZ	85	100	80	64	1.23
United Express/ SkyWest Airlines	A296	91	100	100	66	0.87

Based on discussions with Airport staff, 1% of all arriving bags were assumed to be out-of-gauge (OOG).

The passenger arrival profiles for the Terminal 1 design day in Figure C-4 below were used for passenger arrivals before 9:00 a.m. and after 9:00 a.m.

Figure C-4 : Passenger Arrival Profiles



C.4.1.3.2 Base Demand Estimation

The baseline CBIS design loads were calculated every 10 minutes over the duration of the design day. A surge factor was calculated according to the methodology in Section 6.1.1, and applied to the CBIS design load for each 10-minute time period. These 10-minute results are shown graphically in Figure C-5 and Figure C-6 below.

C.4.1.3.3 Design Year Demand Estimation

Baggage load profiles for Terminal 1 are provided below. The baggage load profiles calculated using the standard methodology and strategy-oriented methodology are provided in Figure C-5 and Figure C-6, respectively.

Figure C-5: Standard Methodology Design Load Profile

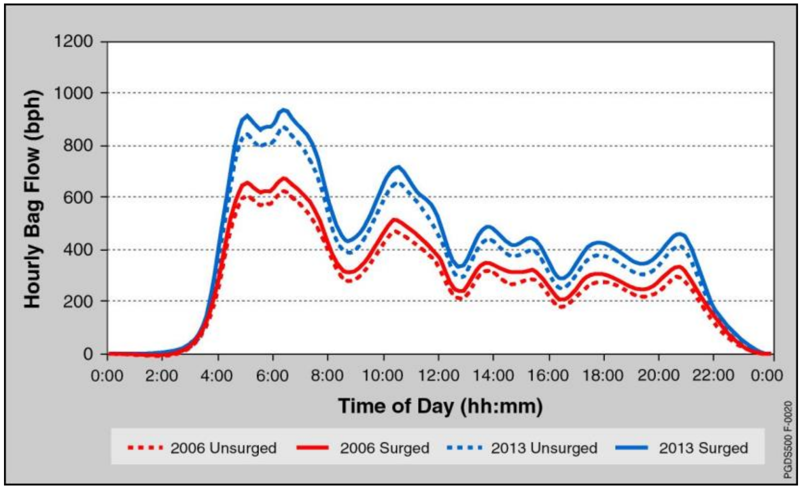
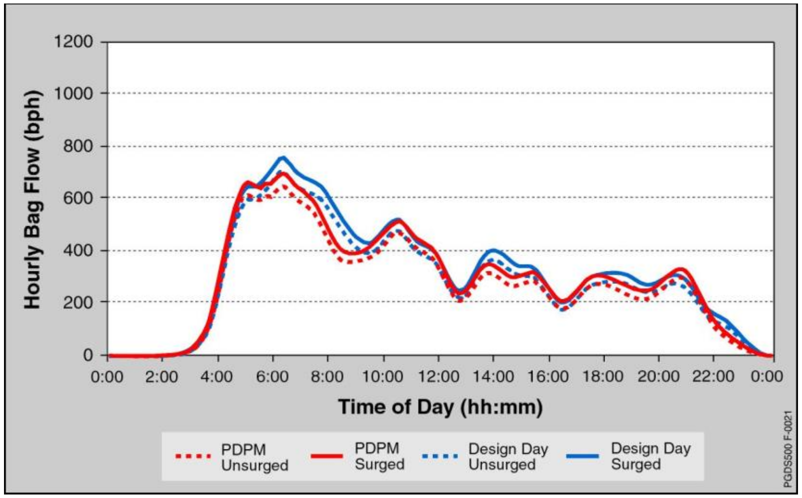


Figure C-6: Strategy-Oriented Methodology Design Load Profile



A comparison of the two design day baggage flows for Terminal 1 is provided in Table C-7 below.

Table C-7: Comparison of Design Day Baggage Flows at Terminal 1

	ADPM (8/26/06) (b)	Standard Methodology Design Day 2013 ADPM	PDPM (8/25/06) (b)	Strategy-Oriented Methodology Design Day
Peak hour baggage flow (bags)	675	938	701	760

(a) Southwest currently uses its own in-line system located at Terminal 2. Therefore, southwest flights were eliminated from all baggage flow calculations.
(b) The ADPM and PDPM flight schedules used in this analysis were based on OAG data for March 2006 and could vary from the actual schedules that occurred on those days.

C.4.1.4 Terminal 1 Design Day Baggage Demand

As Table C-7 illustrates, the peak hour baggage flows of the PDPM (701 bags) and ADPM (675 bags) were very similar. The strategy-oriented methodology increased the peak hour baggage flow by 8% from the PDPM, while the peak hour baggage flows calculated using the standard methodology grew by 39%. A 39% increase in the predicted peak hour baggage flow is considered to be very aggressive given the operational constraints of the airlines at Terminal 1.

Based on the above findings and further consultation with Airport staff, the strategy-oriented design day based on the Port's future strategy for the Airport was selected as the preferred design day. This design day is used throughout the remainder of this case study.

The design day accepted by the Port is summarized as follows:

- 116 departing operations
- 15,585 departing seats
- 12 gates available (approximately 10 daily turns per gate)

This method for estimating baggage demand differs from the standard methodology described in Chapter 5 and is included here as an example in which an alternative method can be used if there is sufficient rationale for doing so. The rationale in this case was based on two key observations. The first observation is that the high gate utilization indicates that the terminal is currently operating at or near maximum capacity. The second observation is that site constraints limit future gate expansion to two gates. The schedule that was developed represents a reasonable estimate of the maximum demand that the terminal could accommodate. When using a demand estimation methodology different from that described in Chapter 5, justification for doing so must be provided to TSA. TSA must review and approve the method and results before design can proceed.

C.5 QUANTITATIVE ASSESSMENT

C.5.1 Baseline Demand Estimation

Existing checked baggage screening flows were estimated for each of the seven F3 screening zones. The F3 screening zones and CBRA were the same for feasible Alternatives 1 and 2. Alternative 3 combines ticket counter groups into common CBRAs. However, each ticket counter group still feeds its own EDS scanner. Therefore, the baseline demand and design day peak hour surged baggage volume calculations to determine the required number of EDS machines for each F3 Zone (ticket counter group) are applicable to all of the feasible alternatives.

C.5.1.1 List of Airlines

Table C-8 lists Terminal 1 airlines by screening zone. The F1 and F2 Zone groupings have been eliminated, as all F1 and F2 alternatives were deemed spatially infeasible during the initial assessment of alternatives described in Section C.3.4 above.

Table C-8: Comparison of Design Day Baggage Flows at Terminal 1

Zone	Airlines
$F3_1$	B6 - JetBlue Airways
$F3_2$	AQ - Aloha Airlines CO - Continental Airlines
$F3_3$	AA - American Airlines
$F3_4$	HP - America West Airlines YV - Mesa Airlines US - US Airways
$F3_5$	AS - Alaska Airlines QX - Horizon Air
$F3_6$	DL - Delta Air Lines OO - SkyWest Airlines TZ - ATA Airlines
$F3_7$	UA - United Airlines A296 - United Express XX - New Entrant Airline (a)

Note: Please refer to Figure C-3 for locations of screening zones.

(a) Assumed new entrant airline using currently occupied gates that will be available after completion of the Terminal 2 expansion.

The design day flight schedules for each screening zone were created using the strategy-oriented methodology described in Section C.4 above. These flight schedules identify the maximum number of aircraft seats available and form the basis for the BHS design load profile. Flight schedules for each screening zone were presented earlier in Table C-4 and Table C-5.

C.5.1.2 Base Year Demand Estimation

As described in Chapter 5, a separate analysis should be conducted to determine the PDPM for each F3 screening zone based on flight schedules obtained from the OAG. Because the strategy-oriented methodology was used, and flights were added to the schedule based on feedback from the airlines, the design day schedule included more seats for each F3 Zone than any of the other days in the peak month (August). Table C-9 below lists the peak month and peak day for each zone.

Table C-9: F3 Screening Zone Peak Month and Peak Day

Zone	Airlines	Peak month	Peak day
$F3_1$	B6 - JetBlue Airways	August	25
$F3_2$	AQ - Aloha Airlines CO - Continental Airlines	August	25
$F3_3$	AA - American Airlines	August	25
$F3_4$	HP - America West Airlines YV - Mesa Airlines US - US Airways	August	25
$F3_5$	AS - Alaska Airlines QX - Horizon Air	August	25
$F3_6$	DL - Delta Air Lines OO - SkyWest Airlines TZ - ATA Airlines	August	25
$F3_7$	UA - United Airlines A296 - United Express XX - New Entrant Airline	August	25

The Terminal 1 design load adjustment factors and rates identified in Table C-6 and the passenger arrival profiles identified on Figure C-4 were applied to the maximum seat capacity identified in each of the PDPM flight schedules for each of the F3 screening zones.

C.5.2 Design Day Demand Estimation

Figure C-7 through Figure C-13 below are the CBIS design load graphs for the $F3_1$ through $F3_7$ screening zones based on the strategy-oriented methodology. The base year CBIS design loads were calculated every 10 minutes over the duration of the design day. A surge factor was calculated according to PGDS Section 6.1.1, and was applied to the CBIS design load of each 10-minute period.

Figure C-7:
Strategy-Oriented Methodology Design Load Profile, F3$_1$ Zone

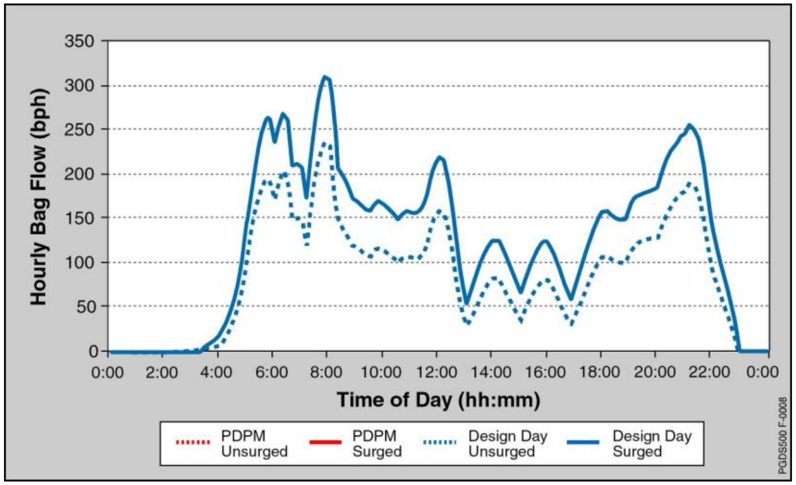


Figure C-8:
Strategy-Oriented Methodology Design Load Profile, F3$_2$ Zone

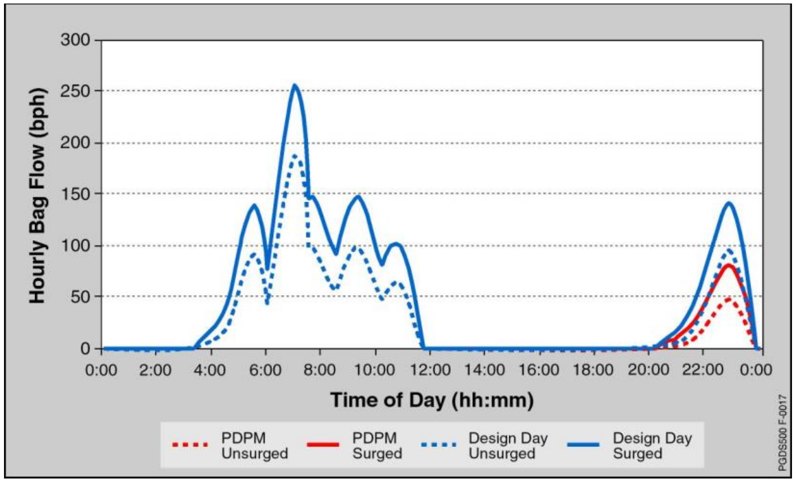


Figure C-9:
Strategy-Oriented Methodology Design Load Profile, F3$_3$ Zone

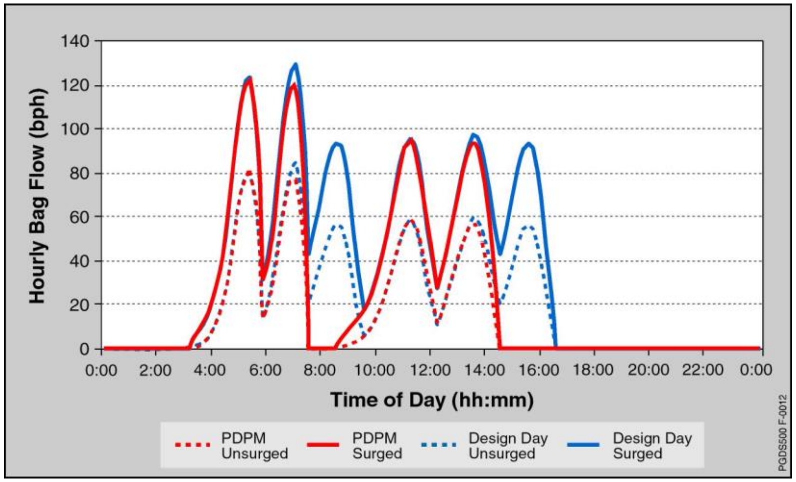


Figure C-10:
Strategy-Oriented Methodology Design Load Profile, F3$_4$ Zone

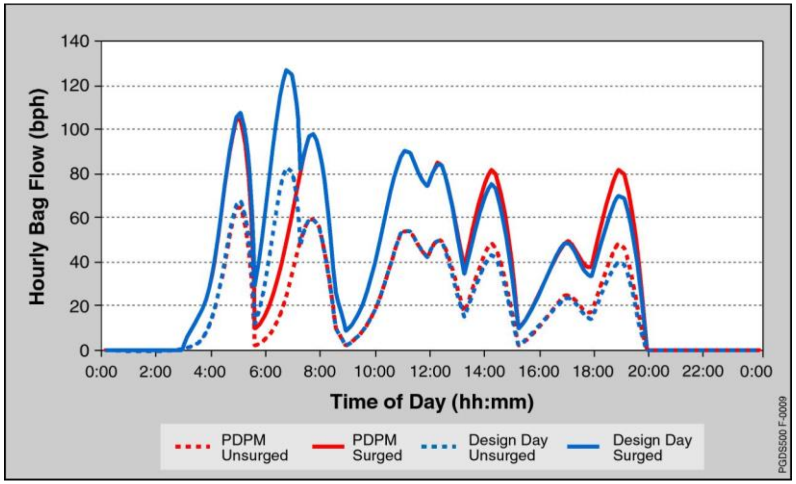


Figure C-11:
Strategy-Oriented Methodology Design Load Profile, $F3_5$ Zone

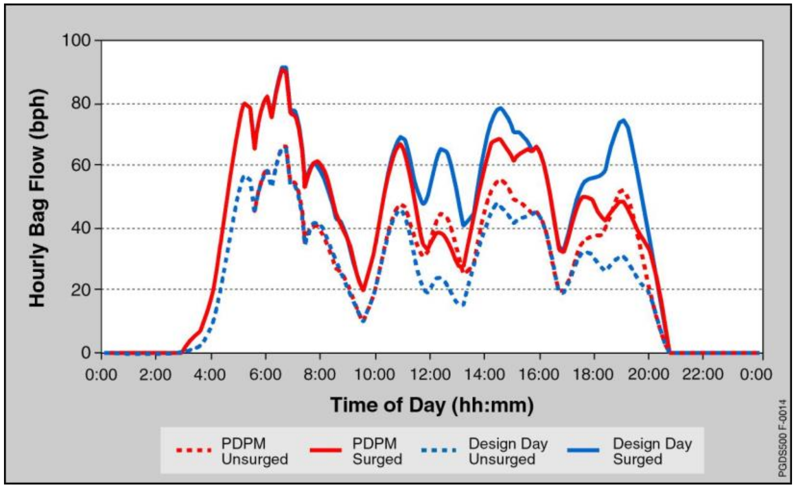


Figure C-12:
Strategy-Orientated Methodology Design Load Profile, $F3_6$ Zone

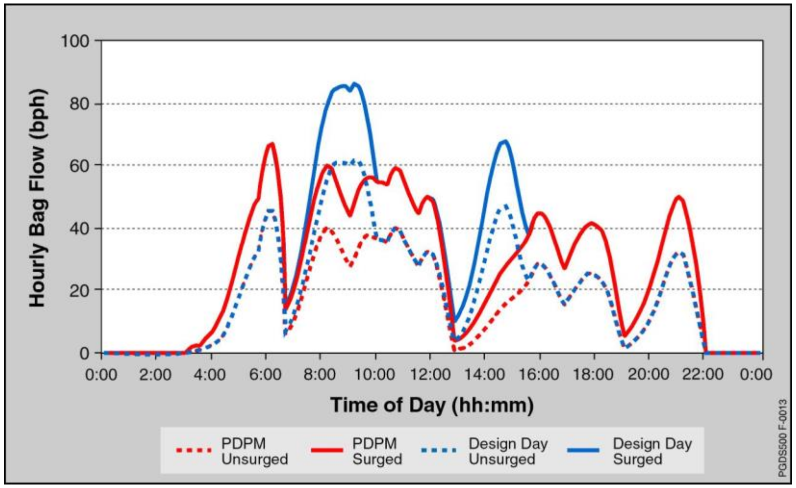


Figure C-13:
Strategy-Orientated Methodology Design Load Profile, $F3_7$ Zone

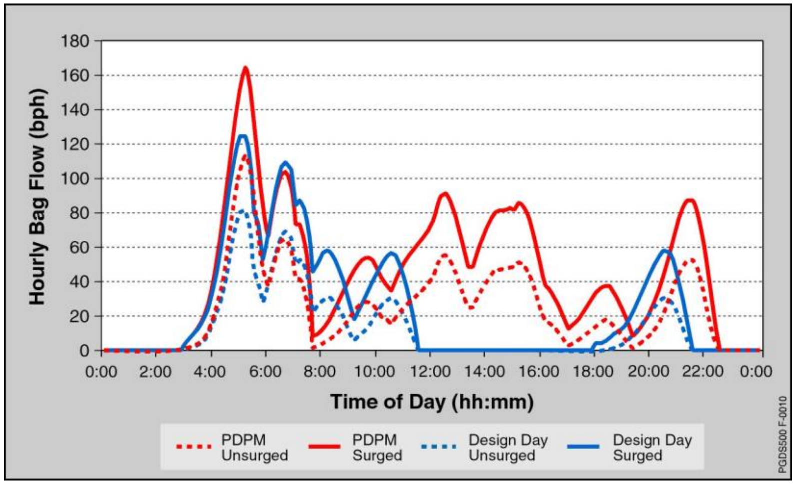


Table C-10 summarizes the PDPM (2008), PDPM surged, and design day and design day surged peak hour baggage volumes for each of the F3 screening zones.

Table C-10: F3 Screening Zone Peak Hour Baggage Volumes

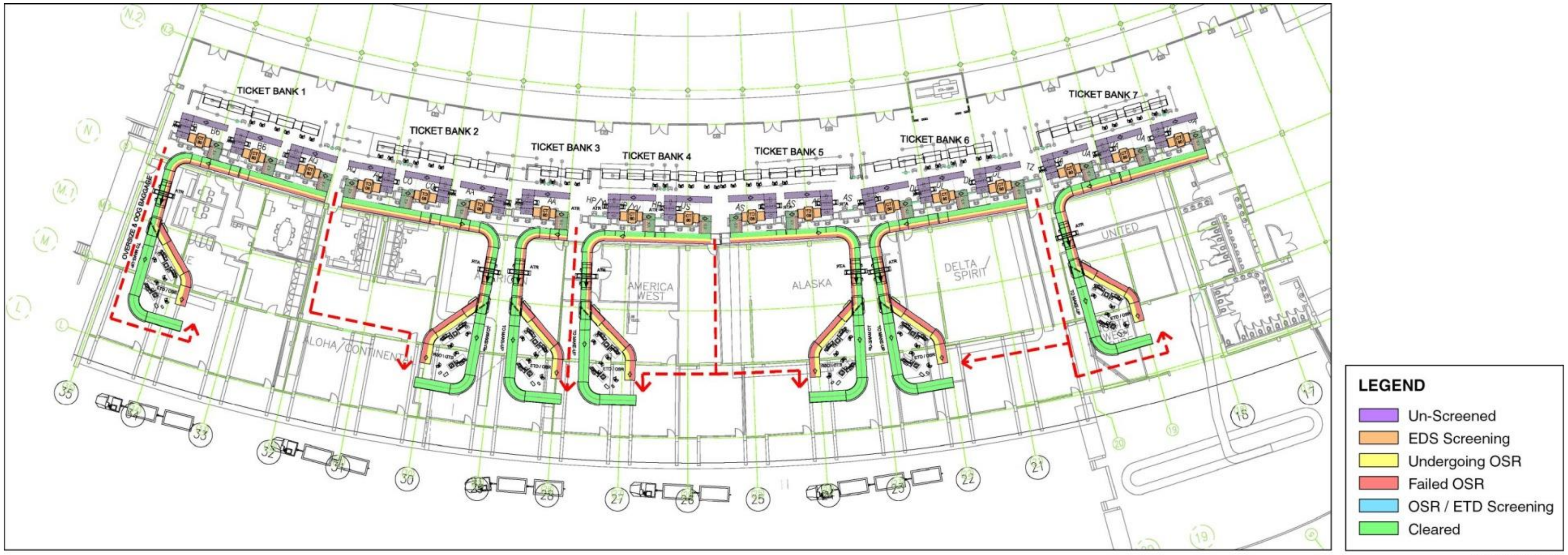
Zone	Airlines	PDPM	Peak Hour Baggage Volume PDPM Surged	Peak Hour Baggage Volume Design Day	Design Day Surged
$F3_1$	B6 - JetBlue Airways	236	311	236	311
$F3_2$	AQ - Aloha Airlines CO - Continental Airlines	188	256	188	256
$F3_3$	AA - American Airlines	80	123	84	129
$F3_4$	HP - America West Airlines YV - Mesa Airlines US - US Airways	65	105	161	224
$F3_5$	AS - Alaska Airlines QX - Horizon Air	164	227	166	229
$F3_6$	DL - Delta Air Lines OO - SkyWest Airlines TZ - ATA Airlines	114	166	154	215
$F3_7$	UA - United Airlines A296 - United Express XX - New Entrant Airline	113	165	186	253

Using the surged peak hour design day baggage volume, EDS, OSR, and ETD equipment requirements can be calculated for each of the three feasible alternatives based on the high-level methodology described in the following paragraphs, and in more detail in Chapter 6.

C.5.3 Feasible Alternative 1 – CT-80 EDS Machines

This alternative is a conceptual layout for the F3 Zone grouping at Terminal 1. Under this alternative, 17 Reveal CT-80 EDS machines would be placed directly behind and parallel to the ticket counters. The ticket counters would be divided into seven groups (F3 Zone grouping). Each group would be served by one, two, or three EDS machines and one CBRA, where combined OSR and ETD screening functions would be performed. Each grouping of machines would have a single conveyor leading to the baggage makeup area and the CBRA. The differences between dedicated and combined OSR functionality would be investigated further if Alternative 1 were selected as a preferred alternative; however, given the highly decentralized nature of this alternative, combined OSR/ETD is likely to be the most cost-effective approach. A conceptual diagram of Alternative 1 is provided in Figure C-14.

Figure C-14: Alternative 1 Conceptual Diagram, Terminal



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C.5.3.1 EDS Screening Equipment

Alternative 1 is based on the use of Reveal CT-80 EDS machines. As discussed in Chapter 3, the use of CT-80 EDS machines in a mini in-line system yields a throughput of 120 bags per hour (bph). The peak-hour surged baggage volume is divided by the assumed EDS equipment throughput, yielding the quantity of required EDS machines. The number of required machines should always be rounded up to the next whole EDS machine without considering redundancy.

As discussed in previous paragraphs, activity at Terminal 1 is constrained by the number of gates and the design year activity was projected based on this constraint; therefore, additional growth beyond the projected design year levels would not be possible. For this reason, the system would not need additional flexibility to accommodate growth beyond the design year. Given the decentralized nature of Terminal 1 mini in-line systems, redundancy would be provided through the use of nearby systems. While the demand profiles indicate that peaks generally occur early in the morning, some of the EDS machines are not fully utilized and could offer spare capacity if needed.

Redundant equipment is only cost-effective for high-throughput and medium-throughput in-line systems, where machine downtime can have a significant effect on system performance because of the high throughput of each EDS machine.

Table C-11 indicates the number of EDS machines required for Alternative 1.

Table C-11: Alternative 1 EDS Machine Capacity Calculations

Zone	Airlines	Peak Hour Bag Volume	EDS Throughput (bags/hour)	# EDS	# EDS With Redundancy
$F3_1$	B6 - JetBlue Airways	311	120	3	Same
$F3_2$	AQ - Aloha Airlines CO - Continental Airlines	256	120	3	Same
$F3_3$	AA - American Airlines	129	120	2	Same
$F3_4$	HP - America West Airlines YV - Mesa Airlines US - US Airways	224	120	2	Same
$F3_5$	AS - Alaska Airlines QX - Horizon Air	229	120	2	Same
$F3_6$	DL - Delta Air Lines OO - SkyWest Airlines TZ - ATA Airlines	215	120	2	Same
$F3_7$	UA - United Airlines A296 - United Express XX - New Entrant Airline	253	120	3	Same

C.5.3.2 OSR/ETD Screening Equipment

C.5.3.2.1 OSR/ETD Screening

As a mini in-line system, Alternative 1 is based on the use of OSR and ETD screening functions combined and performed by the same ETD screener with individual CBRAs dedicated to each screening zone or system. In general, an ETD machine would be shared between two screeners. Thus, the ratio of ETD screening stations to ETD equipment was assumed to be 2 to 1.

The formula for calculating the combined OSR and ETD station requirements is explained below in accordance with Chapter 6. Please note that the values used in these calculations are based on the equipment assumptions listed in Chapter 3. The calculation for screening zone $F3_1$ is shown below. Similar calculations were performed for the other six screening zones.

NOTE: All EDS false alarm rates and OSR clear rates are notional and are used for this example only. False alarm rates are considered SSI and can be requested from TSA, along with OSR clear rates.

The number of combined OSR and ETD screening stations required for zone $F3_1$:

$N_{ETD\ Station}$ = (Sum of $Throughput_{EDS}$ x FA_{EDS})/($Throughput_{OSR/ETD\ Screener}$)

= (360 bph x 19.5%)/34.5 bph

= 2.03 → 3 (rounded up)

$N_{ETD\ Machines}$ = (N_{ETD} Screeners/2) rounded up to the next ETD

= (3/2)

= 2 ETD Machines

Table C-12 indicates the quantity of combined OSR/ETD stations and ETD machines required for Alternative 1.

Table C-12: Alternative 1 OSR/ETD Equipment Calculations

Zone	Airlines	Peak Hour Bag Volume	EDS Throughput (bags/hour)	# EDS	# EDS With Redundancy	Number of combined OSR/ETD stations	Number of ETD machines
$F3_1$	B6 - JetBlue Airways	311	120	3	Same	3	2
$F3_2$	AQ - Aloha Airlines CO - Continental Airlines	256	120	3	Same	3	2
$F3_3$	AA - American Airlines	129	120	2	Same	2	1
$F3_4$	HP - America West Airlines YV - Mesa Airlines US - US Airways	224	120	2	Same	2	1
$F3_5$	AS - Alaska Airlines QX - Horizon Air	229	120	2	Same	2	1
$F3_6$	DL - Delta Air Lines OO - SkyWest Airlines TZ - ATA Airlines	215	120	2	Same	2	1
$F3_7$	UA - United Airlines A296 - United Express XX - New Entrant Airline	253	120	3	Same	3	2

C.5.3.2.2 ETD Screening for Oversize and Out of Gauge Baggage

Based on discussions with Airport staff and analysis of the CT-80 and L-3 eXaminer SX design specifications, it was assumed that 1% of all checked baggage at Terminal 1 is either oversize or OOG. These bags would be manually carried by the ticketing agent to the opposite end of the CBIS and given to TSA agents working at the ETD stations for directed trace screening.

C.5.4 Feasible Alternative 2 – L-3 eXaminer SX EDS Machines

This alternative is a conceptual design for the F3 Zone grouping at Terminal 1. As shown in Figure C-15, seven L-3 eXaminer SX EDS machines would be used under this alternative. The ticket counters would be divided into the same seven ticket counter groups as under Alternative 1. However, each group would be served by one EDS machine integrated downstream of the ticket counter take-away conveyor. This alternative was further split into two parts, Alternative 2A and Alternative 2B. Under Alternative 2A, OSR and ETD screening functions would be combined, similar to Alternative 1. Under Alternative 2B, dedicated OSR screening would be conducted in a separate screening room. The conceptual diagrams for Alternative 2A and Alternative 2B are the same, except for the remote OSR room, which is already built as part of the existing in-line system in Terminal 2.

Figure C-15: Alternatives 2A and 2B Conceptual Diagram, Terminal 1

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C.5.4.1 EDS Screening Equipment

Alternatives 2 and 3 are based on the use of L-3 eXaminer SX EDS machines. As each ticket counter line under both alternatives would feed an EDS scanner, the EDS equipment requirements would be the same under both alternatives. As reported in Chapter 3, the use of L-3 eXaminer SX EDS machines in a mini in-line system yields a throughput of 350 bags per hour per machine. The peak-hour surged baggage volume is divided by the assumed EDS equipment throughput, yielding the quantity of required EDS machines. In accordance with the PGDS, machine requirements should be rounded up to the next whole EDS machine exclusive of redundancy considerations.

Given the decentralized nature of the Terminal 1 mini in-line systems, redundancy would be provided through the use of nearby systems. While the demand profiles indicate that peaks generally occur early in the morning, some of the EDS machines are not fully utilized and could offer spare capacity if needed.

Redundant equipment is only cost-effective for high-throughput and medium-throughput in-line systems, where machine downtime can have a significant effect on system performance because of the high speed of each EDS machine.

Table C-13 indicates the quantity of EDS machines that would be required for Alternatives 2 and 3.

Table C-13: Alternatives 2 and 3 EDS Machine Calculations

Zone	Airlines	Peak Hour Bag Volume	EDS Throughput (bags/hour)	# EDS	# EDS With Redundancy
$F3_1$	B6 - JetBlue Airways	311	350	1	Same
$F3_2$	AQ - Aloha Airlines CO - Continental Airlines	256	350	1	Same
$F3_3$	AA - American Airlines	129	350	1	Same
$F3_4$	HP - America West Airlines YV - Mesa Airlines US - US Airways	224	350	1	Same
$F3_5$	AS - Alaska Airlines QX - Horizon Air	229	350	1	Same
$F3_6$	DL - Delta Air Lines OO - SkyWest Airlines TZ - ATA Airlines	215	350	1	Same
$F3_7$	UA - United Airlines A296 - United Express XX - New Entrant Airline	253	350	1	Same

C.5.4.2 OSR and ETD Screening Equipment

C.5.4.2.1 Alternative 2A, Combined OSR/ETD

As a mini in-line system, Alternative 2A is based on combined OSR and ETD screening functions that would be performed by the same ETD screener, with individual CBRAs dedicated to each screening zone or system. In general, an ETD machine would be shared between two screeners. Thus, the ratio of ETD screening stations to ETD equipment was assumed to be 2 to 1.

The formula for calculating the combined OSR and ETD station requirements is explained below in accordance with Chapter 6. Please note that all of the values used in these calculations are based on the equipment assumptions listed in Chapter 3. False alarm rates are considered SSI and can be requested from TSA. The calculation for screening zone $F3_1$ is shown below. Similar calculations were performed for the other six screening zones.

The number of combined OSR and ETD screening stations required for zone $F3_1$:

$$N_{ETD\ Stations} = \frac{N_{EDS} \times Throughput_{EDS} \times FA}{Throughput_{OSR/ETD Screener}}$$

$$N_{ETD\ Stations} = (350 \text{ bph} \times 15\%)/45.3 \text{ bph} = 1.16 \rightarrow 2 \text{ (rounded up)}$$

$$N_{ETD\ Machines} = \frac{N_{ETD\ Stations}}{2}$$

$$N_{ETD\ Machines} = (2/2) = 1 \text{ ETD Machine}$$

C.5.4.2.2 Alternative 2B, Dedicated OSR Screening

As a mini in-line system, Alternative 2B is based on the use of dedicated OSR and ETD screening functions that would be performed by different screeners, with individual CBRAs dedicated to each screening zone or system. In general, an ETD machine would be shared between two screeners. Thus, the ratio of ETD screening stations to ETD equipment was assumed to be 2 to 1.

The formula for calculating dedicated OSR and ETD station requirements is explained below in accordance with Chapter 6. Please note that the values used in these calculations are based on the equipment assumptions listed in Chapter 3. The calculation for screening zone $F3_1$ is shown below. Similar calculations were performed for the other six screening zones.

NOTE: All EDS false alarm rates and OSR clear rates are notional and used for this example only. False alarm rates are considered SSI and, along with OSR clear rates, can be requested from TSA.

The number of separate OSR and ETD screening stations required:

$$N_{OSR} = \frac{N_{EDS} \times Throughput_{EDS} \times FA_{EDS}}{Throughput_{OSR}}$$

$$N_{OSR} = (350 \text{ bph} \times 15\%)/(180 \text{ bph})$$
$$= 0.29 \rightarrow 1 \text{ (rounded up)}$$

$$N_{ETD\ Stations} = \frac{N_{EDS} \times Throughput_{EDS} \times FA \times (1-CR_{OSR})}{Throughput_{ETD Screener}}$$

$$N_{ETD\ Stations} = (350 \text{ bph} \times 15\% \times (40\%))/24.2 \text{ bph}$$
$$= 0.87 \rightarrow 1 \text{ (rounded up)}$$

Table C-14 indicates the quantity of combined OSR/ETD stations and ETD machines that would be required for Alternative 2.

Table C-14: Alternative 2 OSR/ETD Equipment Calculations

Airlines	Peak Hour Bag Volume	EDS Throughput (bags/hour)	# EDS	# EDS With Redundancy	Alt. 2A # Combined OSR/ETD Stations	Alt. 2B # Separate OSR Machines	Alt. 2B # Separate ETD Machines
B6 - JetBlue Airways	311	350	1	Same	2	1	1
AQ - Aloha Airlines CO - Continental Airlines	256	350	1	Same	2	1	1
AA - American Airlines	129	350	1	Same	2	1	1
HP - America West Airlines YV - Mesa Airlines US - US Airways	224	350	1	Same	2	1	1
AS - Alaska Airlines QX - Horizon Air	229	350	1	Same	2	1	1
DL - Delta Air Lines OO - SkyWest Airlines TZ - ATA Airlines	215	350	1	Same	2	1	1
UA - United Airlines A296 - United Express XX - New Entrant Airline	253	350	1	Same	2	1	1

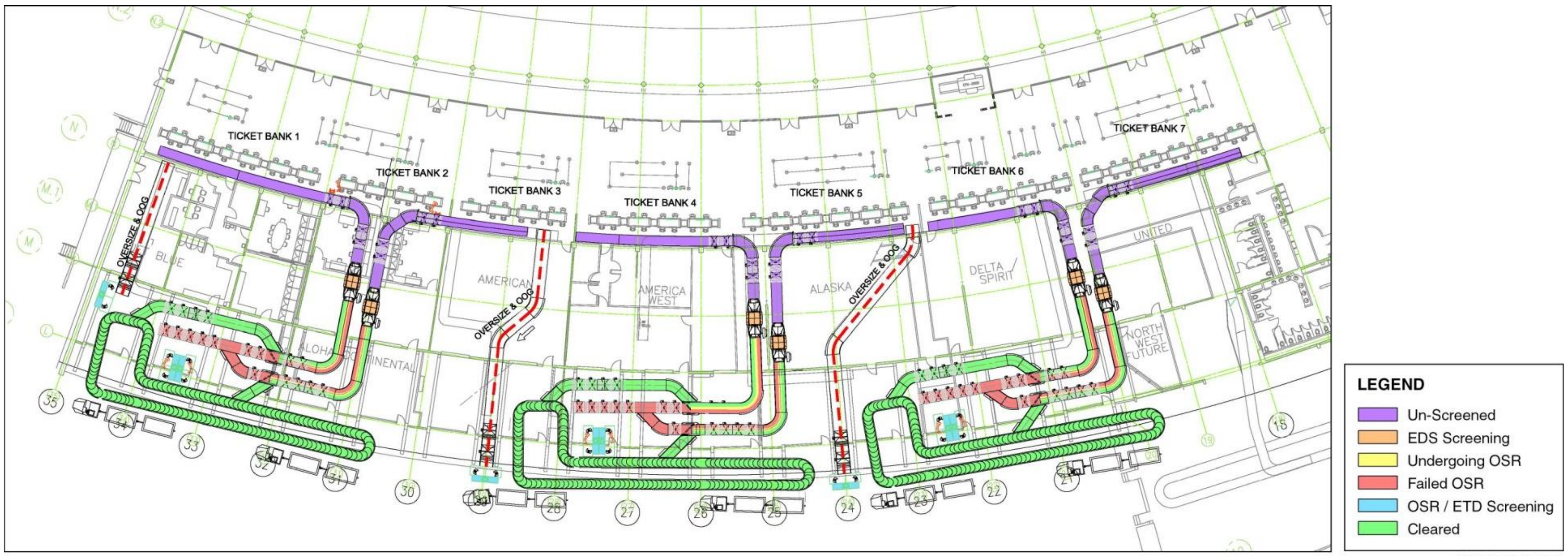
C.5.4.2.3 ETD Screening for Oversize and Out of Gauge Baggage

Based on discussions with Airport staff and analysis of the CT-80 and L-3 eXaminer SX design specifications, it was assumed that 1% of all checked baggage at Terminal 1 is either oversize or OOG. These bags would be manually carried by the ticketing agent to the opposite end of the CBIS and given to TSA agents working at the ETD stations for directed trace screening.

C.5.5 Feasible Alternative 3 – L-3 eXaminer SX EDS Machines

This alternative is also a conceptual design for the F3 Zone grouping at Terminal 1. Seven L-3 eXaminer SX EDS machines would be used. The ticket counters would be divided into seven ticket counter groups. Each group would be served by a single EDS machine integrated downstream of the ticket counter take-away conveyor. ETD screening and baggage makeup functions would be partially consolidated because a common CBRA and makeup area would serve every two EDS machines. In addition, OSR would be performed remotely, while ETD screening functions would be performed in the CBRA, as Alternative 3 represents a more staff-efficient screening method that could be effectively used when the CBIS design calls for common use CBRAs. A conceptual diagram of Alternative 3 is provided in Figure C-16.

Figure C-16: Alternative 3 Conceptual Diagram, Terminal 1



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C.5.5.1 Baseline Demand for Combined CBRAs

C.5.5.1.1 Surged PDPM for the Combined CBRAs

Alternative 3 combines ticket counter groups into common CBRAs for OSR and ETD screening. There are currently three common CBRAs consisting of screening zones $F3_{1-3}$, $F3_{4-5}$, and $F3_{6-7}$. See earlier Figure C-2. To accurately calculate the design day peak baggage flow that would reach the common CBRAs, separate baseline demand and peak day demand calculations must be run based on the combined airline and flight schedules for each common CBRA.

The peak month and the ADPM for each CBRA zone should be calculated if the standard methodology is used, as shown in Table C-15. However, as the strategy-oriented methodology was used, wherein the design day was created based on feedback from the airlines, this approach would not apply.

Table C-15: Combined CBRAs Peak Month and Peak Day

Zone	Airlines	Peak month	Peak day
$F3_{1-3}$	B6 - JetBlue Airways AQ - Aloha Airlines CO - Continental Airlines AA - American Airlines	August	25
$F3_{4-5}$	HP - America West Airlines YV - Mesa Airlines US - US Airways AS - Alaska Airlines QX - Horizon Air	August	25
$F3_{6-7}$	DL - Delta Air Lines OO - SkyWest Airlines TZ - ATA Airlines UA - United Airlines A296 - United Express XX - New Entrant Airline	August	25

The Terminal 1 design load adjustment factors and rates identified earlier in Table C-6 and the passenger arrival profiles identified in Figure C-4 were applied to the maximum seat capacity identified in each of the PDPM flight schedules for each of the combined CBRA zones.

C.5.5.1.2 Design Day Demand Estimation for Combined CBRA

Figure C-17 through Figure C-19 below represent the CBIS design load graphs for the $F3_{1-3}$, $F3_{4-5}$, and $F3_{6-7}$ screening zones. The base year CBIS design loads were calculated every 10 minutes over the duration of the design day. A surge factor was calculated according to PGDS Section 6.1.1, and applied to the CBIS design load of each 10-minute period. These 10-minute results are shown graphically in the following charts.

Figure C-17:
Strategy-Oriented Methodology Design Load Profile, $F3_{1-3}$ Zone

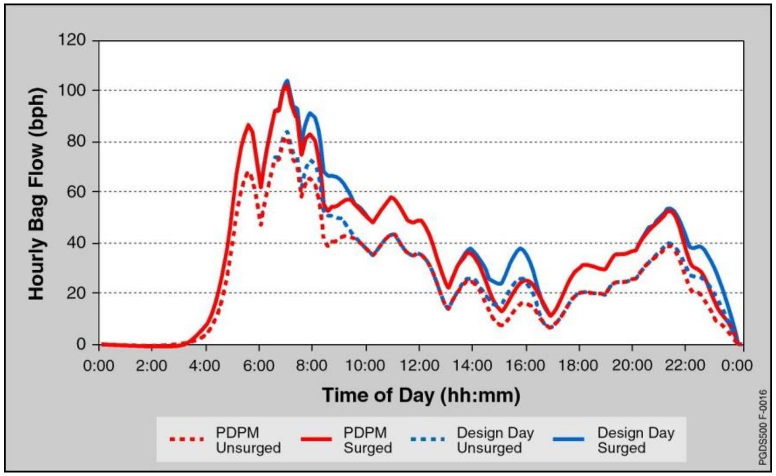


Figure C-18:
Strategy-Oriented Methodology Design Load Profile, $F3_{4-5}$ Zone

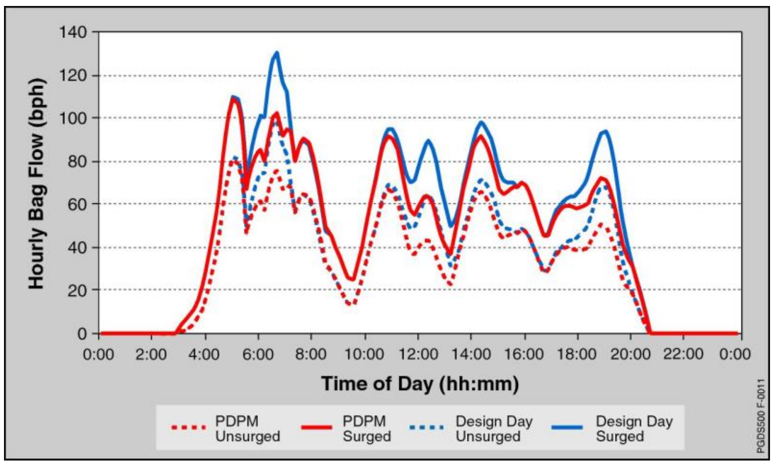


Figure C-19:
Strategy-Oriented Methodology Design Load Profile, $F3_{6-7}$ Zone

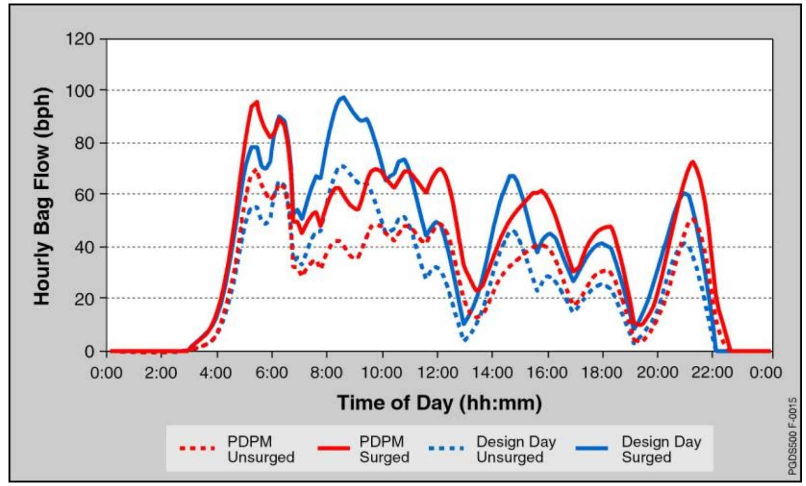


Table C-16 summarizes the PDPM, PDPM surged, and design day peak hour baggage volumes for each of the combined CBRA zones.

Using the surged peak hour design day baggage volume, EDS, OSR, and ETD equipment requirements can be calculated for each of the three combined CBRA zones based on the high-level methodology described in Chapter 6.

Table C-16: Combined CBRA Zone Peak Hour Baggage Volumes

Zone	Airlines	PDPM	Peak Hour Baggage Volume PDPM Surged	Peak Hour Baggage Volume Design Day	Design Day Surged
$F3_{1-3}$	B6 - JetBlue Airways AQ - Aloha Airlines CO - Continental Airlines AA - American Airlines	412	511	419	520
$F3_{4-5}$	HP - America West Airlines YV - Mesa Airlines US - US Airways AS - Alaska Airlines QX - Horizon Air	201	271	326	415
$F3_{6-7}$	DL - Delta Air Lines OO - SkyWest Airlines TZ - ATA Airlines UA - United Airlines A296 - United Express XX - New Entrant Airline	175	240	273	354

C.5.5.2 EDS Screening Equipment

See Table C-13 for EDS screening equipment for Alternative 3.

C.5.5.3 OSR and ETD Screening Equipment

C.5.5.3.1 Dedicated OSR Screening

As a mini in-line system, Alternative 3 is based on the use of dedicated OSR and ETD screening functions performed by different screeners in each of the combined CBRA zones. In general, an ETD machine would be shared between two screeners. Thus, the ratio of ETD screening stations to ETD equipment was assumed to be 2 to 1.

The formula for calculating dedicated OSR and ETD station requirements is explained below in accordance with PGDS Chapter 6. Please note that the values used in these calculations are based on the equipment assumptions listed in Chapter 3. The calculation for combined screening zone $F3_{1-3}$ is shown below. Similar calculations were performed for the other two combined screening zones.

NOTE: All EDS false alarm rates and OSR clear rates are notional and are used for this example only. False alarm rates are considered SSI and, along with OSR clear rates, can be requested from TSA.

The number of separate OSR and ETD screening stations required:

$$N_{OSR} = \frac{N_{EDS} \times Throughput_{EDS} \times FA_{EDS}}{Throughput_{OSR}}$$

$$N_{ETD\ Stations} = \frac{N_{EDS} \times Throughput_{EDS} \times FA \times (1-CR_{OSR})}{Throughput_{ETD Screener}}$$

$$N_{OSR} = (xxx\ bph \times 15\%)/(180\ bph) = xxx$$

$$N_{ETD\ Stations} = (xxx\ bph \times 15\% \times (40\%))/24.2\ bph = xxx$$

Table C-17 indicates the quantity of combined OSR/ETD stations and ETD machines that would be required for Alternative 3.

Table C-17: Combined CBRA OSR/ETD Calculations

Zone	Airlines	Peak Hour Bag Volume	EDS Throughput (bags/hour)	# EDS	# EDS With Redundancy	Number of combined OSR/ETD stations	Number of ETD machines
$F3_{1-3}$	B6 - JetBlue Airways AQ - Aloha Airlines CO - Continental Airlines AA - American Airlines	520	350	3	Same	1	2
$F3_{4-5}$	HP - America West Airlines YV - Mesa Airlines US - US Airways AS - Alaska Airlines QX - Horizon Air	415	350	2	Same	1	2
$F3_{6-7}$	DL - Delta Air Lines OO - SkyWest Airlines TZ - ATA Airlines UA - United Airlines A296 - United Express XX - New Entrant Airline	354	350	2	Same	1	2

C.6 ANALYSIS AND EVALUATION

The alternatives were evaluated using both qualitative assessment based on expert judgment and quantitative analysis of the life-cycle costs of the alternatives.

C.6.1 Qualitative Assessment

Table C-18 shows the qualitative assessment matrix and criteria used to assess all spatially feasible alternatives for Terminal 1. Several qualitative criteria were used to assess the alternatives based on expert judgment, namely:

1. Customer level of service – the effect that each alternative would have on the passenger's experience at the Airport.
2. Effect on Airport operations – the reliability and maintainability of the EDS equipment and the contingency procedures that could be implemented if a machine were inoperative during a peak period, as well as the effect that the alternative would have on the airlines.
3. Economic considerations – the costs associated with TSA staff salaries and with implementing and maintaining the alternative.
4. Design criteria – the effect that the alternative would have on existing facilities as well as the ease with which the alternative could be constructed or expanded.

Results of the qualitative assessment are shown in Table C-18 by alternative.

Table C-18: Qualitative Assessment Matrix

	Alternative 1	Alternative 2A	Alternative 2B	Alternative 3
Screening capacity	Adequate	Adequate	Adequate	Adequate
Customer level of service	Affected	Same	Same	Same
Operations				
Performance	Adequate	Adequate	Adequate	Adequate
Utilization of EDS equipment	Moderate	Moderate	Moderate	Moderate
Reliability and availability	Lower	Moderate	Moderate	Moderate
Contingency operations	Adequate	Moderate	Moderate	Moderate
Maintainability	Adequate	Adequate	Adequate	Adequate
Impact to airline operations	Moderate	Moderate	Moderate	Higher
Design				
Impact on existing facilities	Higher	Lower	Lower	Moderate
Expandability	More difficult	Feasible	Feasible	Feasible
Constructability and phasing	More difficult	Moderate	Moderate	More difficult

All alternatives would provide adequate screening capacity, meet performance standards, be equally maintainable, and provide moderate EDS utilization (typical of decentralized alternatives).

- **Alternative 1**. Alternative 1 would have the greatest effect on customer level of service because lobby space would be reduced by approximately 40% to accommodate the EDS machines behind the ticket counters. The maintainability of this alternative would be the lowest because it would involve the highest number of EDS machines. Alternative 1 was determined to be the worst performing alternative from economic and design standpoints as it would have high capital, maintenance, and operating costs; require the highest number of TSA screeners; have the greatest effect on existing facilities; and would be the most difficult to construct, phase, and expand.
- **Alternative 2A**. Alternative 2A was rated the best in terms of the evaluation criteria. It was determined that Alternative 2A is the most suitable type of checked baggage screening system to be implemented in Terminal 1. Alternative 2A has cost and operational characteristics consistent with the Port's expansion plans and is sufficiently flexible to quickly adapt to changes (e.g., different EDS equipment).

- **Alternative 2B**. Alternative 2B was rated the second best in terms of the evaluation criteria. Alternative 2B would not be as well suited to the Airport as Alternative 2A because of the higher capital cost required to install the remote OSR. Also the 95th percentile bag time in system was 8.90 minutes compared with 6.34 minutes for Alternative 2A. Although fewer bags were processed in the Baggage Inspection Room for Alternative 2B than for Alternative 2A, Alternative 2B still had a higher 95th percentile bag time in system because all of the bags that were sent to the Baggage Inspection Room were subject to a directed ETD search, which requires a longer processing time than the combined OSR/ETD search performed under Alternative 2A.
- **Alternative 3**. Alternative 3 would have a great effect on airline operations because of the combined baggage makeup areas, which are not airline specific. In addition, the Baggage Inspection Room would not be easily accessible, and that may create operational and security difficulties. Alternative 3 also has high capital costs; is difficult to construct and phase; and would have a significant effect on the airline baggage makeup operations because airlines would be required to share baggage carousels. In addition, Alternative 3 would occupy more space because of the increased number of automated conveyors.

Alternatives 2A and 2B had the highest scores, while Alternative 1 had the lowest score among the alternatives based on the above high-level qualitative assessment and expert judgment.

C.6.2 Quantitative Life-Cycle Cost Analysis

A life cycle cost analysis of the alternatives was then conducted. Based on the LCC analysis of each alternative, the preliminary ranking, and discussions with TSA and Airport staff, a decision was made as to the optimal solution that would best meet the Airport's needs while remaining a viable cost-effective alternative for TSA.

The LCC analysis was based on the methodology presented in Chapter 8. A real discount rate of 7% per year and an analysis period of 20 years were used. The costs used in the LCC analysis were based on the costs provided in Chapter 8 unless otherwise stated. A summary of the costs is provided in Table C-19.

Table C-19: Unit Costs Used in the Life Cycle Cost Analysis

Life cycle costs (a)	Alternative 1 CT-80	Alternative 2A L-3 eXaminer SX	Alternative 2B L-3 eXaminer SX	Alternative 3 L-3 eXaminer SX
Capital Costs				
Screening equipment purchase	$285,000	$350,000	$350,000	$ 350,000
Screening equipment installation	100,000	100,000	100,000	100,000
Screening equipment refurbishment	80,000	85,000	85,000	85,000
Screening equipment replacement	50,000	50,000	50,000	50,000
EDS cost of removal (b)	20,000	20,000	20,000	20,000
Required infrastructure modifications to the building and BHS	350,000	650,000	700,000	2,100,000 (c)
Operating and Maintenance Costs				
Screening equipment maintenance	$28,500	$35,000	$35,000	$35,000
Screening equipment pow er consumption	1.6 kWh	4.4 kWh	4.4 kWh	4.4 kWh
Incremental BHS maintenance costs (including additional maintenance personnel)	33,040	33,040	33,040	33,040

(a) All of the costs listed are unit costs per machine.
(b) Costs not provided in the Planning Guidelines and Design Standards, but rather determined using expert judgment.
(c) The costs vary by alternative because some alternatives require significantly more infrastructure modifications than others. Whenever necessary, expert judgment was used.

The methodology used to calculate the LCCs is described below:

- It was assumed that installation of the in-line system would begin in 2007 and that the DBU of the in-line system would be in 2008.
- All EDS machines were assumed to be refurbished after seven years and replaced with new machines four years later.
- All maintenance costs were assumed to be covered by the manufacturer during the first year of operation of a new EDS machine.
- Using expert judgment, incremental BHS operating costs were calculated at 10% of the screening equipment operating costs.
- It was assumed that the EDS machine residual value equals the disposal cost of the EDS machine. As these two costs balance each other, they were not included in the calculations.

Based on the assumptions and costs provided above, the total net present value of the LCCs for each of the alternatives is presented in Table C-20. Please refer to Table C-21 through Table C-24 for more detailed calculations.

Table C-20: Alternative Life Cycle Costs

Alternatives	Life cycle costs*
Alternative 1	$41,348,128
Alternative 2A	25,272,491
Alternative 2B	22,771,578
Alternative 3	31,577,852

*Present value costs over 20 years.

The lowest LCC for Terminal 1 was for Alternative 2B ($22.77 million), with Alternative 2A having the next lowest LCC ($25.27 million).

The difference in LCC between Alternatives 2A and 2B was relatively small (the LCC for Alternative 2B is approximately 10% lower than for Alternative 2A), so these two alternatives were kept for presentation to stakeholders while Alternatives 1 and 3 were eliminated from further consideration.

As the LCCs for Alternatives 2A and 2B were similar and Alternative 2A was rated as qualitatively superior to Alternative 2B (Table C-18), Alternative 2A was selected as the preferred alternative for Terminal 1. Note that this decision was based on input from stakeholders, assessment of the qualitative effects of the systems, and the marginal difference in LCCs between Alternatives 2A and 2B. Therefore, while Alternative 2A would be slightly more expensive from a life-cycle cost perspective, the qualitative benefits of the system outweighed the slightly higher life-cycle cost.

Table C-21 Terminal 1, Alternative 1, Life Cycle Cost Analysis

Cost Categories	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Capital Cost										
Screening equipment purchase		$4,845,000								
Screening equipment installation		1,700,000								
Screening equipment refurbishment									$1,360,000	
Screening equipment replacement									850,000	
EDS removal										
Required infrastructure modifications to the building and BHS	$5,950,000									
O&M Costs										
Screening equipment maintenance		--	$ 484,500	$ 484,500	$ 484,500	$ 484,500	$ 484,500	$ 484,500	484,500	$ 484,500
Screening equipment operating		23,827	23,827	23,827	23,827	23,827	23,827	23,827	23,827	23,827
Incremental BHS maintenance (including additional maintenance personnel)		561,680	561,680	561,680	561,680	561,680	561,680	561,680	561,680	561,680
Incremental BHS operating		2,383	2,383	2,383	2,383	2,383	2,383	2,383	2,383	2,383
Staffing Costs										
TSA screener and supervisor (a)		1,310,074	1,310,074	1,310,074	1,358,147	1,358,147	1,358,147	1,358,147	1,358,147	1,358,147
Staff associated with clearing bag jams or portering bags (if not included in O&M costs described above)		--	--	--	--	--	--	--	--	--
Total	$ 5,950,000	$8,442,964	$2,382,464	$2,382,464	$2,430,537	$2,430,537	$2,430,537	$2,430,537	$4,640,537	$2,430,537
Discount Factor	1.000	1.070	1.145	1.225	1.311	1.403	1.501	1.606	1.718	1.838
Discounted Annual Costs	$ 5,950,000	$7,890,620	$2,080,936	$1,944,800	$1,854,245	$1,732,939	$1,619,569	$1,513,616	$2,700,835	$1,322,051
Present Value of Costs	$41,348,128									

Table C-21 (page 2 of 2): Terminal 1, Alternative 1, Life Cycle Cost Analysis

Cost Categories	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Capital Cost										
Screening equipment purchase			$4,845,000							
Screening equipment installation			1,700,000							
Screening equipment refurbishment										$1,360,000
Screening equipment replacement										850,000
EDS removal			340,000							
Required infrastructure modifications to the building and BHS										
O&M Costs										
Screening equipment maintenance	$ 484,500	$ 484,500	-	$ 484,500	$ 484,500	$ 484,500	$ 484,500	$ 484,500	$ 484,500	484,500
Screening equipment operating	23,827	23,827	23,827	23,827	23,827	23,827	23,827	23,827	23,827	23,827
Incremental BHS maintenance (including additional maintenance personnel)	561,680	561,680	561,680	561,680	561,680	561,680	561,680	561,680	561,680	561,680
Incremental BHS operating	2,383	2,383	2,383	2,383	2,383	2,383	2,383	2,383	2,383	2,383
Staffing Costs										
TSA screener and supervisor (a)	1,358,147	1,358,147	1,358,147	1,358,147	1,358,147	1,358,147	1,358,147	1,358,147	1,358,147	1,358,147
Staff associated with clearing bag jams or portering bags (if not included in O&M costs described above)	--	--	--	--	--	--	--	--	--	--
Total	$2,430,537	$2,430,537	$8,831,037	$2,430,537	$2,430,537	$2,430,537	$2,430,537	$2,430,537	$2,430,537	$4,640,537
Discount Factor	1.967	2.105	2.252	2.410	2.579	2.759	2.952	3.159	3.380	3.617
Discounted Annual Costs	$1,235,562	$1,154,731	$3,921,086	$1,008,586	$942,604	$880,938	$823,307	$769,446	$719,108	$1,283,147
Present Value of Costs										

(a) Costs for TSA staffing are notional and may not reflect existing staffing estimates, unit costs, or policies.

Note: This example is based on a study that has been commissioned by the Port of Oakland, however, some costs estimates are derived from the BSIS Guidelines rather than the actual cost estimates developed by the Oakland study. These cost estimates do not necessarily reflect final results and conclusions for the study commissioned by the Port.

Table C-22: Terminal 1, Alternative 2a, Life Cycle Cost Analysis

Cost Categories	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Capital Cost										
Screening equipment purchase		$2,450,000								
Screening equipment installation		700,000								
Screening equipment refurbishment									$ 595,000	
Screening equipment replacement									350,000	
EDS removal										
Required infrastructure modifications to the building and BHS	$ 4,550,000									
O&M Costs										
Screening equipment maintenance		--	$ 245,000	$ 245,000	$ 245,000	$ 245,000	$ 245,000	$ 245,000	245,000	$ 245,000
Screening equipment operating		26,981	26,981	26,981	26,981	26,981	26,981	26,981	26,981	26,981
Incremental BHS maintenance (including additional maintenance personnel)		231,280	231,280	231,280	231,280	231,280	231,280	231,280	231,280	231,280
Incremental BHS operating		2,698	2,698	2,698	2,698	2,698	2,698	2,698	2,698	2,698
Staffing Costs										
TSA screener and supervisor (a)		847,329	973,563	973,563	1,021,636	1,021,636	1,069,709	1,069,709	1,069,709	1,069,709
Staff associated with clearing bag jams or portering bags (if not included in O&M costs described above)		--	--	--	--	--	--	--	--	--
Total	$ 4,550,000	$4,258,288	$1,479,522	$1,479,522	$1,527,595	$1,527,595	$1,575,668	$1,575,668	$2,520,668	$1,575,668
Discount Factor	1.000	1.070	1.145	1.225	1.311	1.403	1.501	1.606	1.718	1.838
Discounted Annual Costs	$ 4,550,000	$3,979,708	$1,292,272	$1,207,731	$1,165,395	$1,089,154	$1,049,934	$981,247	$1,467,052	$857,059
Present Value of Costs	$25,272,491									

Table C-22 (page 2 of 2): Terminal 1, Alternative 2a, Life Cycle Cost Analysis

Cost Categories	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Capital Cost										
Screening equipment purchase			$2,450,000							
Screening equipment installation			700,000							
Screening equipment refurbishment										$ 595,000
Screening equipment replacement										350,000
EDS removal			140,000							
Required infrastructure modifica-tions to the building and BHS										
O&M Costs										
Screening equipment maintenance	$ 245,000	$ 245,000	--	$ 245,000	$ 245,000	$ 245,000	$ 245,000	$ 245,000	$ 245,000	245,000
Screening equipment operating	26,981	26,981	26,981	26,981	26,981	26,981	26,981	26,981	26,981	26,981
Incremental BHS maintenance (including additional maintenance personnel)	231,280	231,280	231,280	231,280	231,280	231,280	231,280	231,280	231,280	231,280
Incremental BHS operating	2,698	2,698	2,698	2,698	2,698	2,698	2,698	2,698	2,698	2,698
Staffing Costs										
TSA screener and supervisor (a)	1,069,709	1,069,709	1,069,709	1,069,709	1,069,709	1,069,709	1,069,709	1,069,709	1,069,709	1,069,709
Staff associated with clearing bag jams or portering bags (if not included in O&M costs described above)	--	--	--	--	--	--	--	--	--	--
Total	$1,575,668	$1,575,668	$4,620,668	$1,575,668	$1,575,668	$1,575,668	$1,575,668	$1,575,668	$1,575,668	$2,520,668
Discount Factor	1.967	2.105	2.252	2.410	2.579	2.759	2.952	3.159	3.380	3.617
Discounted Annual Costs	$800,990	$748,588	$2,051,632	$653,846	$611,071	$571,095	$533,733	$498,816	$466,183	$696,986
Present Value of Costs										

(a) Costs for TSA staffing are notional and may not reflect existing staffing estimates, unit costs, or policies.

Note: This example is based on a study that has been commissioned by the Port of Oakland, however, some costs estimates are derived from the BSIS Guidelines rather than the actual cost estimates developed by the Oakland study. These cost estimates do not necessarily reflect final results and conclusions for the study commissioned by the Port.

Table C-23: Terminal 1, Alternative 2b, Life Cycle Cost Analysis

Cost Categories	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Capital Cost										
Screening equipment purchase		$2,450,000								
Screening equipment installation		700,000								
Screening equipment refurbishment									$ 595,000	
Screening equipment replacement									350,000	
EDS removal										
Required infrastructure modifications to the building and BHS	$ 4,900,000									
O&M Costs										
Screening equipment maintenance		--	$ 245,000	$ 245,000	$ 245,000	$ 245,000	$ 245,000	$ 245,000	245,000	$ 245,000
Screening equipment operating		26,981	26,981	26,981	26,981	26,981	26,981	26,981	26,981	26,981
Incremental BHS maintenance (including additional maintenance personnel)		231,280	231,280	231,280	231,280	231,280	231,280	231,280	231,280	231,280
Incremental BHS operating		2,698	2,698	2,698	2,698	2,698	2,698	2,698	2,698	2,698
Staffing Costs										
TSA screener and supervisor (a)		751,183	751,183	751,183	751,183	751,183	751,183	751,183	751,183	751,183
Staff associated with clearing bag jams or portering bags (if not included in O&M costs described above)		--	--	--	--	--	--	--	--	--
Total	$ 4,900,000	$4,162,142	$1,257,142	$1,257,142	$1,257,142	$1,257,142	$1,257,142	$1,257,142	$2,202,142	$1,257,142
Discount Factor	1.000	1.070	1.145	1.225	1.311	1.403	1.501	1.606	1.718	1.838
Discounted Annual Costs	$ 4,900,000	$3,889,852	$1,098,036	$1,026,202	$959,068	$896,325	$837,687	$782,885	$1,281,667	$ 683,802
Present Value of Costs	$22,771,578									

Table C-23 (page 2 of 2): Terminal 1, Alternative 2b, Life Cycle Cost Analysis

Cost Categories	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Capital Cost										
Screening equipment purchase			$2,450,000							
Screening equipment installation			700,000							
Screening equipment refurbishment										$ 595,000
Screening equipment replacement										350,000
EDS removal			140,000							
Required infrastructure modifications to the building and BHS										
O&M Costs										
Screening equipment maintenance	$ 245,000	$ 245,000	--	$ 245,000	$ 245,000	$ 245,000	$ 245,000	$ 245,000	$ 245,000	245,000
Screening equipment operating	26,981	26,981	26,981	26,981	26,981	26,981	26,981	26,981	26,981	26,981
Incremental BHS maintenance (including additional maintenance personnel)	231,280	231,280	231,280	231,280	231,280	231,280	231,280	231,280	231,280	231,280
Incremental BHS operating	2,698	2,698	2,698	2,698	2,698	2,698	2,698	2,698	2,698	2,698
Staffing Costs										
TSA screener and supervisor (a)	751,183	751,183	751,183	751,183	751,183	751,183	751,183	751,183	751,183	751,183
Staff associated with clearing bag jams or portering bags (if not included in O&M costs described above)	--	--	--	--	--	--	--	--	--	--
Total	$1,257,142	$1,257,142	$4,302,142	$1,257,142	$1,257,142	$1,257,142	$1,257,142	$1,257,142	$1,257,142	$2,202,142
Discount Factor	1.967	2.105	2.252	2.410	2.579	2.759	2.952	3.159	3.380	3.617
Discounted Annual Costs	$ 639,067	$ 597,259	$1,910,202	$ 521,669	$ 487,541	$ 455,646	$ 425,837	$ 397,979	$ 371,943	$608,911
Present Value of Costs										

(a) Costs for TSA staffing are notional and may not reflect existing staffing estimates, unit costs, or policies.

Note: This example is based on a study that has been commissioned by the Port of Oakland, however, some costs estimates are derived from the BSIS Guidelines rather than the actual cost estimates developed by the Oakland study. These cost estimates do not necessarily reflect final results and conclusions for the study commissioned by the Port.

Table C-24: Terminal 1, Alternative 3, Life Cycle Cost Analysis

Cost Categories	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Capital Cost										
Screening equipment purchase		$2,450,000								
Screening equipment installation		700,000								
Screening equipment refurbishment									$ 595,000	
Screening equipment replacement									350,000	
EDS removal										
Required infrastructure modifications to the building and BHS	$14,700,000									
O&M Costs										
Screening equipment maintenance		--	$ 245,000	$ 245,000	$ 245,000	$ 245,000	$ 245,000	$ 245,000	245,000	$ 245,000
Screening equipment operating		26,981	26,981	26,981	26,981	26,981	26,981	26,981	26,981	26,981
Incremental BHS maintenance (including additional maintenance personnel)		231,280	231,280	231,280	231,280	231,280	231,280	231,280	231,280	231,280
Incremental BHS operating		2,698	2,698	2,698	2,698	2,698	2,698	2,698	2,698	2,698
Staffing Costs										
TSA screener and supervisor (a)		655,037	655,037	655,037	655,037	655,037	655,037	655,037	655,037	655,037
Staff associated with clearing bag jams or portering bags (if not included in O&M costs described above)		--	--	--	--	--	--	--	--	--
Total	$14,700,000	$4,065,996	$1,160,996	$1,160,996	$1,160,996	$1,160,996	$1,160,996	$1,160,996	$2,105,996	$1,160,996
Discount Factor	1.000	1.070	1.145	1.225	1.311	1.403	1.501	1.606	1.718	1.838
Discounted Annual Costs	$14,700,000	$3,799,996	$1,014,059	$947,718	$885,718	$827,774	$773,621	$723,010	$1,225,709	$631,505
Present Value of Costs	$31,577,852									

Table C-24 (page 2 of 2): Terminal 1, Alternative 3, Life Cycle Cost Analysis

Cost Categories	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Capital Cost										
Screening equipment purchase			$2,450,000							
Screening equipment installation			700,000							
Screening equipment refurbishment										$ 595,000
Screening equipment replacement										350,000
EDS removal			140,000							
Required infrastructure modifications to the building and BHS										
O&M Costs										
Screening equipment maintenance	$ 245,000	$ 245,000	--	$ 245,000	$ 245,000	$ 245,000	$ 245,000	$ 245,000	$ 245,000	245,000
Screening equipment operating	26,981	26,981	26,981	26,981	26,981	26,981	26,981	26,981	26,981	26,981
Incremental BHS maintenance (including additional maintenance personnel)	231,280	231,280	231,280	231,280	231,280	231,280	231,280	231,280	231,280	231,280
Incremental BHS operating	2,698	2,698	2,698	2,698	2,698	2,698	2,698	2,698	2,698	2,698
Staffing Costs										
TSA screener and supervisor (a)	655,037	655,037	655,037	655,037	655,037	655,037	655,037	655,037	655,037	655,037
Staff associated with clearing bag jams or portering bags (if not included in O&M costs described above)	--	--	--	--	--	--	--	--	--	--
Total	$1,160,996	$1,160,996	$4,205,996	$1,160,996	$1,160,996	$1,160,996	$1,160,996	$1,160,996	$1,160,996	$2,105,996
Discount Factor	1.967	2.105	2.252	2.410	2.579	2.759	2.952	3.159	3.380	3.617
Discounted Annual Costs	$590,191	$551,581	$1,867,512	$481,772	$450,254	$420,798	$393,269	$367,542	$343,497	$582,325
Present Value of Costs										

(a) Costs for TSA staffing are notional and may not reflect existing staffing estimates, unit costs, or policies.

Note: This example is based on a study that has been commissioned by the Port of Oakland, however, some costs estimates are derived from the BSIS Guidelines rather than the actual cost estimates developed by the Oakland study. These cost estimates do not necessarily reflect final results and conclusions for the study commissioned by the Port.

C.7 FINAL CONSIDERATIONS

The development of conceptual alternatives and selection of the preferred solutions for any airport terminal is an iterative process based both on quantifiable analysis and good judgment. Terminal space constraints, airline preferences, and TSA security and operational considerations play major roles in determining which zoning schemes can be successfully translated into a feasible concept. Cost considerations are fundamental in determining which concepts should be eliminated in the process of selecting the preferred alternative(s).

In this particular case study, the preferred alternative had the second lowest cost as identified by the life cycle cost analysis, the best design, and the fewest operational effects on the Airport, as identified in the qualitative assessment matrix (Table C-18).

APPENDIX D:

COMMISSIONING AND EVALUATION REQUIREMENTS

D.1 INTRODUCTION

Commissioning and Evaluation Requirements and safety are evaluated through a top level suite of CBIS tests, non-test verification conducted during ISAT, and a subsequent operational run-in period. The sum of these evaluation means are used to evaluate a checked baggage inspection system for adherence to the requirements established throughout the PGDS, including in Chapters 2, 3, 7, 9, 10, 11, and 12. Each CBIS being commissioned or evaluated by or on behalf of the TSA will be tested in accordance with a SSTP developed for this top level suite of tests. As each CBIS is unique, the individual tests contained in the SSTP may be a subset of this overall suite and may contain additional or modified tests as needed to evaluate the individual CBIS for adherence to the requirements.

The test and evaluation information described herein apply to all CBIS (In-line and Mini In-line), and associated BHSs, including the delivery to and takeaway from the screening system unless specifically stated otherwise.

The physical, programming, networking, and reports of the entire CBIS will be in final operational configuration prior to ISAT. This includes (unless waivered):

- All induction points tied in (unless phased)
- All BHS conveyors, pathways, and components are operational (CBRA lines, OOG/OS lines, RI lines, clear outbound paths, BMAs, ATRs, etc.), including legacy BHS components delivering bags to the CBIS and taking bags away from the CBIS
- All BHS interfaces operational (including manual encode stations; IQ; E-stops; BRPs, BISs, and BSDs; jam control stations; etc.)
- All BHS functionality (e.g., bag allocation, load leveling, merge logic, purge logic, and other conditional performance programming)
- All EDS components (EDS, CI, PVS, SVS, printers) installed and networked in final—not temporary—configuration, to include redundancy, if applicable
- BHS network in final configuration accessible via the BHS control room and its interfaces, including redundancy, if applicable
- Complete BHS/CBIS reports

TSA uses bag sets of various sizes to simulate stream of commerce bags during ISAT. The ILDT should ensure bags of varying sizes are used in its pre-testing. Table D-1 shows bag dimensions (LxWxH) of a nominal TSA bag set. Depending on the bag set and local policy, average bag lengths differ between sites. Bag weights vary from 5 to 50 pounds.

In addition to the specific tests described in this appendix, the individual SSTPs will contain requirements to verify that the reporting capabilities defined in Section 7.2.13 have been provided and that the reports are accurate.

Table D-1: TSA ISAT Bag Dimensions

Bag Type	Length (inches)	Width (inches)	Height (inches)
1	27	19	10
2	24	15	9
3	22	12	12
4	26	17	10
5	22	15	9
6	21	14	7.5
7	27	19	10
8	24	15	9
9	22	12	12
10	28	23	8.5
11	27	19	10.5
12	23	21	8
13	35	16	15
14	30	15	10
15	17	9	7
16	30	18	18
17	43	16	6
18	52	16	6

CBIS Testing is divided into four suites. These suites are:

1. Introductory Testing
2. Detailed Testing
3. System-wide Testing
4. Operational Run-In

As each CBIS is unique, the individual tests contained in an SSTP may be a subset of the overall suite of tests contained in the PGDS, and may contain additional or modified tests as needed to evaluate the individual CBIS for adherence to the requirements and/or TSA guidance. The SSTP will include such modifications and will be reviewed with the Project Sponsor during the Site Survey and/or SSTP Review meetings which precede CBIS testing. The Project Sponsor will have the opportunity to ask questions and comment on drafts of the SSTP during this time.

The TSA and/or the TSA's Independent Acceptance Testing Team will verify that the tests and evaluations contained in the SSTP and this appendix have been performed by participating in the conduct of pre-ISAT or TRR testing, where authorized, and/or by performing an independent test of the system.

When any change to the CBIS is required following issuance of the TRN through the completion of ISAT, a change request will be submitted as defined in Section 2.1.2. Acceptance testing must be informed of and approve of requested changes during this time if they impact system performance or design, as changes may require alteration to the testing suite, and because such changes must be documented in the QLR report.

The specific tests described in Section D.2.4 through D.2.6 below contain requirements to verify that the reporting capabilities defined in Section 7.2.13 have been provided and that the reports are accurate, as well as that the BHS displays in the CBRA meet the requirements defined in Section 9.2.2.

In addition to the testing suite and associated PGDS sections defined herein, TSA's Independent Acceptance Test Team will confirm other PGDS requirements that include evaluation of CBIS performance relative to the requirements set forth in the following PGDS Sections and submitted procedures and processes:

Section	Requirements Verified
2.2.5.1	Procedures Requirements • Bag Induction Procedures • CBIS Failsafe Procedures • Bag Jam and Fault Clearing Procedures
2.2.6	PLC Code • Test and Commissioning (Process, Support, Final Configuration)
7.2.1.2	Tail-to-Head Bag Spacing • The speed of the queue belt immediately before and after the EDS unit as bags transition into and out of the EDS shall comply with the EDS Integration Manual
7.2.6.1	Divert and Merge Requirements • Item 2: Separated clear and non-clear bags shall not be commingled
7.2.11.1	Recirculation Loop Requirement • The automatic recirculation of bags shall not be designed, either pre-EDS screening or post-EDS screening, except for automated reinsertion lines in the CBRA as shown in Chapter 9.

Section	Requirements Verified
7.2.11.2	Reinsertion Line Requirement • Non-cleared bags shall only be reinserted upstream of the STZ
7.2.11.3	Draft Curtains Requirement • All PECs shall be clear of obstructions including draft curtains
7.2.12.3	Specific STIP Design Requirement • All ETDs and stand-alone EDSs shall have 1 "dual telecommunications outlet"
7.3.2.8	BHS Reporting During Maintenance • BHS Reporting capabilities shall be designed such that logging of system events and bag counts are able to be disabled for maintenance activities.
9.2.1	CBRA Layout and Equipment • CBRA layout and Equipment Details • Ergonomic Dimensions of CBRA Interfaces and Component
10.1	OSR Planning • OSR Components
10.4.3	OSR Room Layout
11.3.2	Programming Logic (Contingency Planning)
A.7	Daily CBIS Report Examples
A.9	CBIS Change Request
A.11	Request for PGDS Variance Template

D.2 INTRODUCTORY TESTING

Introductory tests will be performed on each spur line containing an EDS. At a minimum, bags are inducted from the point of acquisition of tracking through the EDS to the point(s) of diversion to the Clear or outbound lines and into the CBRA, "the Security Tracking Zone." When possible, bags should be inducted from their natural point(s) of origin (e.g., ticket counters, curbside).

For all EDS, bag spacing—both tail-to-head and head-to-head—should be optimized to meet the required throughput rate and still maintain positive bag tracking. The ILDT will ensure that all tracking and spacing is compliant with the OEM's Site Planning and Installation guidelines.

D.2.1 CBRA Equipment and Functionality Test

Purpose: The CBRA Equipment and Functionality Test will be performed to assess compliance with PGDS or TSA-approved CBRA requirements relating to CBRA equipment, layout, and functionality and controls in Normal and AQM scenarios.

Procedure: This test will be performed in three parts run contiguously as a single test to observe and evaluate the CBIS in distinct functionality regimes.

Part 1, Normal Queueing and Automated Re-Insertion:

- CBRA Configuration:
  - Enable two or three BIS, excluding the first/last positions. Ensure that there are one or two intermediate queues between the enabled BIS.
- Induct enough alarm bags to exercise Normal Queuing logic and invoke use of the intermediate queues. The induction rate and quantities should be controlled so that queuing logic upstream of enabled BRPs, outside of CBRA, and at intermediate queues can be distinctly assessed. During this part of the test, Normal queuing priority, automatic reinsert functionality, and the display details and display options for most bag types will be verified. In addition, SVS information will be confirmed for both the Alarmed bag arrival (via automatic lookup) and Unknown bag arrival (via scan gun operation).
  - Create differing bag statuses. Of the bags arriving at enabled BRPs, they should possess differing statuses consisting of those described in PGDS (i.e., Alarmed, Unknown – lost alarm bag, OOG, Timeout, and/or EDS Error – as applicable).
    - For Unknown status, manipulate a bag post EDS
    - For EDS Errored, enable an EDS E-stop when one or 2 alarm bags are in the scan plane of the EDS. Other methods to generate the EDS Errored status may be used.
    - Use an OOG bag only if OOG bags are routed to CBRA and it’s a valid status
    - For a Timeout bag, advise PVS Operator to let one Alarmed bag to timeout on-screen in OSR.
  - Once the target bags occupy the enabled BRP/BIS, document and verify that the Unknown, EDS Errored, and OOG bag present the option for automatic “Reinsert” on the BIS BSD.
  - While processing bags from BRPs, confirm that bags are assigned to the BRP from which a bag was most recently cleared, or first logged in BRP, whichever is available first.
  - Ensure that the remaining Timeout and Alarmed bags on the BIS are not “cleared” – i.e. the BIS remains occupied.

Part 2, AQM and Manual Re-Insertion:

- CBRA functionality and manual reinsert logic/functionality during AQM will be verified.
  - Induct additional Alarmed bags, based on how many intermediate queues are in-between the BIS that were enabled in Part 1. For CBIS possessing large CBRAs, enough bags will be inducted in this part of the test to permit manual reinsertion from both the RL queue as well as the center queue.
  - Create several Unknown status bags to be processed from BRPs under AQM and Normal modes.
  - These bags should exceed the storage capacity remaining in the CBRA and thus force AQM to occur on one or two, but not all BRPs. Induct additional bags, if needed.
- Use the bags to perform a manual reinsertion from the next to last BIS/BRP under AQM.
- The furthest downstream enabled BRP should not be under AQM. Confirm this at the BSD and conduct auto-reinsertion for an Unknown Bag at this location.

Part 3, Resumption of Normal Queueing, BIS E-Stops, and Other Display Assessment:

- During this part of the test, initially no additional bags are inducted, but all remaining bags are cleared per SOPs and the resolution of AQM on applicable BRP/BISs can be observed.
- Near the end of the resolution of inducted bags, one of the BIS E-Stops should be selected to confirm expected functionality and all bags statuses should be maintained.
- The display status and options for the remaining bag arrival types not already confirmed will be created while queued bags are processed following CBRA clearing procedures.
  - Clear Bag Routing to CBRA: Configure the CBIS final decision point to divert all bags to CBRA and induct an Alarmed Bag that will be cleared by OSR with 5-10 seconds of viewing time remaining. Confirm BSD status and other display details.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.5.1.2	Post-EDS Requirements
7.2.13	CBIS Reporting
9.2.1	CBRA Layout and Equipment
9.2.2	CBRA Functionality
9.2.3	Workstation Sequence of Operations

D.2.2 Travel Time/On-Screen Resolution Test

Purpose: The Travel Time/OSR Test will be performed to ensure that sufficient conveyor travel distances are available for the use of OSR protocols. This test will also evaluate bag routing and BHS/EDS network interfaces in accordance with OSR-related settings on the EDS during late and absent Level 2 OSR screening decisions or when a high percentage of alarm bags are identified during Level 1 screening.

Procedure 1 and Procedure 2 are conducted for each EDS line. Procedures 3, 4, and 5 will be performed a minimum of once per CBIS.

Procedure: The CBIS displays and reporting databases will be evaluated to confirm appropriate bag routing and status information based on OSR decisions.

- **Procedure 1, Operator Timeout**: A Suspect bag is screened through the EDS and an OSR Decision is withheld indefinitely, forcing an EDS decision based on the decision time setting. Measure the length of time between when the bag's <u>leading edge</u> passes through the <u>exit from</u> the EDS and the final diversion <u>trigger</u> point <u>to the CBRA without holding bags.</u> Measure the duration from image population at the PVS to when the image times out and either drops from the PVS display or provides a visual indication to the Operator that the OSR time has expired. If bags are held while in transit to an active decision point (HSD or Vertical Sortation Unit (VSU)), the hold time is recorded.
- **Procedure 2, Delayed Operator Decision**: A Suspect bag is screened through the EDS and an OSR Clear Decision is withheld until the image has been displayed at the OSR PVS for the maximum time prior to the decision time expiring. Confirm that the Operator screening decision was correctly transmitted, received, and displayed at the EDS and BHS interfaces and accurately recorded within the EDS/BHS reporting systems.

- **Procedure 3, Operator Timeout/Image Queue Timeout (CTX 9800 Only)**:
  - Part A: With a single PVS active and an Operator logged-in, two sequential Suspect bags are screened through an EDS. The OSR Decisions are withheld indefinitely, forcing an EDS timeout decision on the bag displayed on the PVS and the bag in the MUX image queue, based on the CTX BMTT setting. The EDS Motion Control (MC) log or Communications Report disposition codes will be compared with BHS-received dispositions and the CBRA displays to verify compliance with EDS Integration Guides and PGDS CBRA display requirements. (The Procedure 3 Test, Part A, is conducted to gather system configuration data only and will not be rated as Pass/Fail.)
  - Part B: Configure the EDS Decision Mode setting to Operator. With a single PVS active and an Operator logged-in, two sequential Suspect bags are screened through an EDS. The OSR Decisions are withheld indefinitely, forcing an EDS timeout decision on the bag displayed on the PVS and the bag in the MUX image queue, based on the CTX BMTT setting. The EDS Motion Control (MC) log or Communications Report disposition codes will be compared with BHS-received dispositions and the CBRA displays to verify compliance with EDS Integration Guides and PGDS CBRA display requirements. Reconfigure the EDS Decision mode setting to Automatic.
- **Procedure 4, Multiple Alarmed Objects (L3 OptiNet CBIS Only)**: One non-Clear bag will be screened with two or more distinct alarm objects. When the image is displayed for Level 2 (PVS) processing, one of the alarmed objects will remain unresolved (not cleared). After all other alarm objects are cleared, the bag should be Suspected at the PVS. This procedure will be repeated a second time, except with the image allowed to time-out onscreen instead of a Level 2 Operator decision. The number of alarmed objects identified in each SVS image will be recorded and compared with PVS decisions. This procedure will confirm whether PVS settings are consistent with anticipated TSA operations regarding how threat-level versus bag-level OSR decisions are reported and executed. Each image, alarmed and timed-out, will be recalled at every available SVS in the CBRA to confirm that only Alarmed objects not cleared at the PVS remain as threats requiring Level 3 inspection. Alarm objects that were cleared at the PVS should not be highlighted as Alarms in the SVS image. (The Procedure 4 Test is conducted to gather system configuration information only and will not be rated as Pass/Fail.) Note: If an EDS OEM technician can demonstrate that the configuration setting associated with each SVS is set appropriately relative to cleared objects displayed in alarm images on the SVS, this test need not be performed.
- **Procedure 5, No Final EDS Disposition**: This procedure will confirm that bag routing and status display in the CBRA is only based on the EDS Final Disposition message and the bag is not routed or displayed based on the EDS Exit Disposition Message.
- **CTX-MUX V2 Series Only**: Configure the selected EDS Timeout Value Settings to "No Timeout" (Decision Mode - Operator/Show Mode - Show All) and process one Clear bag through the EDS and CBIS decision point(s) while withholding any Level 2 Operator Decision. Confirm the bag is routed to the CBRA and the appropriate decision message (EDS Final Disposition message [CTX_Decision_Bag_Disposition], not EDS Exit Disposition Message [CTX_Exit_Decision_Status]) is reflected in the EDS log file or EDS to BHS Communications Report.
- **L3 OptiNet Only**: Increase the selected EDS Time-to-Live (TTL) setting to allow the bag to arrive at the BRP prior to TTL expiring (All Bags Mode). The L3 Bag ID Timeout setting may also need to be increased to remain 30 seconds longer than the TTL. Process one Clear bag through the EDS and CBIS decision point(s) while withholding any Level 2 Operator Decision. Confirm the bag is routed to the CBRA

and the appropriate decision message ([EDS_ID.BagIDArray], not [EDS_ID.BagIDArray [13]] correlating with a Pending disposition (code 4)) is reflected in the EDS log file or EDS to BHS Communications Report.

- **Reveal Multiplexing Only**: (pending)
- Confirm the appropriate CBRA display status of EDS Error when there is no Final EDS Disposition received for a Machine Clear/ Operator Pending bag. This test will be rated as “Pass” if the described confirmation checks are verified. This test will be rated as “Fail” if the results indicate bag routing or CBRA display status based on the EDS Exit Disposition.

Requirements Verified: The performance of the system is judged against the Requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.4	OSR Decision Time Requirements
7.2.5.1	CBIS Positive Bag Tracking
7.2.5.1.2	Post-EDS Requirements Item 1: BHS maintenance of EDS status Item 2: Assignment of Communication Error Item 5: Monitor and log invalid arrivals at CBRA via the BHS reporting system
9.2.3	Workstation Sequence of Operations

D.2.3 Over-Height Bag Test

Purpose: This test will be conducted to ensure that the CBIS recognizes Over-Height (OH) baggage and prevents it from entering any EDS. It is also used to confirm proper routing of near maximum and minimum conveyable height dimension baggage.

This test is to be conducted at each location in the CBIS where OH bag detection is provided.

Procedure:

- Record the measurement(s) at which bags will activate the OH detector(s).
- Ensure that this setting is equal to the maximum bag height specification for the EDS in question.
- Introduce a stream of bags upstream of both the point of acquisition of tracking and upstream of the device used to measure bag dimensions. Bags used for testing will include those slightly greater and slightly smaller than maximum height capability of the EDS. The bag stream will also include bags near the minimum and maximum conveyable height dimensions.
- Record whether the system properly detects OH bags and prevents them from entering the EDS. In addition, record whether any non-OH bags are incorrectly detected as OH. At the conclusion of this test, the screening status and bag IDs for all bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.7.2	Out-Of-Gauge Bag Requirement
7.2.13.1	Reporting Frequency Requirement
7.2.13.2	Reporting Detail Requirements (all except Item 4)
7.2.13.3	Daily Reporting Requirements
9.2.3	Workstation Sequence of Operations

D.2.4 Over-Width Bag Test

Purpose: This test will be conducted to ensure that the CBIS recognizes Over-Width (OW) baggage and prevents it from entering any EDS. It is also used to confirm proper routing of near maximum and minimum conveyable width dimension baggage.

This test is to be conducted at each location in the CBIS where OW bag detection is provided.

Procedure:

- Record the measurement(s) at which bags will activate the OW detector(s).
- Ensure that this setting is equal to the maximum bag width specification for the EDS in question.
- Introduce a stream of bags upstream of both the point of acquisition of tracking and upstream of the device used to measure bag dimensions. Bags used for testing will include those slightly greater and slightly smaller than the maximum width capability of the EDS. The bag stream will also include bags near the minimum and maximum conveyable width dimensions.
- Record whether the system properly detects OW bags and prevents them from entering the EDS. In addition, record whether any in-gauge bags are incorrectly detected as OW. At the conclusion of this test, the screening status and bag ID for all bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.7.2	Out-Of-Gauge Bag Requirement
7.2.13.1	Reporting Frequency Requirement
7.2.13.2	Reporting Detail Requirements (all except Item 4)
7.2.13.3	Daily Reporting Requirements
9.2.3	Workstation Sequence of Operations

D.2.5 Over-Length Bag Test

Purpose: This test will be conducted to ensure that the CBIS recognizes Over-Length (OL) baggage and prevents it from entering any EDS. It is also used to confirm proper routing of near maximum and minimum conveyable length dimension baggage.

This test is to be conducted at each location in the CBIS where OL bag detection is provided.

Procedure:

- Record the measurement(s) at which bags will activate the OL detector(s).
- Ensure that this setting is equal to or less than the maximum bag length specification for the EDS in question.
- Introduce a stream of bags upstream of both the point of acquisition of tracking and upstream of the device used to measure bag dimensions. Bags used for testing will include those slightly greater and slightly smaller than the system's programmed OL setting. The bag stream will also include bags near the minimum and maximum conveyable length dimensions.
- Record whether the system properly detects OL bags and prevents them from entering the EDS. In addition, record whether any in-gauge bags are incorrectly detected as OL. At the conclusion of this test, the screening status and bag ID for all bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.7.2	Out-Of-Gauge Bag Requirement
7.2.13.1	Reporting Frequency Requirement
7.2.13.2	Reporting Detail Requirements (all except Item 4)
7.2.13.3	Daily Reporting Requirements
9.2.3	Workstation Sequence of Operations

D.2.6 Out-of-Gauge/Lost Bag Routing Test

Purpose: This test is conducted to evaluate the proper routing of both in-gauge and OOG bags when their dimension status tracking data is lost after passing through the bag measuring device.

The routing of lost dimension bags is required to be to a Screening Spur Line and not to the OOG Line. Further, Spur Lines are to be equipped with an Over-Height protective device at least two queues in front of each EDS to stop OH bags from entering the EDS.

Procedure:

- Introduce a bag that exceeds OOG OH or OW dimensions upstream of the baggage dimensioning equipment.
- After the bag has been processed through the dimensioning equipment and prior to the OOG or first screening line diversion, whichever is first, the OOG bag will be delayed to cause a loss of dimension status tracking data.
- The procedure will be repeated using a bag that does not exceed OOG dimensions.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.7.2	Out-Of-Gauge Bag Requirement
7.2.13.1	Reporting Frequency Requirement
7.2.13.2	Reporting Detail Requirements (all except Item 4)
7.2.13.3	Daily Reporting Requirements
9.2.3	Workstation Sequence of Operations

D.2.7 Duplicated IATA/RFID Tag Test

Purpose: This test will be performed on CBISs that utilize IATA/Radio Frequency Identification (RFID) tag data in the security screening process. The test will evaluate the CBIS response, including the BHS reporting system, when a duplicated IATA/RFID tag is presented or the same IATA/RFID tag ID is screened more than once with differing screening decisions. These procedures will be performed once for each upstream ATR/RFID reader and include an assessment of CBRA hand scanner functionality for bag status/ID acquisition under duplicated tag scenarios.

Duplicated IATA/RFID Procedure 1 (Leading Alarmed Bag):

- Five bags sharing the same duplicated tag data will be introduced to the CBIS with 5- to 10-second spacing and processed through the same EDS. A reprinted RFID/IATA tag, cut tag, or use of IATA bingo tags are options for creating the tag ID duplication. The IATA barcode sticker should be affixed to each bag in a location that will provide a high probability for a good read.
- The induction sequence will be Alarmed, Cleared, Alarmed, Alarmed, and Cleared.
- Each non-Clear tracked bag will be handled normally in the CBRA, using BRP to BIS data transfer via BSDs.
- The fourth and fifth bags inducted will be manipulated downstream of the EDS, such that they arrive in the CBRA as Unknown, and are then hand-scanned to check image/status data.
- When necessary, reinsert the eligible bag types into the Reinsertion subsystem to assess ID handling and reporting.
- The Bag Data Report (or similar) and Critical PEC Tracking Report will be reviewed for each bag to determine what IATA/RFID tracking information is retained and/or updated throughout the screening process and confirm that appropriate screening statuses are reported when the IATA/RFID tag is duplicated.
- Conditions that can result in a test fail rating include if: Any non-Clear bag misrouting occurs or an incorrect bag screening status causes improper Level 3 procedures at the CBRA (i.e., non-Clear bag recalled with a “Cleared” status and sent clear). The following conditions will not be grounds for test failure, but may result in a deficiency finding: 1) if the duplicate IATA/RFID is not detected and prevented from hand-off to the EDS; 2) incorrectly reported screening statuses; or 3) the wrong SVS image is presented.

Duplicated IATA/RFID Procedure 2 (Leading Cleared Bag):

- Five bags sharing the same duplicated tag data (using a different ID than used in Procedure 1) will be introduced to the CBIS with 5- to 10-second spacing and processed through the same EDS. A reprinted tag, cut tag, or use of IATA bingo tags are options for creating the IATA ID duplication. The IATA barcode sticker should be affixed to each bag in a location that will provide a high probability for a good read.
- The induction sequence will be Cleared, Alarmed, Cleared, Alarmed, and Cleared.
- Each non-Clear tracked bag will be handled normally in the CBRA, using BRP to BIS data transfer via BSDs.
- The fourth and fifth bags inducted will be manipulated downstream of the EDS, such that they arrive in the CBRA as Unknown, and are then hand-scanned to check image/status data.
- The Bag Data Report (or similar) and Critical PEC Tracking Report will be reviewed for each bag to determine what IATA/RFID tracking information is retained and/or updated throughout the screening process and confirm that appropriate screening statuses are reported when the IATA/RFID is duplicated.

- Conditions that can result in a test fail rating include if: Any non-Clear bag misrouting occurs or an incorrect bag screening status causes improper Level 3 procedures at the CBRA (i.e., non-Clear bag recalled with a "Cleared" status and sent clear). The following conditions will not be grounds for test failure, but may result in a deficiency finding: 1) if the duplicate IATA/RFID is not detected and prevented from hand-off to the EDS; 2) incorrectly reported screening statuses; or 3) the wrong SVS image is presented.

Test Iterations:

- Duplicate IATA/RFID Procedure 1, Leading Alarmed Bag
- Duplicate IATA/RFID Procedure 2, Leading Cleared Bag

Conclusion: At the conclusion of this test, the screening status and ID for all bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.5.1	CBIS Positive Bag Tracking Requirements
7.2.5.1.1	Pre-EDS Requirements (Items 1, 2, 5, 6, 7, 10)
7.2.5.1.2	Post-EDS Requirements (Items 1, 3)
7.2.13	CBIS Reporting Requirements
9.5.7.4	Order of Bag ID Lookup
9.6.2	BSD Statuses and High Level Processing Procedures

D.2.8 Mixed Bag Line Test

Purpose: This test is conducted to verify the basic operation of the CBIS, specifically to ascertain if BHS tracking can properly handle multiple bags with differing decisions.

Procedure:

- A minimum of 20 bags (5 Suspect and 15 Clear) are introduced to the EDS from the BHS.
- The Bag IDs and EDS decisions are recorded at the EDS PVS, and the final status of the bags is recorded at the CBRA.
- Test bag quantities may be adjusted depending on the complexity of the CBIS.
- At the conclusion of this test, the screening status and ID for all test bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.1.2	Tail-to-Head Bag Spacing Requirement
7.2.5.1	CBIS Positive Bag Tracking Requirements
7.2.5.1.1	Pre-EDS Requirements (Items 1, 2, 4, 5, 6, 7, 9, 10)
7.2.5.1.2	Post-EDS Requirements (Items 1, 2, 3, 4, 5, 7, 8)
7.2.6.1	Divert and Merge Requirements
7.2.13.1	Reporting Frequency Requirement
7.2.13.2	Reporting Detail Requirements (all except Item 4)
7.2.13.3	Daily Reporting Requirements
9.2.3	Workstation Sequence of Operations

D.2.9 PLC versus Upper Level Sort Test

Purpose: This test is conducted to verify that the CBIS can track and screen bags via the PLCs independent of Upper Level Sort Systems.

Procedure:

- Prior to the start of the test, all PLCs controlling the CBIS must be disconnected from the sort controller(s).
- A minimum of 20 bags (5 Suspect and 15 Clear) are introduced to the EDS from the BHS.
- The Bag IDs and EDS decisions are recorded at the EDS PVS, and the final status of the bags is recorded at the CBRA.
- Test bag quantities may be adjusted depending on the complexity of the CBIS. This test is conducted across one Spur Line per CBIS.
- At the conclusion of this test, the screening status and ID for all test bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections.

Section	Requirements Verified
Section 7.2.5.1.1	Item 6: "CBIS tracking shall in no way be controlled or constrained by a sort controller where the relation is maintained within the PLC."

D.2.10 Clear Bag Bypass Test

Purpose: This test is conducted to verify the requirements of Section 7.2.6.1 to ascertain if the BHS has a Clear Bag Bypass feature and if so, that it is manually controlled and not automatic.

Procedure:

- **Part 1:** Ensure that the bypass feature is **NOT** enabled via the operator's workstation in the BHS control room.
  - A minimum of 20 bags (5 Suspect and 15 Clear) are introduced to the EDS from the BHS. Before inducting bags, disable any Clear Lines just past First Chance Diverters.
  - As bags are approaching the final chance divert, disable the Clear Line conveyor past the divert.
  - All Bags should proceed down the OSR Line past the first chance divert with Non-Clear bags proceeding to CBRA until the first Clear Bag approaches the divert. The first Clear Bag must cascade stop and NOT bypass the diverter on the Alarm Line to CBRA.

- **Part 2:** Ensure that the bypass feature **IS** enabled via the operator's workstation in the BHS control room.
  - A minimum of 20 bags (5 Suspect and 15 Clear) are introduced to the EDS from the BHS.
  - As bags are approaching the final chance divert, disable the Clear Line conveyor past the divert.
  - All bags should proceed into CBRA.
- At the conclusion of this test, the screening status and ID for all test bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.1.2	Tail-to-Head Bag Spacing Requirement
7.2.5.1	CBIS Positive Bag Tracking Requirements
7.2.5.1.1	Pre-EDS Requirements (Items 1, 2, 4, 5, 6, 7, 9, 10)
7.2.5.1.2	Post-EDS Requirements (Items 1, 2, 3, 4, 5, 7, 8)
7.2.6.1	Divert and Merge Requirements
7.2.13.1	Reporting Frequency Requirement
7.2.13.2	Reporting Detail Requirements (all except Item 4)
7.2.13.3	Daily Reporting Requirements
9.2.3	Workstation Sequence of Operations
11.3.2	Programming Logic

D.3 DETAILED TESTING

Detailed tests will be performed on all EDS spur lines and performed in multiple logical "tracking zones" on spur, mainline, and other lines. For the purposes of testing, these tracking zones are defined as follows:

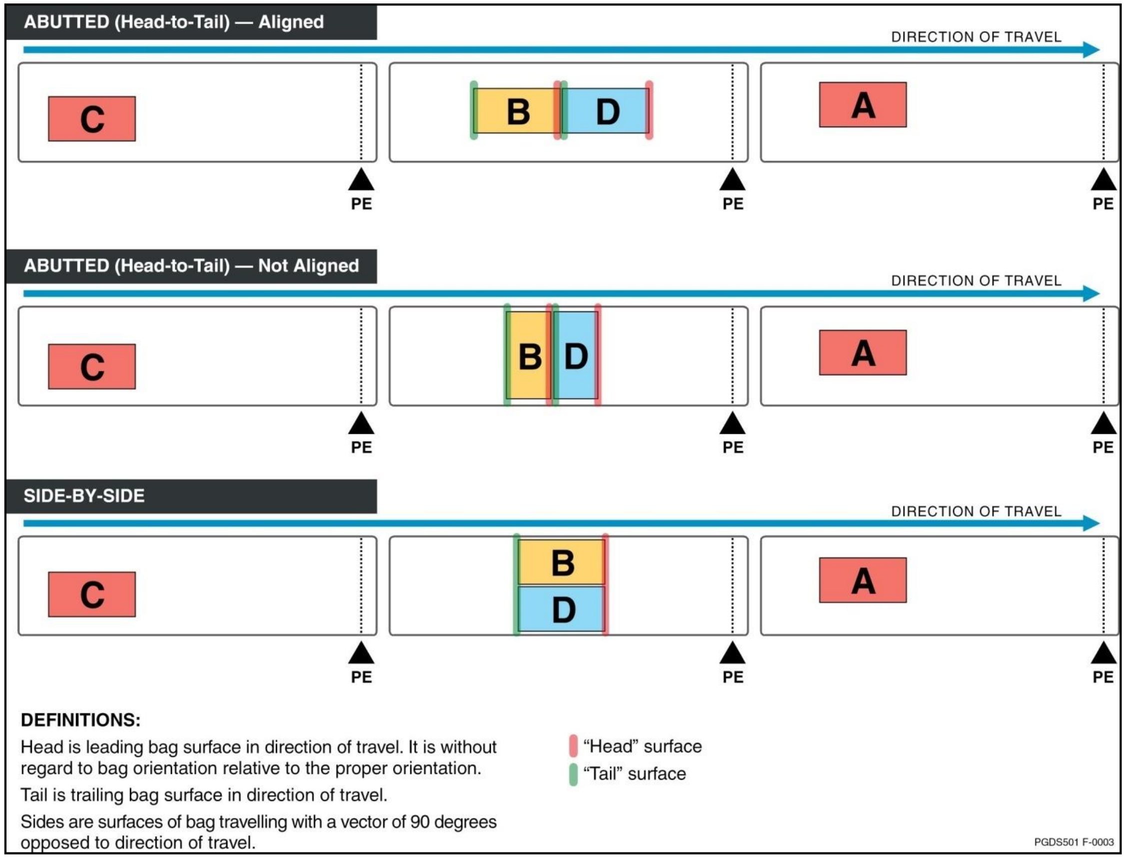
- Zone 1: Point of acquisition of tracking to bag handoff to the EDS
- Zone 2: Bag handoff to the EDS and the first-chance diversion point
- Zone 3: Between the first- and second-chance diversion points
- Zone 4: Between the second-chance (or final) diversion point and the CBRA

During detailed testing, test bags are inducted from the point of acquisition of tracking through the EDS to the point(s) of diversion to the Clear or outbound lines and into the CBRA, the STZ. Preferably, test bags should be inducted from their natural point(s) of origin; deviations from testing in this final configuration will need to be approved by TSA in advance.

For specific tests, the induction and testing zones may be fewer than what is specified above and are noted as such in the Purpose and/or Procedure sections.

In the following sections, several references will be made to bag positioning. Refer to Figure D-1 for illustration purposes.

Figure D-1: Problematic Bag Alignments



Common Requirements Verified: The list of verified requirements below is applied to all Section D.3 Tests unless specifically noted.

Section	Requirements Verified
7.2.1.2	Tail-to-Head Bag Spacing Requirement (unless specific test manipulations force below minimum spacing)
7.2.5.1	CBIS Positive Bag Tracking Requirements
7.2.5.1.1	Pre-EDS Requirements (Items 1, 2, 4, 5, 6, 7, 9, 10)
7.2.5.1.2	Post-EDS Requirements (Items 1, 2, 3, 4, 5, 7, 8)
7.2.6.1	Divert and Merge Requirements
7.2.13.1	Reporting Frequency Requirement
7.2.13.2	Reporting Detail Requirements (all except Item 4)
7.2.13.3	Daily Reporting Requirements
9.2.2.3	Bag Status
9.2.3.3	Bag Inspection Operations
9.2.3	Workstation Sequence of Operations

D.3.1 Removed Bag Test

Purpose: This test will be conducted to ensure that the BHS handles bags securely when one or more bags are removed from the system.

This test will be run in various sections of the tracking zones from the start of the STZ through the SF Line(s), SS Line(s), OSR Line and AL Line.

Procedure:

- A series of at least 10 bags (7 Clear and 3 Suspect) enters the EDS through the BHS.
- The bag IDs and EDS decisions are recorded at the EDS PVS and the final disposition of the bags is recorded at the CBRA. One or two bags are then removed from the baggage stream to simulate missing bags.
- At the conclusion of this test, the screening status and ID for all bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
	See Section D.3 Common Requirements Verified

D.3.2 Delayed Bag Test

Purpose: This test will be conducted to ensure that the BHS handles bags securely when one or more bags are delayed outside their tracking window(s).

Procedure:

- A series of at least 10 bags (7 Clear and 3 Suspect) enters the EDS through the BHS.
- The bag IDs and EDS decisions are recorded at the EDS PVS and the final disposition of the bags is recorded at the CBRA.
- Within each tracking zone from the start of the STZ through the SF Line(s), SS Line(s), OSR Line and AL Line, two nonconsecutive bags are held back within the baggage stream to simulate bags that slid outside their tracking windows.
  - In each test, one bag should be moved so that it does not interfere with the tracking window of any other bag, while the other bag should be moved so that it does interfere with the tracking window of another bag.
  - Tracking window interference includes the case where the trailing edge of a leading bag of minimum conveyable length (12”) is directly abutted against the leading edge of a trailing bag.
- At least one iteration of the Delayed Bag Zone 1 Test will be conducted creating abutted and spacing infringement conditions through the ATR(s). This will include at least three variations to include: both bags with IATA tags, only leading bag with an IATA tag, and only trailing bag with an IATA tag.
- At the conclusion of this test, the screening status and ID for all bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
	See Section D.3 Common Requirements Verified
7.2.5.1.3	CBIS Detection Requirements

D.3.3 Accelerated Bag Test

Purpose: This test will be conducted to ensure that the BHS handles bags securely when one or more bags are accelerated outside their tracking window(s).

Procedure:

- A series of at least 10 bags (7 Clear and 3 Suspect) enters the EDS through the BHS.
- The bag IDs and EDS decisions are recorded at the EDS PVS and the final disposition of the bags is recorded at the CBRA.
- Within each tracking zone from the start of the STZ through the SF Line(s), SS Line(s), OSR Line and AL Line, two nonconsecutive bags are accelerated within the baggage stream to simulate bags that slid outside their tracking windows.
  - Initiate each manipulation variation by first activating a BHS E-Stop in the tracking zone under test; then accelerate the bag as described before resetting the E-stop.
  - In each test, one bag should be moved so that it does not interfere with the tracking window of any other bag, while the other bag should be moved so that it does interfere with the tracking window of another bag.
  - Interference includes the case where the leading edge of a trailing bag of minimum conveyable length (12”) is directly abutted against the trailing edge of a leading bag.
- At the conclusion of this test, the screening status and ID for all bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
	See Section D.3 Common Requirements Verified
7.2.5.1.3	CBIS Detection Requirements

D.3.4 Added Bag Test

Purpose: This test is conducted to ensure that the BHS handles bags securely when one or more bags are added to the system and to verify that added bags are not misdirected and that the tracking of other bags is not affected.

The Added Bag Test will primarily be applied to locations with greater potential for jam events and/or an increased vulnerability to human intervention, in particular EDS entrance conveyors and Fail-Safe bag insertion points.

Procedure:

- Review the system specific Jam Clearing and Jam Bag Handling Policy(ies).
- A series of at least 10 bags (7 Clear and 3 Suspect) enters the EDS through the BHS. The baggage induction can be staggered to allow two separate manipulations to occur and also permit adequate bag spacing to ensure the added bag spacing distances defined herein can be accommodated.
- The bags' IDs and EDS decisions are recorded at the EDS PVS, and the final disposition of the bags is recorded at the CBRA.
- A jam event will be created by holding a bag over a PE. Alternately, blocking a PE is an option where creating the jam by holding a bag is not feasible or safe. The bags involved in the jam event will be removed and the jam condition cleared.
- Within the tracking zones described in the purpose statement above, two nonconsecutive bags that were removed from the jam event are added to the baggage stream to simulate added bags.
  - One bag should be added such that its leading or trailing edges are no closer than 15 inches to any other bag.
  - The second bag should be added such that either its leading or trailing edge is between 8 inches and 12 inches from another bag.
- At the conclusion of this test, the screening status and ID for all bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
	See Section D.3 Common Requirements Verified
7.2.5.1.3	CBIS Detection Requirements

D.3.5 CBRA Contingency Mode Test

Purpose: This test is conducted to evaluate CBRA and BRP functions when the Contingency mode printer is activated. The Contingency mode feature will be activated and deactivated with bags present just upstream and within the CBRA.

Procedure: (Generic and subject to modification for site unique Contingency Features)

- Stage 15 non-Clear bags.
- Induct and process several Suspect bags, issuing Alarmed decisions, and allow the bags to remain on CBRA BRP queues, including the first BRP.
- Place CBRA in Contingency Mode.
- Induct remaining Suspect bags and render Suspect or Clear decisions on all bags.
- Manipulate bags or system configuration to create alternate screening IDs or CBRA statuses at the BRP printer.
- After bags have queued behind removal point/printer location, begin recording printed status and ID information and removing bags per contingency procedure.
- Confirm printed data matches BRP display, OSR data, and Report statuses.
- After five to seven bags have been processed through the Contingency removal point, confirm Alarm Images can be recalled at the SVS using printed data from the CBRA printer.
- Deactivate Contingency Mode and continue processing bags on all CBRA BRPs.
- At the conclusion of this test, the screening status and bag IDs for all bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
	See Section D.3 Common Requirements Verified
9.3.1	CBRA Printers
11.3.2	Programming Logic

D.3.6 Bag Spacing Test

Purpose: This is a two-part test. The first part is conducted to determine if the CBIS delivers bags to EDS units in accordance with the OEM's Guidelines and/or Integration Manuals and PGDS Requirements. The second part is conducted to ensure that the CBIS routes bags securely if proper bag spacing into the EDS is not maintained.

No waivers will be issued for the Bag Spacing Test or the requirement for bag singulation into EDS units.

Procedure:

- **Part 1:** This test will be repeated across varying induction points until all SS Lines have been exercised.
  - A series of at least 10 bags (7 Clear and 3 Suspect) enters the EDS through the BHS.
  - The bags' IDs and EDS decisions are recorded at the EDS PVS, and the final disposition of the bags is recorded at the CBRA.
  - Tail-to-Head bag spacing is monitored and recorded at the EDS Entrance.
  - Bags are inducted from natural points of origin (i.e., Ticket Counters, Curbside Induction, and CBRA Re-Introduction).
  - Tail-to-Head bag spacing at induction will be maintained at 15 inches or greater except for two sets of two bags.
  - One set will have Tail-to-Head spacing of between 8 to 10 inches and the second set will be inducted with the tail and head abutted (zero gap).
  - Bags will then flow through the system and be directed to one EDS Spur Line per test iteration.
- **Part 2:** This test will be repeated for each SS Line.
  - Induct two bags just upstream of the start of STZ. Ensure these bags are close together, but separate at the point of induction such that final manipulation can occur.
  - Configure the BHS to send these two bags to a single SS Line.
  - Just as the leading bag is entering the immediate upstream queue conveyor from the EDS, force the second bag to become abutted to the first bag such that they enter the EDS together and in direct contact with each other.
- At the conclusion of both Parts of the Procedure, the screening status and ID for all bags processed are compared against the EDS status and bag IDs. In addition, at the conclusion of Part 1, the Tail-to-Head bag spacing will be compared against the EDS and PGDS required spacing.

Requirements Verified – Part 1: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
	See Section D.3 Common Requirements Verified
	OEM Bag Spacing Requirements

Requirements Verified – Part 2: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.5.1	CBIS Positive Bag Tracking Requirements
7.2.5.1.2	Post-EDS Requirements (Items 1, 2, 3, 4, 5, 7, 8)
7.2.6.1	Divert and Merge Requirements
7.2.13.1	Reporting Frequency Requirement
7.2.13.2	Reporting Detail Requirements (all except Item 4)
7.2.13.3	Daily Reporting Requirements
9.2.2.3	Bag Status
9.2.3.3	Bag Inspection Operations
9.2.3	Workstation Sequence of Operations

D.3.7 E-Stop Test

Purpose: This test will be conducted to ensure the ability of the EDS and BHS to activate and recover from E-Stops, and to maintain tracking of bags during E-Stop conditions. This test is to be conducted for both EDS and BHS E-Stops.

This test is to be conducted for each SS line.

Procedure:

- In the EDS E-Stop Test, a series of at least 10 bags (7 Clear and 3 Suspect) is sent to the EDS through the BHS.
  - When bags are in a position such that bags are leaving, entering, and within the EDS, an EDS E-Stop is activated.
  - The EDS must immediately disable its X-rays and the EDS conveyors should stop operating.
  - The BHS should recognize the E-Stop and halt any further bags from being sent to the EDS.
- In the BHS E-Stop Test, a series of at least 10 bags (7 Clear and 3 Suspect) is sent to the EDS through the BHS.
  - When bags are in a position such that bags are leaving, entering, and within the EDS, a BHS E-Stop is activated.
  - The EDS should recognize the E-Stop, and prevent additional bags from being sent to the BHS.
  - Further, the system should not allow bags on EDS conveyors to be forced forward onto stopped BHS conveyors. An exception to the prevention of bags forced onto the BHS exit queue conveyor is permitted for the L3-6X00 EDS series due to known functionality when bags are present in the EDS scan plane ("B" conveyor) and exit tunnel ("C" conveyor). If observed, this condition will result in a Safety deficiency, but will not be a basis for issuing a "Fail" test result.
- At the conclusion of this test, the screening status and bag IDs for all bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
	See Section D.3 Common Requirements Verified

D.3.8 Halt/Fail-Safe Test

Purpose: The purpose of this test is to ensure that the CBIS does not pass any non-Clear or unscreened bag to the outbound/sortation system. In addition, this test verifies that TSA is immediately notified of a Fail-Safe event, allowing an appropriate response.

D.3.8.1 Fail-Safe Operation for In-Line CBIS

Refer to PGDS Sections 7.2.8, 7.2.8.1 and 7.2.8.2 for Fail-Safe operations and requirements governing In-Line CBIS.

Procedure:

- **Part 1:** The test is conducted with bags flowing normally through the CBIS in sufficient quantity such that bags are present from the EDS output through the Clear/Suspect bag diversion point(s).
  - At each Post-EDS diversion point between the OSR Line(s) and Clear Line(s) force a non-clear bag to lose tracking between the decision photo eye upstream of the diverter and before the Fail-Safe photo eye on the OSR Line or AL Line by removing it from the system or preventing it from reaching the Fail-Safe photo eye.
- **Part 2:** The test is conducted with bags flowing normally through the CBIS in sufficient quantity such that bags are present from the EDS output through the Clear/Suspect bag diversion point(s).
  - At each Post-EDS diversion point between the OSR Line(s) and Clear Line(s) add a bag of greater than 12" in length directly abutted to the trailing edge of another bag prior to the bags leading edge reaching the decision photo eye upstream of the diverter.
  - The bag must be conveyed to CBRA with a Status of "Length Change".

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.8	Fail-Safe Operation
7.2.8.1	Fail-Safe Operation General Requirements
7.2.8.2	Fail-Safe Operation Requirements for In-Line CBIS

D.3.8.2 Fail-Safe Operation for Mini In-Line CBIS with a Manually Operated In-Line Decision Point

Refer to PGDS Sections 7.2.8, 7.2.8.1 and 7.2.8.3 for Fail-Safe operations and requirements governing Manually Operated In-Line Decision Point CBIS.

Procedure:

- Introduce a string of ten bags with one bag being a Suspect Bag followed by a Clear Bag.
- Render a late Alarm decision on the Suspect Bag and Clear the Clear Bag, run this test in Show All mode.
- Then force a non-clear bag beyond the last BRP onto the Clear Line.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
	Verify that the Alarm/Clear combination with late decision does not activate the Halt condition.
7.2.8	Fail-Safe Operation
7.2.8.1	Fail-Safe Operation General Requirements
7.2.8.3	Fail-Safe Operation Requirements for a Manually Operated In-Line Decision Point CBIS

D.3.9 EDS Entrance Jam Recovery Test (Continuous Feed EDS only)

Purpose: This test will be conducted to evaluate the BHS to EDS communications and recovery processes when a bag jam occurs at the entrance to the EDS.

Procedure:

- Induct a series of 10 test bags (7 Clear, 3 Suspect) for transport to the screening line.
- After several bags have entered the EDS, hold a bag at the BHS PE adjacent to the EDS entrance tunnel until a jam condition is activated at the associated BHS control station. Alternately, the BHS PE adjacent to the EDS entrance tunnel may be shielded to simulate a bag jam condition.
- Record the PE Jam Timer (seconds) associated with the blocked PE.

- Remove bags involved in the jam event from the conveyors and reset the Jam Condition per local procedures and per EDS Integration Manuals (including removing bags from within the EDS if necessary).
- Confirm normal resumption of baggage screening by the EDS and BHS upon reset of the jam condition.
- Induct each bag removed during the jam event per local procedures and far enough upstream of the EDS to not interfere with BHS-to-EDS handshaking or BHS OOG detection located on the SS Lines.
- At the conclusion of this test, the screening status and bag IDs for all bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.5.1	CBIS Positive Bag Tracking Requirements
7.2.5.1.2	Post-EDS Requirements (Items 1, 2, 3, 4, 5, 7, 8)
7.2.6.1	Divert and Merge Requirements
7.2.13.1	Reporting Frequency Requirement
7.2.13.2	Reporting Detail Requirements (all except Item 4)
7.2.13.3	Daily Reporting Requirements
9.2.2.3	Bag Status
9.2.3.3	Bag Inspection Operations
9.2.3	Workstation Sequence of Operations

D.3.10 EDS Exit Jam Recovery Test (Continuous Feed EDS only)

Purpose: This test will be conducted to evaluate the BHS to EDS communications and recovery processes when a bag jam occurs at the exit of the EDS.

Procedure:

- Induct a series of 10 test bags (7 Clear, 3 Suspect) for transport to the screening line.
- After several bags have been processed through the EDS, hold a bag at the BHS PE adjacent to the EDS exit tunnel until a jam condition is activated at the associated BHS control station. Alternately, the BHS PE adjacent to the EDS exit tunnel may be shielded to simulate a bag jam condition.
- Record the PE Jam Timer (seconds) associated with the blocked PE.
- Remove bags involved in the jam event from the conveyors and reset the Jam condition per local procedures and per EDS Integration Manuals (including removing bags from within the EDS if necessary).
- Confirm normal resumption of baggage screening by the EDS and BHS upon reset of the jam condition.
- Induct each bag removed during the jam event per local procedures. If local procedures are to induct bags upstream of the EDS then induct bags far enough upstream of the EDS to not interfere with BHS to EDS handshaking or BHS OOG detection located on the SS Lines.
- At the conclusion of this test, the screening status and bag IDs for all bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.5.1	CBIS Positive Bag Tracking Requirements
7.2.5.1.2	Post-EDS Requirements (Items 1, 2, 3, 4, 5, 7, 8)
7.2.6.1	Divert and Merge Requirements
7.2.13.1	Reporting Frequency Requirement
7.2.13.2	Reporting Detail Requirements (all except Item 4)
7.2.13.3	Daily Reporting Requirements
9.2.2.3	Bag Status

Section	Requirements Verified
9.2.3.3	Bag Inspection Operations
9.2.3	Workstation Sequence of Operations

D.3.11 Decision Expiration Functionality Test

Purpose: This test is conducted to verify the basic operation of the CBIS when multiple non-Clear bags are screened sequentially, leading to OSR images being queued while awaiting an available PVS.

Note: This test applies only to systems designed with CT-80 series EDS equipment.

Procedure:

- Induct 10 consecutive non-Clear bags through a single EDS, utilizing an individual PVS.
- When each Suspect bag image is displayed on the OSR PVS, allow 80 to 90 percent of the available OSR time to expire prior to issuing a Clear decision status, using as a guide known EDS decision mode settings and declared BHS and EDS timeout settings. Repeat this procedure for all subsequent Suspect bags that appear at the OSR PVS.
  - Confirm that all bags are routed and displayed in accordance with the Level 2 decision issued by the EDS or OSR operator, or that they are routed to the CBRA if confirmed to be OSR timeout bags.
  - Record the CBRA arrival status for any bags that timeout awaiting an operator decision while in the EDS image queue and confirm that the status in use reflects PGDS Chapter 9 Section 9.2.2.3 and 9.2.3.3 Requirements.
  - Report any instances where EDS Clear decisions are issued and then accepted by the BHS after the bag is beyond the final decision point. If this condition exists, obtain information on the BHS Timer setting and functionality.
  - Report any instances where the EDS Unknown status (or any EDS-assigned status) is displayed in the CBRA, with BHS report details confirming whether the status was EDS-issued.
  - Report any instances where the Unknown status is used. The Unknown status is only valid if the bag is lost in tracking OR the BHS does not receive a Level 1 or Level 2 disposition from the EDS, as confirmed through BHS reports.
- At the conclusion of this test, the screening status and ID for all test bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.5.1	CBIS Positive Bag Tracking Requirements
7.2.5.1.1	Pre-EDS Requirements (Items 1, 2, 4, 5, 6, 7, 9, 10)
7.2.5.1.2	Post-EDS Requirements (Items 1, 2, 3, 4, 5, 7, 8)
7.2.13.1	Reporting Frequency Requirement
7.2.13.2	Reporting Detail Requirements (all except Item 4)
7.2.13.3	Daily Reporting Requirements
9.2.2.3	Bag Status
9.2.3.3	Bag Inspection Operations
9.2.3	Workstation Sequence of Operations

D.3.12 Operational Test Kit Functionality Test

Purpose: This test is conducted to evaluate the ability of the CBIS to perform daily and shift-change OTK Functionality Tests efficiently and safely.

The OTK Functionality Test is conducted on each EDS line.

Procedure:

- Continuous Feed EDS
  - Record the specific steps taken to prepare the BHS for insertion of the OTK Test bag.
  - Begin to process no fewer than 10 bags (7 Clear and 3 Suspect).
  - While these bags are entering, leaving, and within the EDS, using available EDS and BHS controls, place the systems in OTK Test mode and record the results (Phase 1).
  - Conduct no fewer than three OTK Tests and record the results (Phase 2).

  - Record the steps necessary to process the OTK test bag, including insertion and removal procedures using the BHS and EDS controls.
  - Using the EDS and BHS controls, return the system to its normal mode of operation.
  - Complete the processing of the original 10 bags and record the results (Phase 3).

- Non-continuous Feed EDS
  - Record the specific steps taken to prepare the BHS for insertion of the OTK Test bag.
  - Completely process no fewer than 10 bags (7 Clear and 3 Suspect) in normal screening modes (Phase 1).
  - Using the EDS and BHS controls, place the system in the OTK Test mode.
  - Conduct no fewer than three OTK Tests and record the results (Phase 2).
  - Record the steps necessary to process the OTK test bag, including insertion and removal procedures using the BHS and EDS controls.
  - Using the EDS and BHS controls, return the system to its normal mode of operation.
  - Completely process no fewer than 10 bags (7 Clear and 3 Suspect) with the EDS and BHS configured for normal baggage screening mode (Phase 3).

Report any non-secure handling of the OTK Test bag or other test bags. Report any faults or system behaviors that require a BHS or EDS restart. At the conclusion of this test, the screening status and bag ID for all bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.9.1	OTK Test Requirements

D.3.13 Crossover Test

Purpose: This test is conducted to verify the CBIS crossover capabilities including bag tracking, orientation, and spacing when the crossover subsystem is engaged causing all bags to be transferred between SF Lines.

Note: The Crossover Test will be conducted unless the crossover functionality must be engaged manually or will engage only under extreme circumstances that cannot be expected during normal operations.

Procedure:

- A minimum of 40 bags (10 Suspect and 30 Clear) are routed through the EDS units through utilization of a crossover divert.
- The diversion device will be activated by CBIS cascade conditions, fault events, or through an HMI selection simulating such occurrences prior to the test.
- Bag IDs and EDS decisions are recorded at the EDS PVS, and the final status of the bags is recorded at the CBRA.
- Test bag quantities may be adjusted depending on the complexity of the CBIS.
- At the conclusion of testing, the screening status and ID for all test bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
	See Section D.3 Common Requirements Verified

D.4 SYSTEM-WIDE TESTING

System-Wide Testing consists of three tests conducted across the entire CBIS, the System Dieback Test, the System Mixed Bag Test and the System Throughput Test. Each System Test is tailored to stress the system in different ways. The Dieback measures performance when the system is under heavy load and conveyors have halted. The System Mixed Bag Test measures performance under normal non-stressed conditions and the System Throughput Test measures performance at or near Peak Load conditions.

Except for the actual Throughput Measurement, each of these tests is judged across the same set of criteria as listed below.

Common System Test Requirements Verified:

Section	Requirements Verified
7.2.1	BHS Capacity
7.2.1.2	Tail-to-Head Bag Spacing Requirement
7.2.2	Screening Throughput Capacity Requirement (System Throughput Test only)
7.2.4	OSR Decision Time Requirements
7.2.5.1	CBIS Positive Bag Tracking Requirements
7.2.5.1.1	Pre-EDS Requirements
7.2.5.1.2	Post-EDS Requirements
7.2.5.1.3	CBIS Detection Requirements
7.2.6.1	Divert and Merge Requirements
7.2.7.2	Out-Of-Gauge Bag Requirement
7.2.8.1	Fail-Safe Operation General Requirements
7.2.8.2	Fail-Safe Operation Requirements for In-Line CBIS
7.2.8.3	Fail-Safe Operation Requirements for a Manually Operated In-Line Decision Point CBIS (Mini In-Line Systems Only)
7.2.10.1	Bag Jam Requirements
7.2.11.1	Recirculation Loop Requirement

Section	Requirements Verified
7.2.11.2	Reinsertion Line Requirement
7.2.11.3	Draft Curtains Requirement
7.2.13.1	Reporting Frequency Requirement
7.2.13.2	Reporting Detail Requirement
7.2.13.3	Daily Reporting Requirement
7.2.13.4	BHS ID Log Report Requirement
9.2.2	CBRA Functionality (All subsections)
9.2.3	Workstation Sequence of Operations (All subsections)

D.4.1 System Dieback Test

Purpose: This test will be conducted to determine the ability of the system to properly track and handle bags during system-wide conveyor halt conditions.

Procedure:

- Induct as many Suspect bags (or force Suspect decisions on bags) as needed to completely fill the CBRA line conveyors upstream through all primary and secondary decision points.
- Continue to fill the BHS with Mixed Decision Bags until the conveyors stop to either just before the EDS or to the start of tracking. This condition is defined as "dieback."

Once the dieback condition through the screening lines have cleared, resume bag induction at a slow to medium pace. The CBIS should not re-enter a CBRA initiated dieback state for the remainder of the test.

Data Collection and Analysis:

- The IDs and decisions for each bag will be recorded at the alarm resolution workstations, in the CBRA, and at any other available terminals, printers, and displays. On completion of the test, the datasheets from the workstations, decision point(s), and the CBRA will be compared with hand-collected data and information from the BHS and EDS Reporting systems to evaluate baggage tracking.

- During the test, personnel will not prevent bag jams from occurring. Only after bag jams occur will personnel clear the jams. The location of each bag jam will be recorded along with any observations that will help reduce the jam rate.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
	See Section D.4 Common Requirements Verified

D.4.2 System Mixed Bag Test

Purpose: The System Mixed Bag Test is conducted to evaluate the CBIS performance at low to medium baggage processing rates (10 to 50 percent of design rate). Baggage induction pacing and locations, conveyable item characteristics, and Operator screening processes at Level 2 and Level 3 inspection interfaces are simulated to establish a baseline of CBIS performance capabilities under non-peak screening conditions.

During the test, personnel will not prevent bag jams from occurring. Only after bag jams occur will personnel clear the jams. The location of each bag jam will be recorded along with any observations that will help reduce the jam rate.

Procedure:

- **Conveyable Item Characteristics:** The baggage types included in this test will reflect projections in the Basis of Design Report, BHS Specification, and CBIS-specific Bag Hygiene policies developed by the ILDT. Conveyable items used for this test will specifically include EDS OOG bags and tubs (Totes) in projected percentages, as defined in the ILDT documents or as established by the TSA OAPM. The percentage of Alarm Bags must be 20 percent.
- **Induction Location and Pacing:** Primary induction locations at the first conveyor of ticket counter and curbside subsystems will be utilized, with test bags allocated to these locations based on CBIS design documents and ILDT bag load projections. Induction pacing at the ticket counter inputs will use predetermined intervals and spacing that reflect individual and group check-in baggage loads. Induction intervals and spacing should be controlled to maintain a low to medium-paced processing rate. Secondary induction points may also be used with bag quantities corresponding to expected loads.
- **Level 2 and Level 3 CBIS Interface:** Baggage ID and OSR screening decisions are recorded at PVSs (Level 2 inspection) and SVSs (Level 3 inspection) to support test data reconciliation. Operator actions at these locations will be simulated to reflect average baggage processing durations. The Level 2 Operator(s) will permit 10 to 15 seconds of the bag viewing time to expire before rendering a Cleared or Alarmed status. Level 2 Operator decisions will not be rendered for one percent of the total bag volume, allowing these bags to “time-out” on the PVS display. The Level 3 inspection at the CBRA will incorporate CBIS bag handling processes, including an average processing time for Alarmed status bags at each BIS for up to two minutes to simulate bags being inspected.

- **Induction Quantities:** For In-Line CBIS, the minimum number of bags to be inducted should be equivalent to 100 bags per EDS.
- For Mini In-Line CBIS, and those with manual removal decision points, the minimum number of bags processed through each EDS line will be 200 bags. This increase in bags for Mini In-Line Systems is intended to increase the sample rate because a System Throughput Test will not be performed on these lower volume systems.

Data Collection and Analysis:

- The IDs and decisions for each bag will be recorded at the alarm resolution workstations, in the CBRA, and at any other available terminals, printers, and displays.
- On completion of the test, the datasheets from the workstations, decision point(s), and the CBRA will be compared with hand-collected data and information from the BHS and EDS Reporting systems to evaluate baggage tracking.
- The screening status and bag ID for all bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
	See Section D.4 Common Requirements Verified

D.4.3 System Throughput Test

Purpose: The System Throughput Test will be conducted to demonstrate the ability of the CBIS to operate under conditions at or approaching peak throughput rates and to evaluate the PGDS Screening Throughput Capacity requirement.

During the test, personnel will not prevent bag jams from occurring. Only after bag jams occur will personnel clear the jams. The location of each bag jam will be recorded along with any observations that will help reduce the jam rate.

Procedure: The Throughput will be measured at each EDS using the EDS FDRS Reports. In the event of a problem with the reports develops, the Throughput may be measured using BHS Reports and Timestamps of bags seen at the closest PE upstream of the EDS entrances. Configure the CBIS to only screen baggage through non-redundant EDS. Staff CBRA sufficiently to prevent any restriction on processing rate. Immediately prior to starting the test, reset/calibrate EDS in attempt to prevent auto-calibrations from occurring during the test. Preload the ticket counter, curbside, and interline transfer lines (and any other input lines) selected for the test by disabling the mainline(s) just upstream of security tracking start via motor disconnect. Once inputs are filled to the load points, deactivate motor disconnect(s) and commence the test.

- Process bags correctly through the CBIS such that:
  - Clear bags are sent directly to the outbound sortation system.
  - Suspect bags are sent directly to the CBRA, and once cleared, are sent to the outbound sortation system.
  - Faulted, mis-tracked, and error bags are sent to the CBRA.
  - Induction Location and Pacing: Induct baggage as fast as the system will allow, while not violating system-required minimum bag spacing.
- **Induction Quantities:** The minimum number of bags inducted should be equivalent to 100 bags per non-redundant EDS with 95% throughput less than 600 bph and 200 bags per non-redundant EDS with 95% throughput greater than 600 bph.
- If technically possible, and working with the EDS vendor, configure the CBIS to save all bag images. In this way, when reconciling the test data, any CBRA anomalies can be more thoroughly investigated by examining the EDS and BHS data logs and all saved images.
- Using available inputs (e.g., ticket counters, curbside, and transfer lines), induct a mix of bags (Suspect/Clear) as fast as the system will allow while not violating system-required minimum bag spacing. Process a mix of bags (Alarmed/Clear) and for testing purposes, Clear 50% of the Alarmed Bags through OSR. The CBIS must be in its final configuration as a pre-requisite of this test and it cannot be performed until no construction constraints preventing induction at the normal points of origin remain.
- The IDs and decisions for each bag will be recorded at the alarm resolution workstations in the CBRA, and at any other available terminals, printers, and displays. On completion of the test, the datasheets from the workstations, decision point(s), and the CBRA will be compared to evaluate baggage tracking. During the test, personnel will not prevent bag jams from occurring. Only after bag jams occur will personnel clear the jams. The location of each bag jam will be recorded along with any observations that will help reduce the jam rate.

Data Collection and Analysis:

- The IDs and decisions for each bag will be recorded at the alarm resolution workstations, in the CBRA, and at any other available terminals, printers, and displays. On completion of the test, the datasheets from the workstations, decision point(s), and the CBRA will be compared with hand-collected data and information from the BHS and EDS Reporting systems to evaluate baggage tracking.
- The System Throughput rate specified as the SSTP Evaluation Criteria Method in Chapter 3 Table 3-1, 3-2, etc. must be met. Although alternative system-level throughput rates may additionally be determined, bags screened across the non-redundant EDS per unit of time as reported in the EDS FDR reporting will be the basis for determining the actual screening throughput to be judged against the Screening Throughput Capacity Requirement. Additionally, TSA's Testing Team will report both the Overall Throughput Achieved and while not a requirement, the Peak 5 minute Throughput Achieved.
- At the conclusion of this test, the screening status and bag ID for all bags processed are compared against the EDS status and bag IDs.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
	See Section D.4 Common Requirements Verified

D.5 OPERATIONAL RUN-IN

Purpose: The Run-In Period should consist of a nominal 30-day period to collect meaningful operational data (BHS and EDS) to support a well-rounded Test Summary Report (TSR) that accurately depicts system performance characteristics. This kind of information will be invaluable to the ILDT to correct defects found during commissioning and evaluation of the CBIS, and to ensure that the system remains stable and secure under actual operational use. The Run-In period may be extended at TSA direction until open issues are resolved or if new defects are detected during the operational Run-In. The Run-In period may also be shortened at TSA direction based on results of the ISAT and Run-In performance evaluated in the first weeks of Run-In.

Procedure:

- After successful completion of the ISAT, and upon notification from the TSA OAPM that the system may be used for screening (i.e., delivery of a TSA-signed QLR and Operational Decision Letter), the system may enter live screening operations. The Run-In period will extend for a nominal 30 days from the start of substantial operations. Substantial operations are the point at which the system encounters 85 percent of its normal daily baggage volume.
- During the Run-In period, the site must submit weekly data reports in electronic format, preferably in PDF or native CSV file format (i.e., not scanned hard copies) to the TSA Independent Acceptance Testing Contractor as stated in Section 2.2.6. Should native CSV format not allow correct separation of tabular data, especially for event reports where locations and events are listed, reports should be available in MS Excel (.xls or .xlsx) format. These reports will include all BHS reports required by section 7.2.13 (CBIS Reporting); the EDS Vendor Specific Reports equivalent to the Bag Info Report and the EDS Equipment Summary Report must also be provided. In the event the site does not comply with Section 7.2.13, then the site will supply existing BHS and EDS Reports that define, at a minimum, the following information:
  - CBRA Bag Arrival Screening Status
  - Bag Induction Volume per Mainline and Spur Line
  - Jam Statistics by Location
  - Fail-Safe Statistics by Location
  - Unknown/Lost in Tracking Statistics by PE Location

- BMA and ATR Read Rates
- OS/OOG Statistics
- EDS Bag Info Report
- EDS Equipment Summary Report
- Critical Tracking PE Report

- During on-site observations for the run-in period, or upon successful completion of the run-in period if observations are not made, the Baggage Handling System Contractor (BHSC) will supply PLC Code to TSA and/or its Independent Acceptance Testing Contractor as required by PGDS Section 2.2.6.

- During the Run-In period, at a point determined by TSA, the Independent Acceptance Testing Contractor will return to the site to verify the close-out of open deficiencies from the original ISAT and observe the system's operation against reported data. This on-site observation will normally occur over a minimum of three days After On-Site Observations and the analysis of the BHS and EDS Reports is finalized, the TSA Contractor will then prepare and submit a TSR consisting of the following details: (1) original testing performance and deficiencies, (2) updates to include run-in performance and any associated new deficiencies, and (3) updates to original testing deficiencies that remain unresolved or that were resolved after ISAT. The TSR will include recommendations to the TSA whether to end the Run-In period, extend the Run-In period, or to change the operational status of the CBIS.

Requirements Verified: The performance of the system is judged against the requirements set forth in the following PGDS Sections:

Section	Requirements Verified
7.2.1	BHS Capacity
7.2.2	Screening Throughput Capacity Requirement
7.2.5.1	CBIS Positive Bag Tracking Requirements
7.2.5.1.1	Pre-EDS Requirements
7.2.5.1.2	Post-EDS Requirements
7.2.5.1.3	CBIS Detection Requirements
7.2.6.2	Round Robin BAM
7.2.8.1	Fail-Safe Operation General Requirements

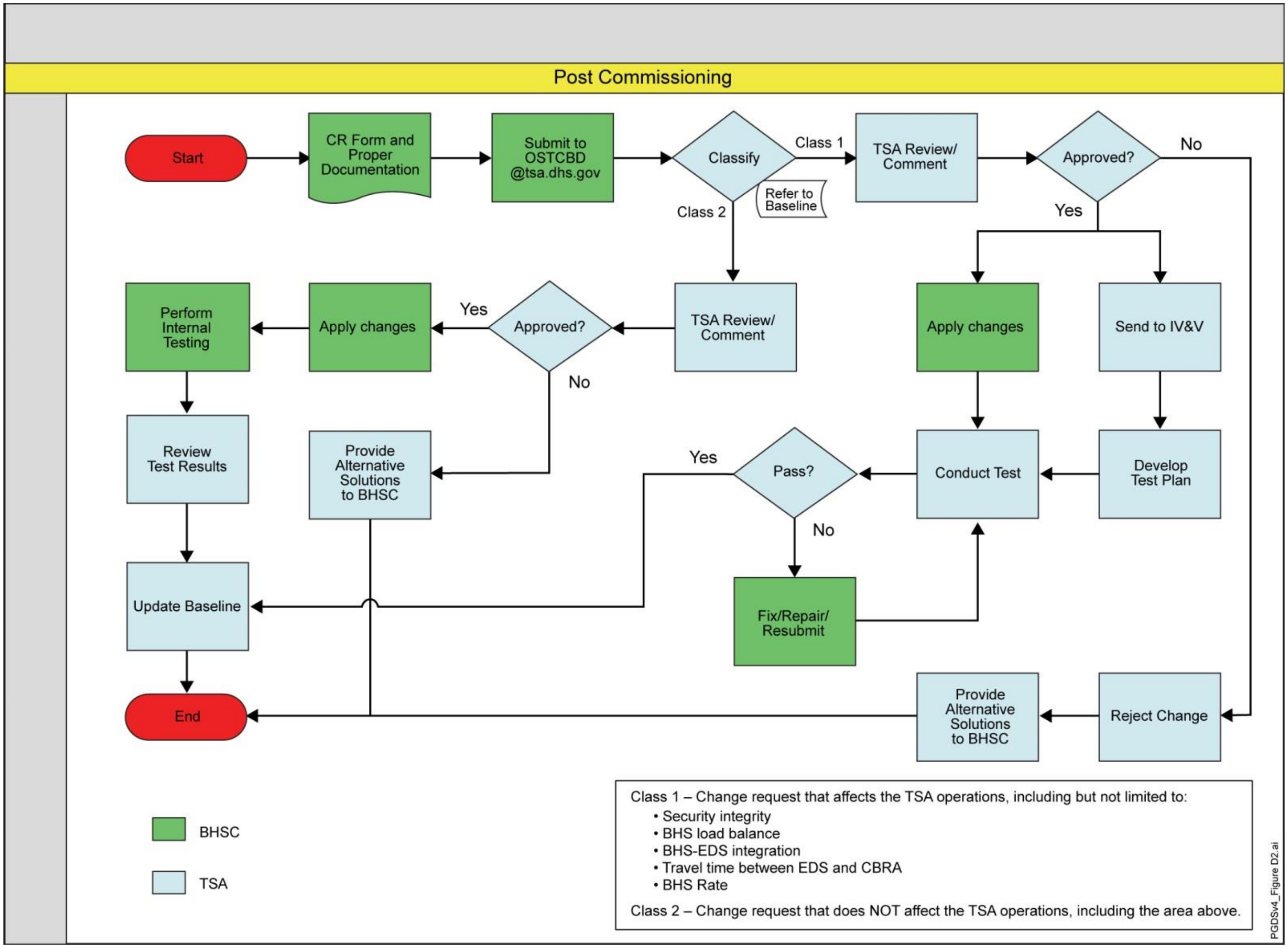
Section	Requirements Verified
7.2.8.2	Fail-Safe Operation Requirements for In-Line CBIS
7.2.8.3	Fail-Safe Operation Requirements for a Manually Operated In-Line Decision Point CBIS (Mini In-Line Systems Only)
7.2.10.1	Bag Jam Requirements
7.2.11.1	Recirculation Loop Requirement
7.2.11.2	Reinsertion Line Requirement
7.2.11.3	Draft Curtains Requirement
7.2.13.1	Reporting Frequency Requirement
7.2.13.2	Reporting Detail Requirement
7.2.13.3	Daily Reporting Requirement
7.2.13.4	BHS ID Log Report Requirement
9.2.2	CBRA Functionality (All subsections)
9.2.3	Workstation Sequence of Operations (All subsections)

D.6 POST-COMMISSIONING REQUIREMENTS

All proposed PLC or computer code changes to the CBIS must be submitted to the TSA using the CBIS change request form as shown in Section A.9 of PGDS 5.0. Overall, the change request process consists of three steps: 1) The BHSC develops the proper documentation, completes the change request form, and submits it to the TSA; 2) TSA receives, reviews, and provides disposition to the change request; and 3) BHSC implements the change and supports the verification of successful implementation as tested by the TSA designated entity.

A detailed block diagram outlining the roles of the BHSC and the TSA, as well as the detailed steps required to complete the process, is shown in Figure D-2. It is essential for the continued secure and efficient operation of the CBIS that changes to the system are evaluated, reviewed, and approved by the TSA before they are implemented. A Configuration Management (CM) process has been established and must be followed throughout the lifecycle of the CBIS. Related documentation and requirements are found in Appendix A, Section A.8 (Configuration Management Process).

Figure D-2: CBIS Configuration Management Process



APPENDIX E:

CONTINGENCY PLAN EXAMPLES

This appendix provides two examples of Contingency Plans developed for the CBISs at Chicago O'Hare and Myrtle Beach International Airport. The Contingency Plan is intended to: (1) identify all likely scenarios for system or component failure that may occur during operation of the CBIS, and (2) describe the protocols and procedures to be followed by BHS control, the airlines, and the Transportation Security Administration when these scenarios occur. This appendix has been updated based upon lessons learned and new requirements.

Sources: Contingency Plan for Chicago O'Hare United Airlines B-South EDS Project provided by BNP Associates, Inc. (reproduced and reformatted with permission); Contingency Plan for Myrtle Beach International Airport provided by BNP Associates, Inc. (reproduced and reformatted with permission).

APPENDIX E-1:
UNITED AIRLINES ORD B-SOUTH EDS PROJECT
CONTINGENCY PLAN

Issued for: TSA 100% Submitted

By: BNP Associates, Inc.

13 August 2010

REVISIONS

Version	Description of Version	Date Completed
0.1	Initial draft submitted to TSA	08-13-10

CONTENTS

ACRONYMS AND ABBREVIATIONS

AS shall mean Alaska Airlines
BHS shall mean Baggage Handling System
BMA shall mean Baggage Measuring Array
CB shall mean Clear Bag Subsystem
CBIS shall mean Checked Baggage Inspection System
CBRA shall mean Checked Baggage Resolution Area
CCB shall mean Configuration Control Board
CF shall mean Component Folder
CI shall mean Configuration Identification
CM shall mean Configuration Management
CMP shall mean Configuration Management Plan
CR shall mean Change Request
EDS shall mean Explosive Detection System (Computer Tomography)
ER shall mean Engineering Request
ETD shall mean Explosive Trace Detection
FIS shall mean Federal Inspection Service
HSD shall mean High Speed Diverter
LAX shall mean Los Angeles International airport
OSR shall mean On-Screen Resolution
PGDS shall mean Planning Guidelines and Design Standards
PTRI shall mean Passive Threat Resolution Interface
SB shall mean Suspect Bag Subsystem
TSA shall mean Transportation Security Administration

E.1 Contingency Plan for United Airlines B-South EDS Project, Chicago O'hare International Airport

E.1.1 Introduction

This site specific version of the Contingency Plan is for the Concourse B-South CBIS located at the Chicago O'Hare International Airport. In accordance with the TSA Planning Guidelines and Design Standards, V3.0 dated 27 November, 2009 this document outlines a contingency plan for the procedures and notification requirements applicable for equipment failures, loss of power and unplanned surges in system demand etc. in the B-South system.

The contingency plan attempts to identify O & M activities for failure mode operations (automatic or manual), documenting and informing relevant parties of changes to the BHS after system failure that have an impact on the processing baggage. The contingency plan does not address general mechanical maintenance, where equipment is replaced, as this work is generally assumed to not have any impact on the BHS operation.

The success of any automated Checked Baggage System Inspection System (CBIS), regardless of the redundancies built into a particular system, rest with the creation of a Contingency Plan (CP) that is agreed upon by key stakeholders, including United Airlines, any second part O&M Contractors, and the TSA (Local and HQ).

E.1.1.1 Purpose

The following are overview topics for Contingency Plan consideration and "triggers" that would initiate contingency operations in the event of.

- Screening equipment failure
- Conveyance equipment failure
- Loss of utility power
- Unplanned surges in system demand
- Temporary alternative screening locations for baggage
- Removal of threat "Suspect" bags from the CBRA
- Threat evacuation and associated impact on baggage screening
- Airport Operations emergency Response Plan
- TSA local standard operating procedures
- United Airlines / O'Hare Emergency Incident Response Plan

E.1.2 BHS System Overview

E.1.2.1 CBIS Overview

The B-South CBIS layout is based on the design standards and practices detailed in the TSA Planning Guidelines and Design Standards (PGDS) Version 3.0, as coordinated between the TSA, United Airlines and the BNP Design Team. The proposed design is also consistent with United Airlines intent to provide a remote screening facility to process all Canadian transfer bags and to provide a secondary EDS system to screen a configurable percentage of outbound originating baggage.

The 14520 BHS Specification details the complete system, equipment to be provided and the functional description of operation.

The purpose of the reconfiguration of the South EDS area is to facilitate an in-line integrated EDS screening process for “Hot-Bag” and “Cold Bag” transfers.

The reconfigured IB1 conveyor line will be utilized as a ”Cold-Bag” transfer input to the EDS matrix for screening. A new (EX1)”Expedited Bag” transfer input will be provided to transport “Hot” transfer bags to the new CBIS area for screening.

The new CBIS mainline (EDS3) shall consist of four (4) integrated L3 6600 EDS devices X9, X10, X11 and X12 for the screening of the transfer bags. The system design is based off of the N+1 method by which three (3) of the EDS machines are installed to handle the peak baggage demand of the average day peak month the airport will experience with the fourth EDS device installed as redundancy.

A new scanner array (ATR) shall be installed on the EDS mainline EDS3. Once cleared bags have been merged back onto EDS3, after screening, the associated ten digit IATA bag tag shall be read by the array and will correlate the bag tag with the associated outbound flight departure information time in order to determine if it will be treated as a “Cold Bag” or a “Hot Bag”. If it is determined to be a “Cold Bag” then the bag will be diverted onto the CB9 subsystem for transport into the existing Terminal One outbound BHS for sortation. If it is determined to be a “Hot Bag” then it will be diverted onto the EX2 subsystem run out conveyor for immediate transport to its associated flight. If the bag is pending a decision or has been alarmed, it will be transported to the CBRA area for Level 3 ETD screening. Cleared “hot bags” will be re-inducted onto the CB7 clear bag line where they will be read by the CB7 ATR. If the system determines the bag to be “hot” it will be diverted to the CB8 clear bag line which merges back onto the EX2 run out conveyor.

Any bags that cannot be cleared at Level 1 or Level 2 (OSR) will be transported into the CBRA area for further processing (Level 3 ETD screening). Once the bag has been cleared it will be placed on the CB7 subsystem for transport to the existing Terminal One outbound BHS for sortation.

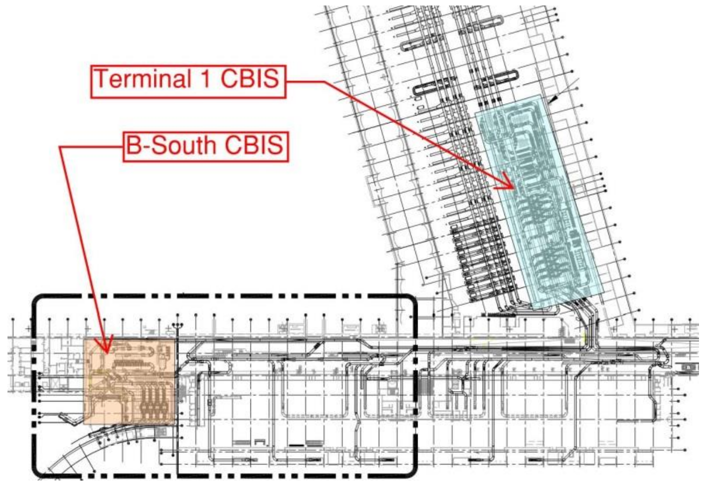
Any bags that receive an EDS “unknown” status in the CBRA can be re-introduced to the EDS mainline via the RI subsystem according to local TSA protocols. The CBIS is considered to be tracked from the first ATR location located along TX1A, and at the EDS3-1 conveyor when the IB1 RI1 and EX1 merge together onto the EDS mainline. The tracked subsystems continue through the EX2 decision point, the CB8 decision point and into the CBRA room. Any modification to the PLC program affecting these areas needs to be approved and coordinated with TSA.

E.1.2.2 Screening Methodology Overview

The 100% In-Line integrated EDS configuration for this project will consist of three (3) Screening Level classifications which are as follows:

Level 1 – EDS screening in the "Automatic" mode:

All originating "in-gauge" checked bags shall be routed to an EDS device for security screening. The EDS device software will automatically scan each bag. The EDS device will provide a status for the bag "clear" or 'unclear' based on the assessment of the images and notify the BHS via the EDS/BHS interface. "Clear" level 1 "Cold Bags" will be routed to the sortation system using the CB9 subsystem. "Clear" level 1 "Hot Bags" will be routed to the EX2 runout conveyor for immediate transport to its flight.



Level 2 – On Screen Resolution (OSR) operation:

Baggage that receives a "Unclear" status from the level 1 EDS device will have the suspect image delivered via the security interface network to the EDS security monitoring area (level 2). The images shall be received and displayed on monitors in the OSR control room. An operator will view the image in the display for a configurable time duration utilizing Threat Resolution Tools (TRT) to determine if the bag is "Clear" or "Unclear". If the operator determines that the bag is suspect or the allocated time period expires (minimum of 45 seconds), and no decision has been rendered, the image and relevant bag will be given an "Unclear" level 2 status. These bags shall be transported into the CBRA on the SB4 line for review and appropriate handling.

Level 3 Explosive Trace Detection (ETD) operation:

Bags with "Unclear" level 2 or "Out of Gauge" status will be transported to the CBRA for further inspections and appropriate handling (ETD). "Clear" Level 2 bags will be placed on the CB7 conveyor subsystem. "Clear" Level 2 "Cold Bags" will be routed to the sortation system using the CB9 subsystem. "Clear" Level 2 "Hot Bags" (determined by a new ATR located upstream of the CB8 diverter) will be diverted to the CB8 subsystem and routed to the EX2 run out conveyor for immediate transport to its flight.

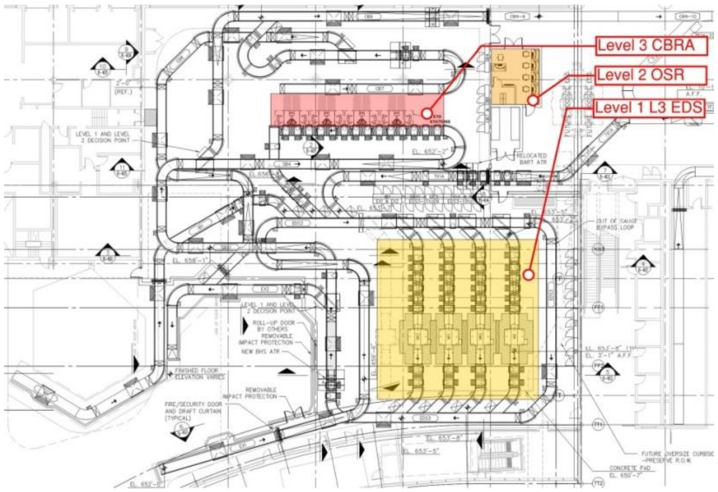
All "Failed" level 3 bags shall be handled per the local EOD protocol. Full access is provided into the CBRA to allow for any required LEO explosive robot to maneuver as required to eliminate the potential threat.

E.1.3 Objectives of the Contingency Plan

E.1.3.1 Contingency Plan Implementation Risk

In the event the CBIS becomes inoperative due to any event which prevents the CBIS from processing baggage in a designed timely manner a contingency plan developed for that event will be implemented.

This plan, dependent on the critical nature and size of event, would require multiple parties to communicate in a timely and efficient manner. If the plan is not implemented properly or promptly, and event that already has degraded the system will only become more compounded and take a longer duration to alleviate.



E.1.3.2 Desired Outcomes

The Desired outcome of implementing a contingency plan is to screen as many bags as possible in the shortest time possible despite an event in the system that would be preventing this operation. A contingency plan would remain in place until the system has reverted to its original state and all the events / faults have been mitigated and corrected.

E.1.3.3 Potential Impacts

If an event that creates a sever long term downtime situation occurs, United Airlines would be required to quickly and effectively modify their operation to ensure all outbound and transfer baggage are still processed in a timely manner. In most B-South extreme duration failure incidents the baggage inducted onto the MOD1 and MOD2 ticketing counters will be re-routed to the existing basement EDS system. All transfer bags would be loaded onto alternate input points to route all transfer bags to the existing basement EDS. All bags that normally would be inducted onto the curbside lines (inputs CS1 and CS2) would need to be manually carted to another active input location that feeds into the existing basement EDS.

E.1.3.4 Recourse Requirements

TSA should be have in place a dynamic agent deployment plan to provide any extra staffing inside the CBRA room in the event an unexpected flood of bags is routed to the CBRA. This could be caused by multiple EDS device faults or in the event the clear bag mainline of the decision point diverter has an extended duration fault.

E.1.4 Contingency Plan – CBIS Failures and Resolutions

The following is a preliminary contingency plan for ORD B-South BHS and will be updated by the BHS Contractor based on their functional specification and updated throughout the Construction Phase.

E.1.4.1 General

It should be noted that for any failure of a system component in the B-South CBIS or CBRA that is determined to cause an extensive period of downtime or a severe reduction in throughput capacity, the response team can choose to prevent any bags from being routed to the disabled B-South system by changing the conveyor direction of the MOD1 and MOD 2 ticket counter conveyors. Any unscreened or suspect stranded bags in the B-South system will need to be found, unloaded and transported to an appropriate input into the existing Terminal 1 CBIS. Any clear bags stranded on the clear bag mainline out of the B-South system will need to be recovered and inducted onto a functional input into the sortation system downstream of the B-South system.

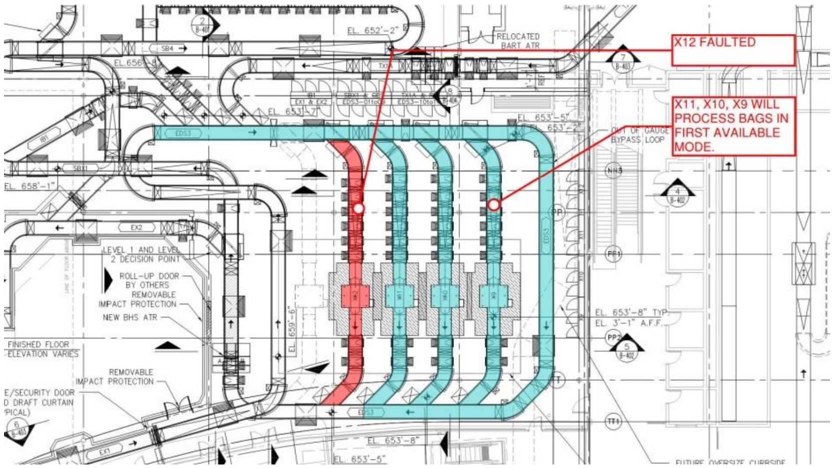
E.1.4.2 Unavailable EDS Line

E.1.4.2.1 System Response

- The HSD that feeds the affected ED subsystem will automatically be placed in the "divert none" mode by the control system.
- Any bags inside the L3 at the time of the fault will be tracked to the CBRA with an EDS "error" status and manually re-inducted into the system from the CBRA utilizing the Re-insertion Subsystem (RI1).
- Throughput capacity is still realized utilizing the PGDS N+1 requirement which will allow the system to still process its peak demand despite the faulted EDS unit.

E.1.4.2.2 Maintenance Response

- In the event an EDS line is unable to process bags (L3 EDS failure, or BHS conveyor failure), the stranded bags upstream of the EDS device will be manually transferred to the adjacent EDS line (X9, X10, X11, or X12) upstream of the faulted screening device. These bags will be assigned a pseudo BHS bag ID, at a photocell on the queue conveyor upstream of the EDS device that will be associated with the status assigned by the L3 after Level 1 screening.
- Any removal of bags from any TSA supplied equipment (e.g., L3 6600 EDS device) may only be performed by TSA Staff.



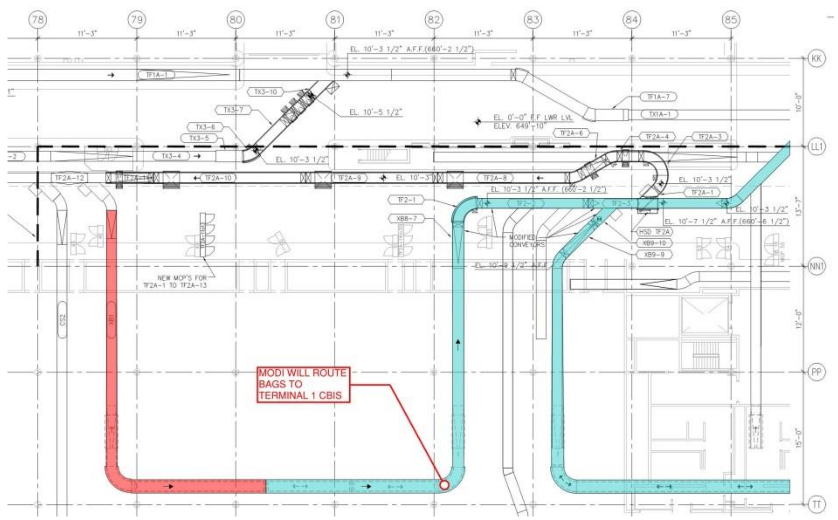
E.1.4.3 Unavailable EDS Mainlines (EDS3) Medium/Extended Duration

E.1.4.3.1 System Response

- In the event the EDS3 mainline feeding the X9 through X12 security shunt lines becomes disabled, the system will alert the Central Control Room.
- All baggage that is downstream of the failed subsystem will be processed to the clear bag lines or routed to the CBRA room as normal.

E.1.4.3.2 Maintenance and Operations Response

- The UAL O&M group will re-direct the direction of the MOD1 and MOD2 ticketing conveyors to route all outbound baggage to the Terminal 1 CBIS.
- All transfer bags will have to be inducted into the existing Concourse B-C Connector BHS at an existing transfer inputs.
- All bags stranded upstream of the disabled EDS3 mainline will be manually removed and carted to a functioning input point to induct bags into the Terminal 1 CBIS.



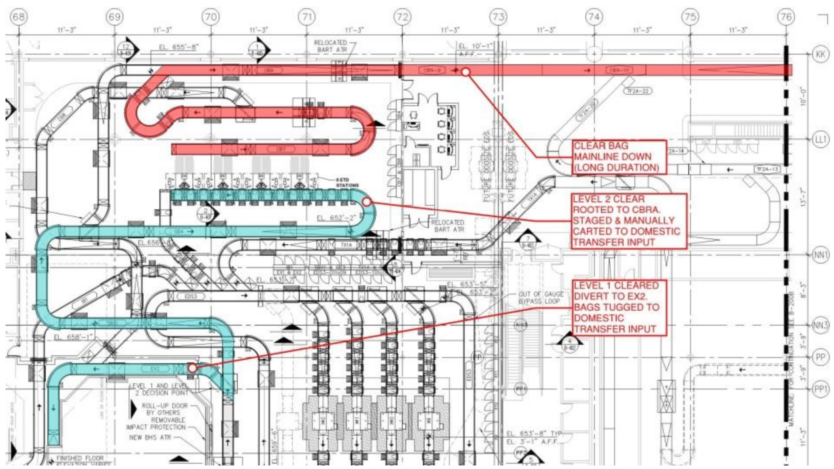
E.1.4.4 Clear Bag Mainline Failure Medium/Long Duration

E.1.4.4.1 System Response

- System will alert the Terminal 1 Central Control Room.
- All clear bags immediately cleared by the Level 1 EDS will be diverted to the EX2 pier (for long duration failures). This fallback procedure will only be initiated by UAL O&M within the Terminal 1 Control Room.
- The system will prevent any bags from being routed to the B-South CBIS. All originating bags will be conveyed to the Terminal 1 CBIS.

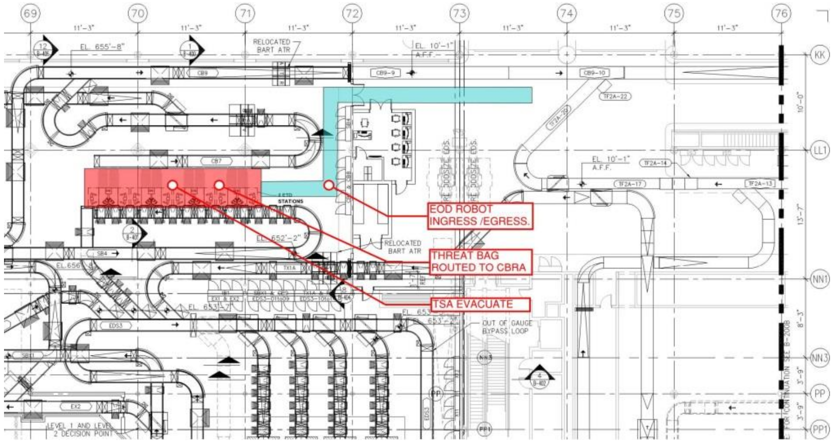
E.1.4.4.2 Maintenance and Operations Response

- If the failure is a long duration failure Operations will be notified that clear bags will need to be transported from the EX2 expedited hot bag pier and re-input into the Terminal 1 sortation system through a domestic transfer input.
- All clear bags from the CBRA will be manually carted to an existing domestic transfer input to transport the clear bags to the Terminal 1 sortation system.
- All stranded bags on the clear bag mainline will be manually removed and input onto a domestic transfer input.



E.1.4.5 Treatment of Positively Identified Threat Bags by TSA Staff

- When TSA staff cannot clear an alarmed bag following Standard Operating Procedures (SOPs) they shall contact the Airport Manager on Duty (MOD) as well as the Airports Designated Law Enforcement Officer (LEO) for resolution of the Identified Threat.
- The Designated Law Enforcement Officer (LEO) then assumes full responsibility of the threat bag and his/her standard operating procedure shall be followed.
- An accessible route has been provided for to allow for any EOD robot access in and out of the CBRA area where the threat bag will be located.



E.1.4.6 B-South OSR Failure

E.1.4.6.1 System Response

- If the B-South OSR stations (MUX failure/fault) become disabled, the remaining bags on the system that are not cleared by the EDS will be routed to the CBRA for Level 3 processing.
- The system will also prevent the MOD1 ticket conveyor from transporting any additional bags to the B-South CBIS. The conveyor will stop and change directions to feed the existing Terminal 1 CBIS located between Concourses B and C.

E.1.4.7 Decision Point HSD Failure

- If the decision point HSDs become inoperable (either the EX2 or the CB9 diverter), the diverters will need to be manually opened and locked in that position during operations. All bags either clear or alarmed will be routed to the CBRA room for reconciliation. Clear bags will be indicated at the CBRA removal queue conveyors on the BSD (baggage status displays). These bags can immediately be transferred to the CB7 clear bag line. All suspect, unknown, lost in tracking bags will be handled normally, or per local TSA SOP.
- If the diverter is unable to be locked open, additional UAL staffing will be required to manually remove the stranded bags upstream of the diverter and load onto an operating conveyor downstream of the diverter. These bags will NOT be reinserted into the system from the CBRA. The TSA will be aware of the system fault condition and will reconcile the bags in the CBRA.

E.1.4.8 CBRA Equipment Failure

- If the BSDs located in the CBRA room become inoperable, all bags will have to be searched manually, or as directed by local ORD TSA protocol. Additional staff will be required if necessary to process the bags. TSA will need to coordinate with the BHS Control Room to ensure that originating checked bags be routed to the Terminal 1 CBIS and that any hot or cold transfer bags be input onto another transfer input to the Terminal 1 CBIS.

E.1.4.9 Transfer Input Failure

- In the event of a failure of IB1 or hot bag EX2 transfer input failure, United will still be able to induct bags on the alternate transfer input line or if both input lines are disabled, alternate transfer input points are available that route bags to the basement EDS.

E.1.4.10 Out of Gauge Subsystem Failure or BMA Failure

- In the event the BMA (baggage measuring array) becomes faulted for an extended period of time, the system will continue to sort bags to a security line X9 through X12. The BHS Control Room will be made aware of this event and should provide additional manpower to staff the entrance of the EDS devices to ensure bags too large to be processed by the Level 1 machines are removed so as not to cause damage to the machines or create a jam event.

E.1.4.11 Power Loss

- In the event of a system power loss, an Uninterruptible Power Supply (UPS) will allow the PLCs to retain all tracking data for a minimum of two (2) hours.
- The UPSs provided for the L3 devices (if purchased) will allow for a controlled shut down of the x-ray gantry and screening computers.
- In the event any power failure results in an extended duration of the non-operable B-South system, TSA and UAL will proceeded in fall back operations currently in place and initiated by UAL.

E.1.4.12 Unplanned Surge in System Demand

- Surge in system demand is handled by the redundant N+1 L3 6600 EDS device[1]. Additionally the system can be metered to only send a certain percentage of originating baggage to the B-South CBIS, if B-South becomes to overloaded a smaller percentage of bags can be routed off.

[1] The TSA notes that although the redundant EDS machine may make it feasible to handle a larger overall baggage rate, the redundant EDS machine(s) are supplied to attain a reasonable level of operational availability.

APPENDIX E-2:
MYRTLE BEACH INTERNATIONAL AIRPORT (MYR)
IN-LINE BAGGAGE SCREENING
CONTINGENCY PLAN

Issued for: TSA 100% Submitted

By: BNP Associates, Inc.

21 September, 2011

REVISIONS

Version	Description of Version	Date Completed
0.1	Initial draft submitted to TSA	11-29-10
1.0	70% design submitted to TSA	05-27-11
2.0	70% design re-submitted to TSA	07-18-11
2.0	100% design submitted to TSA (with TSA 70% comments incorporated)	09-21-11

CONTENTS

ACRONYMS AND ABBREVIATIONS

AL shall mean Alarm Line Subsystem
AOA shall mean Airport Operations Authority
ATR shall mean Automatic Tag Reader
BHS shall mean Baggage Handling System
BMA shall mean Baggage Measuring Array
BNP shall mean Baggage Consultant for MYR
CBIS shall mean Checked Baggage Inspection System
CBRA shall mean Checked Baggage Resolution Area
CD shall mean Claim Device
CL shall mean Clear Line Subsystem
EDS shall mean Explosive Detection System (Computer Tomography)
ETD shall mean Explosive Trace Detection
HSD shall mean High Speed Diverter
IB shall mean Inbound Baggage System
MYR shall mean Myrtle Beach Airport Authority
MU shall mean Make Up
O&M shall mean Operations and Maintenance
OOG shall mean Out Of Gauge
OSR shall mean On-Screen Resolution
PGDS shall mean TSA's Planning Guidelines and Design Standards
PLC shall mean Programmable Logic Controller
PTRI shall mean Passive Threat Resolution Interface
RI shall mean Reinsertion Line
SL shall mean Sortation Line Subsystem
SS shall mean Security Screening Subsystem
SAC shall mean Sortation Allocation Computer
TC shall mean Ticket Counter Subsystem
TSA shall mean Transportation Security Administration
TSO shall mean Transportation Security Officer (Baggage Screener)
VMU shall mean Vertical Merge Unit
VSU shall mean Vertical Sorter Unit

E.2 Contingency Plan for Myrtle Beach International Airport In-Line Baggage Screening

E.2.1 Introduction

This site specific version of the Contingency Plan is for the new Medium Volume In Line EDS system located at the Myrtle Beach International Airport. In accordance with the TSA Planning Guidelines and Design Standards, V3.0 dated 27 November, 2009 this document outlines a contingency plan for the procedures and notification requirements applicable for equipment failures, loss of power and unplanned surges in system demand etc. in the CBIS system.

The contingency plan attempts to identify O & M activities for failure mode operations (automatic or manual), documenting and informing relevant parties of changes to the BHS after system failure that have an impact on the processing baggage. The contingency plan does not address general mechanical maintenance, where equipment is replaced, as this work is generally assumed to not have any impact on the BHS operation.

The success of any automated Checked Baggage System Inspection System (CBIS), regardless of the redundancies built into a particular system, rest with the creation of a Contingency Plan (CP) that is agreed upon by key stakeholders, including MYR, any second part O&M Contractors, and the TSA (Local and HQ).

E.2.1.1 Purpose

The following are overview topics for Contingency Plan consideration and “triggers” that would initiate contingency operations in the event of.

- Screening equipment failure
- Conveyance equipment failure
- Loss of utility power
- Unplanned surges in system demand
- Temporary alternative screening locations for baggage
- Removal of threat “Suspect” bags from the CBRA
- Threat evacuation and associated impact on baggage screening
- Airport Operations emergency Response Plan
- TSA local standard operating procedures
- Horry County Airport Emergency Incident Response Plan

E.2.2 BHS System Overview

E.2.2.1 CBIS Overview

The Myrtle Beach International Airport CBIS layout is based on the design standards and practices detailed in the TSA Planning Guidelines and Design Standards (PGDS) Version 3.0, as coordinated between the TSA, AOA and the BNP Design Team. The major objectives of the Integrated CBIS are to improve passenger circulation, eliminate EDS screening from the ticketing lobby to the make-up area, increase baggage handling capacities and improve TSA employee work area ergonomics.

The 14520-3 BHS Specification details the complete system, equipment to be provided and the functional description of operation.

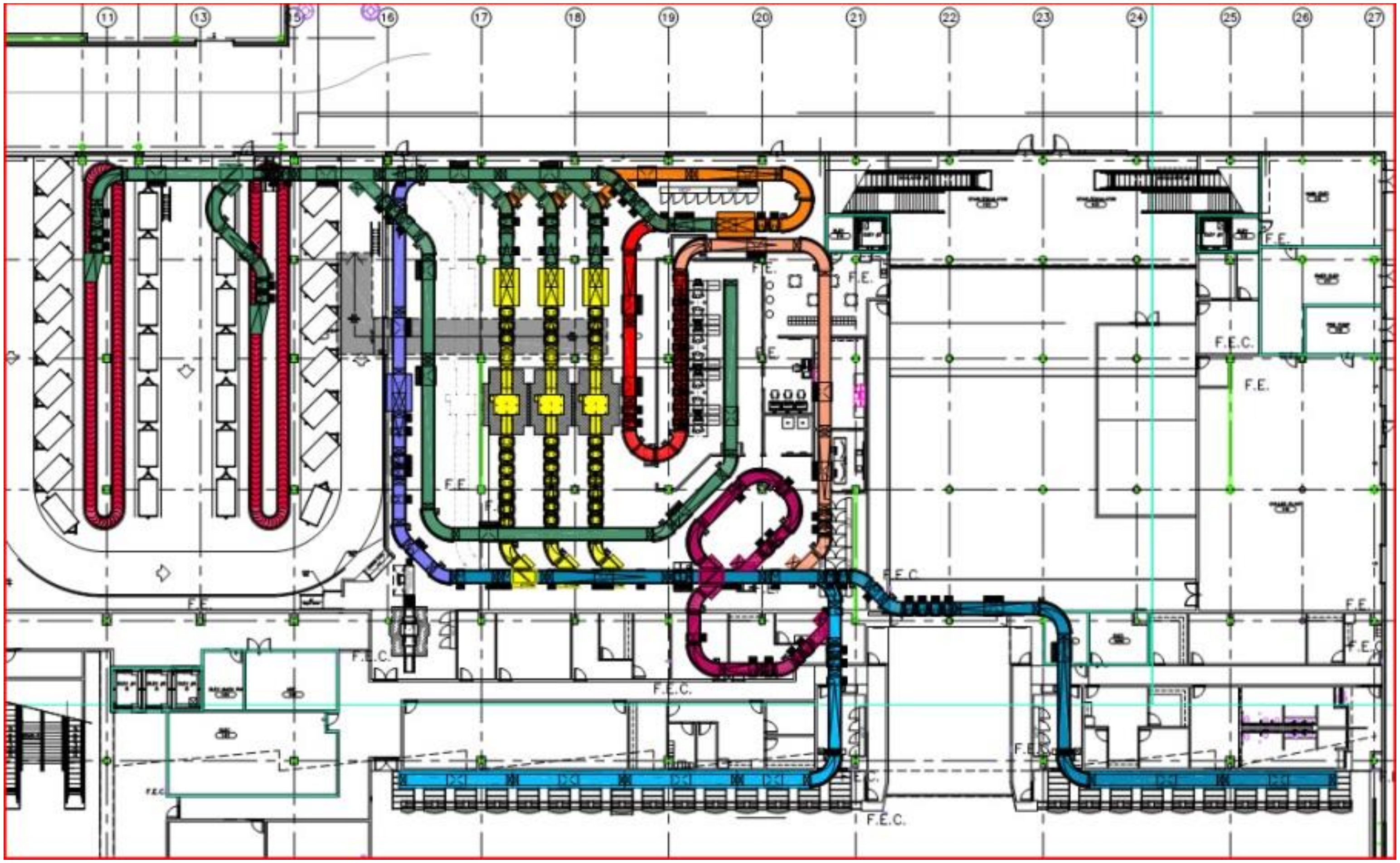
The baggage system consists of a check in area where passengers check baggage, a CBIS area where checked baggage is screened, an outbound make up area where baggage is collected and manually loaded into baggage carts and an inbound area composed of two c laim devices with direct loading of the bags and two additional claims that are feed by two inbound transport line.

Bags enter the system via one of the two ticket counter lines installed east of grid line D, TC1 is located south of grid line 21 and TC2 is located to the north of Grid line 23. Both ticketing mainlines turn west through and incline up over new ATO offices before turning 90º to the south prior to entering the CBIS area. A new BMA will be installed both the TC1 and TC2 ticketing mainlines to dimension bags and ensure they are within the size characteristics allowed by the L3-6600 EDS device. In gauge bags are diverted off of the TC2, and TC1 mainlines to the SS1, SS2 and SS3 security screening lines. Each SS line has eight (8) queuing positions that feed a L3-6600 EDS device. After bags have been processed by the Level 1 EDS device they are tracked to a Level 1 decision point vertical sorter (SS1-VS, SS2-VS, and SS3-VS) where suspect, lost in tracking, no decision (also pending decision), and EDS error bags are sorted to an associated OSR line. All OSR lines merge together onto the OSR5 mainline and transport all bags to a Level 2 decision point vertical sorter (OSR5-VS). All bags cleared by the EDS device at the Level 1 decision will be diverted by the Level 1 decision point VSU to an associated CL clear bag line. All the CL lines merge together onto the CL5 mainline which routes bags to the make-up sortation area.

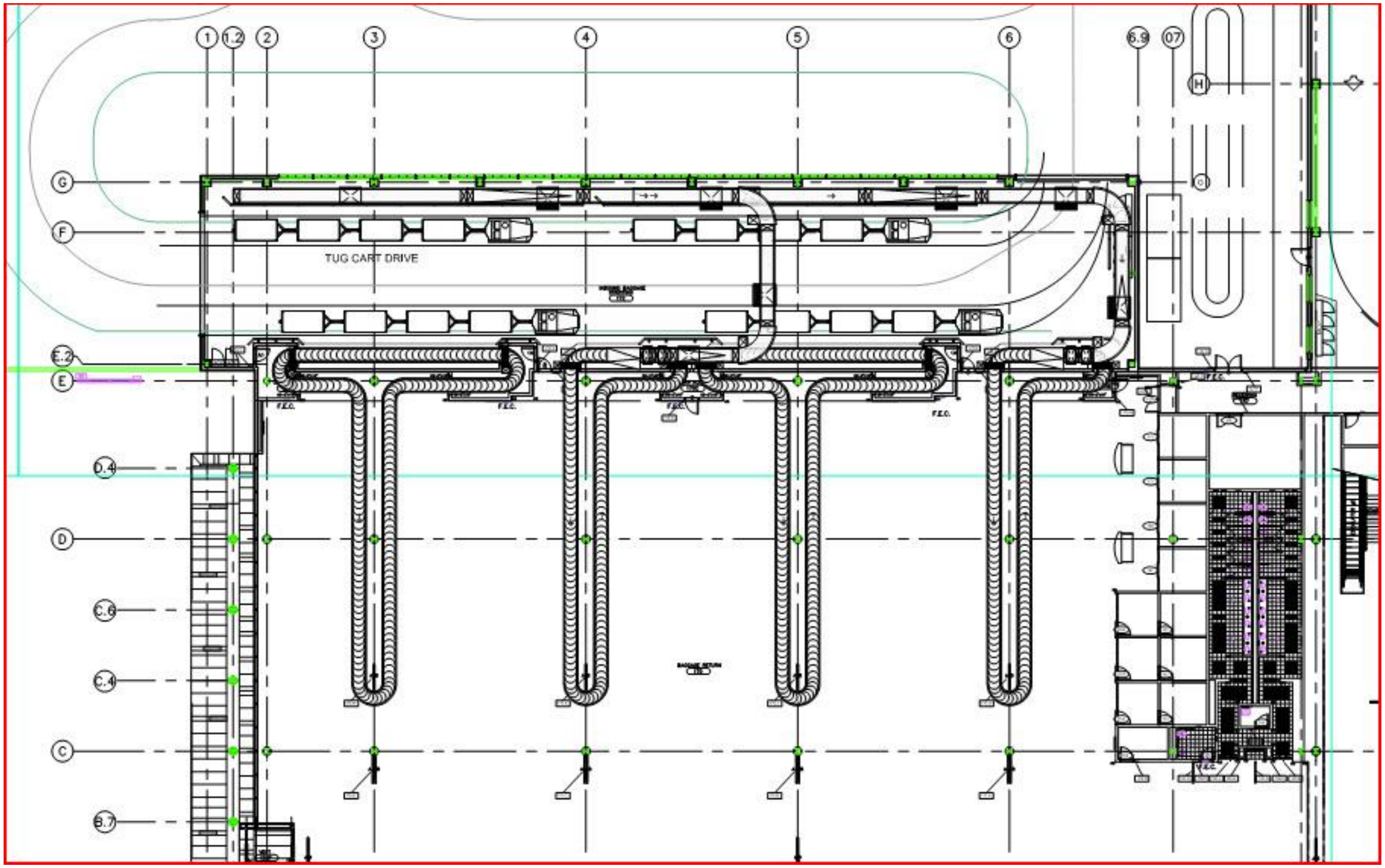
If during transport on the OSR line a clear decision is provided for any pending decision bags, a Level 2 VSU will sort those bags to the CL5 Clear Line. All other alarmed (suspect), lost in tracking, or EDS error bags will be diverted by the Level 2 decision point VSU to the AL1 Alarm Line which transports bags to the CBRA for Level 3 inspection or reintroduction into the system via the RI1 line.

All out of gauge bags transition onto the respective OG subsystem (OG1 or OG2) then merge together at a vertical merge onto a single OG3 mainline. These bags merge are routed to the CBRA for Level 3 inspection.

All Level 1 clear bag lines, CL1 through CL3, and the Clear Line from the CBRA, CL6, merge onto the Level 2 Clear Line CL5. CL5 transports bag to the make-up sortation area where all bags are read by an ATR. Once scanned by the ATR CL5 becomes the SL1 mainline. Bags are tracked along the sortation mainline SL1 and are diverted to either the MF1 or MF2 subsystem for transport to the appropriate make-up carousel (MU1 & MU2). All sortation will be done by the BHS PLC and the SAC (sortation allocation computer) sorting bags by carrier codes. Tip chutes are provided to transition the bags onto the flat plate make-up devices.



The new MYR inbound layout allows all four claim devices to be utilized at once so the inbound operation can handle four inbound flights in process at the same time. Claims CD2 and CD4 utilize a direct drop procedure where the user airlines will unload bags from their carts directly onto the moving claim device. Claims CD1 and CD3 are both feed by inbound transport conveyors IB1 and IB3 which feed bags onto the claims using tip chutes. The inbound transport load belts are located on the west side of the one-way tug drive aisle and incline up over the tug drive aisle before feeding onto their associated claims.



E.2.2.2 Screening Methodology Overview

The 100% In-Line integrated EDS configuration for this project will consist of three (3) Screening Level classifications which are as follows:

Level 1 – EDS screening:

All originating "in-gauge" checked bags shall be transported into a L3-6600 EDS device for Level 1 screening. Once the bag has been scanned by the L3, the bag is ejected from the L3 scan tunnel. The L3 PLC must then track the bag through the L3 exit tunnel before the bag triggers the first photocell downstream of the EDS device where the EDS machines Level 1 decision is handed back. The BHS PLC then tracks the bag with BHS ID and the EDS decision. If the L3 has assigned the bag a CLEAR decision prior to the Level 1 VSU the BHS will divert the bag up to the associated clear bag line (CL1 through CL3). If the l3 has assigned the bag a SUSPECT decision the bags image will be transferred to an OSR operator for Level 2 processing. These bags as they reach the Level 1 decision point will be diverted down to their respective OSR screening line. Bags that loose tracking or are given and EDS error or unknown status will also be diverted to the OSR screening line.

Level 2 – On Screen Resolution (OSR) operation:

Baggage that receives a SUSPECT decision from the L3 during Level 1 screening will have the suspect image delivered via the NEDS network to a OSR station. The images shall be received and displayed one of multiple monitors in the OSR room. An operator will view the image in the display for a configurable time duration utilizing Threat Resolution Tools (TRT) to determine if the bag can be determined CLEAR or SUSPECT. If the operator determines that the bag is suspect or the allocated time period expires (maximum of 45 seconds), and no decision has been rendered, the image and relevant bag will be given a SUSPECT Level 2 status. These bags shall be diverted at the Level 2 decision point vertical sorter to the AL1 Alarm Line and transported to the CBRA for inspection. Bags that are given a CLEAR decision by an OSR operator will be diverted to the associated Clear Line at the Level 2 decision point vertical sorter.

Level 3 Explosive Trace Detection (ETD) operation:

Lost in tracking bags, EDS unknown or error bags, and valid out of gauge and SUSPECT Level 2 bags will be transported to the CBRA via the AL line for inspections and appropriate handling (ETD). Cleared Level 3 bags will be placed on the CL6 clear bag line that will transport bags across the CBIS area and merge onto the CL5 mainline out to the make-up sortation area.

All Level 3 bags that cannot be cleared with ETD shall be handled per the local EOD protocol. Full access is provided into the CBRA to allow for any required LEO explosive robot to maneuver as required to eliminate/remove the potential threat.

E.2.3 Objectives of the Contingency Plan

E.2.3.1 Contingency Plan Implementation Risk

In the event the CBIS becomes inoperative due to any event which prevents the CBIS from processing baggage in a designed timely manner a contingency plan developed for that event will be implemented.

This plan, dependent on the critical nature and size of event, would require multiple parties to communicate in a timely and efficient manner. If the plan is not implemented properly or promptly, and event that already has degraded the system will only become more compounded and take a longer duration to alleviate.

E.2.3.2 Desired Outcomes

The Desired outcome of implementing a contingency plan is to screen as many bags as possible in the shortest time possible despite an event in the system that would be preventing this operation. A contingency plan would remain in place until the system has reverted to its original state and all the events / faults have been mitigated and corrected.

E.2.3.3 Potential Impacts

If an event that creates a sever long term downtime situation occurs, MYR would be required to quickly and effectively modify their operation to ensure all outbound and transfer baggage are still processed in a timely manner.

E.2.3.4 Recourse Requirements

TSA should have in place a dynamic agent deployment plan to provide any extra staffing inside the CBRA room in the event an unexpected flood of bags is routed to the CBRA. This could be caused by both EDS device faults or in the event the clear bag mainline of the decision point has an extended duration fault.

E.2.4 Contingency Plan – CBIS Failures and Resolutions

The following is a preliminary contingency plan for Myrtle Beach International Airport for the BHS and will be updated by the BHS Contractor based on their functional specification and updated throughout the Construction Phase.

E.2.4.1 General

While expectations for airline ticketing staff, baggage handling staff, TSA personnel and BHS maintenance staff may be different for each event, it may be generalized that additional staff will be required for each discipline. In the case of the BHS maintenance group, there is a set of standard procedures that should be followed for each event. The programmable logic controller (PLC) will incorporate coded control logic to automatically direct the conveyors to produce many of the necessary changes to the system as defined in the following contingency procedures. It should be noted that for any failure of a system component in the new CBIS or CBRA that is determined to cause an extensive period of downtime or a severe reduction in throughput capacity, the response team can choose to prevent any bags from being routed to the disabled CBIS system. Any unscreened or suspect stranded bags in the CBIS system will need to be found, unloaded and transported to a CBRA for manually screening. Any clear bags stranded on the clear bag mainline out of the CBIS system will need to be recovered and inducted onto a functional input into the sortation system downstream of the CBIS system.

E.2.4.2 BHS Contingency Plan

Examples of what may "Trigger" a contingency operation are as follows:

- Screening equipment failure
- Conveyance equipment failure
- Loss of utility power
- Unplanned surges in system demand
- Temporary alternative screening location for baggage
- Removal of threat "Alarmed" bag from CBRA
- Threat evacuation and associated impact on baggage screening
- Airport Operations Emergency Response Plan
- TSA local standard operating procedures
- Standard Operating Procedures (SOP) for transportation security incidents
- Airport Emergency/Incident Response Plan

E.2.4.3 Defining Contingency Operation

The following must be taken into consideration before a full need assessment can be made on the best course of action for any failure:

- Peak or non-peak hours of operation
- Critical nature of failed components
- Difficulty in correcting the failure
- Availability of new components to correct failure
- Availability of appropriate personnel to correct or manage the event
- Time needed to correct the failure

E.2.4.4 Standard Procedures for BHS O&M Staff

1. Upon fault recognition dispatch appropriate personnel to faulted conveyor or device for inspection and determination of impact.
2. If fault can be rectified in less than 20 minutes, institute fix and then return to normal activities.
3. If fault will take greater than 20 minutes to repair, affected operations should be informed and contingency operations implemented.
4. Baggage Jam Runners (or Third-party Baggage Handling Agency) will manually transfer stranded bags and load them on closest operational system.
5. Maintenance personnel will implement plans to rectify the fault and advise impacted staff of expected time for the conveyor to be operable.
6. Once the fault is corrected, maintenance to inform affected staff, through the BHS Control Room, that their operations will return to normal.

E.2.4.5 Standard Procedures for Airline Ticketing Staff

1. Determine if failed condition on the affected line requires intervention from BHS Maintenance personnel and inform the BHS Control Room if it does for appropriate action.
2. If the rectification is going to take longer than 20 minutes request additional help in moving baggage to a nearby available take away load conveyor (e.g., Baggage Jam Runners or Third-party Baggage Handling Agency).
3. Use small carts to facilitate the moving of bags, if redundant conveyor line is far from the Kiosk.
4. Carefully place bags on the conveyor and maintain at least 8 inches intervals between bags.

E.2.4.6 EDS Device Failure Notification Procedures

1. The EDS vendor should be contacted for the emergency maintenance and repair of TSA provided equipment.
2. TSA equipment includes EDS devices, ETD equipment, NEDS interface, on-screen resolution equipment and passive threat resolution information.
3. Any changes to the EDS device programming by the TSA must be communicated to the BHS Control Room.
4. TSA protocols exist for formal documentation of repairs and maintenance of TSA furnished equipment.
5. TSA agents shall clear jams within the EDS device when notified by the BHS Control Room per conformance protocols.

E.2.4.7 PLC Failure

A PLC failure may affect a large area resulting in loss of control for many conveyors or even the complete matrix or both. PLC failures are typically rare and relatively easy to fix and recover from.

The PLC control system has been compartmentalized into 4 distinct areas:

1. CBIS
2. Upstream of the CBIS
3. Downstream of the CBIS
4. Inbound

Each master PLC located in the control room maintains a redundant hot back up clone that automatically switch (seamless operation) between the two when one fails.

The Inbound system is provided with cold back up PLC's that can be manually switched between the two when one fails.

It should be noted that maintenance procedures must be instituted and maintained that ensure the integrity of the backup system. All program changes made to a PLC must also be made to its back up PLC.

E.2.4.8 Computer Failure

The computer system servers—those used for sort control, reporting and fault monitoring—are all protected with redundant backup servers. These redundant servers are called hot backups in that they are constantly observing the activities of their counterpart online server and they can completely take over the activities of the online server if necessary without any intervention from an operator.

PLC sort control is an additional sort backup.

E.2.4.9 Ticket Counter Load Belts Failure Prior Fire Doors (TC1, TC2)

If the loading take-away belt for ticket counters conveyors become inoperable a conveyor immediately downstream of the faulted conveyor and before the security door may be used.

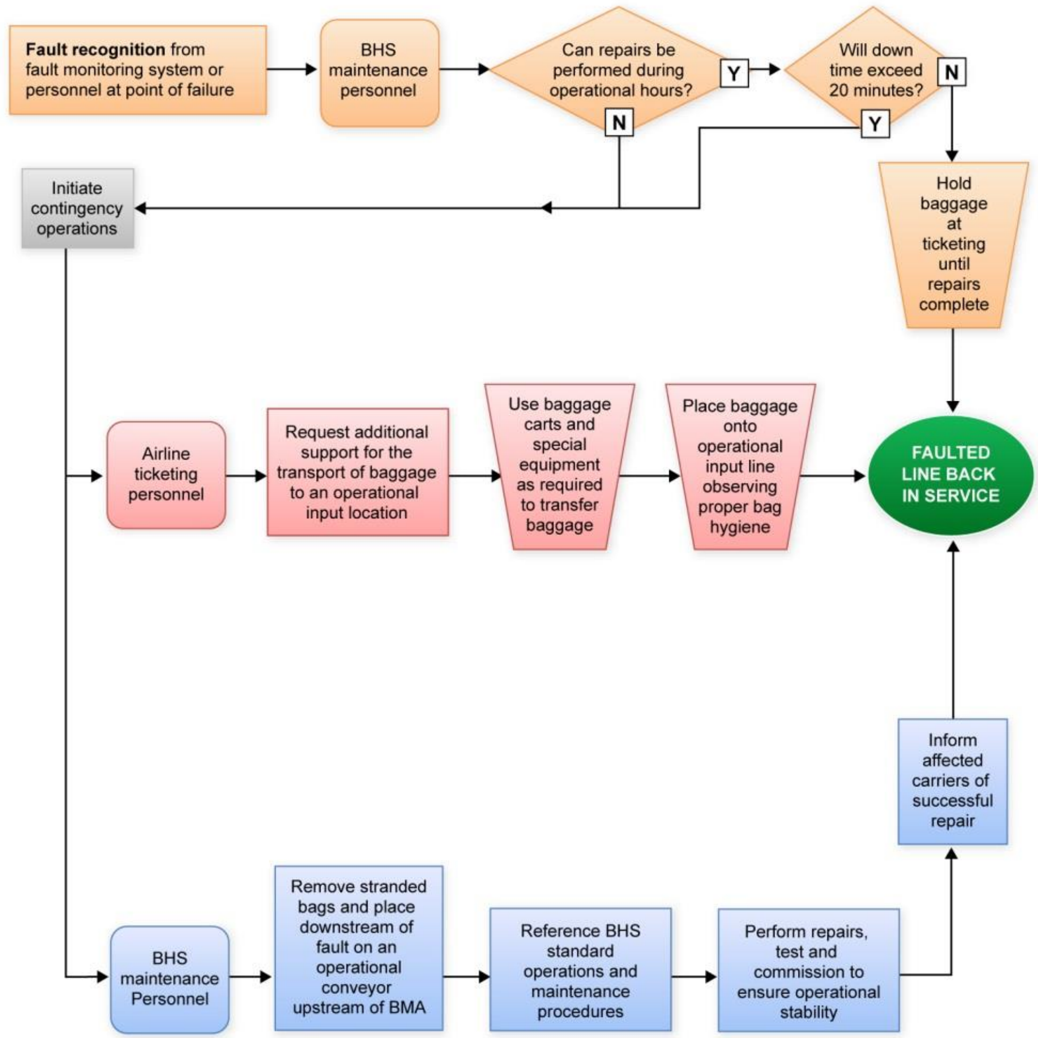
E.2.4.9.1 Procedures for Airline Ticketing Staff

- Request additional help for moving bags to next available load point.
- If necessary, especially during peak loading periods, use small cart to facilitate transfer of bags.
- Carefully place bags lengthwise onto the conveyor observer proper bag hygiene.

E.2.4.9.2 Procedures for BHS Maintenance Staff

- Assess fault and time necessary to correct. If more than 20 minutes is needed initiate contingency operations.
- Determine if work can be conducted during airport operational hours as this work involves the public areas.
- If only one ticket counter can be used provide added personnel as required to transport baggage to the operational load belt.
- Follow BHS maintenance standard procedures.
- Coordinate with all parties involved to complete work in a timely and least disruptive manner.

TICKETING OR CURBSIDE FAILURE



E.2.4.10 Ticket Counter Failure (TC1, TC2) Downstream of Fire Door

This will be treated similar to line failure before the fire doors. Baggage already placed onto these conveyors will need to be removed and placed on the nearest downstream, operating conveyor before the BMA on either transport line.

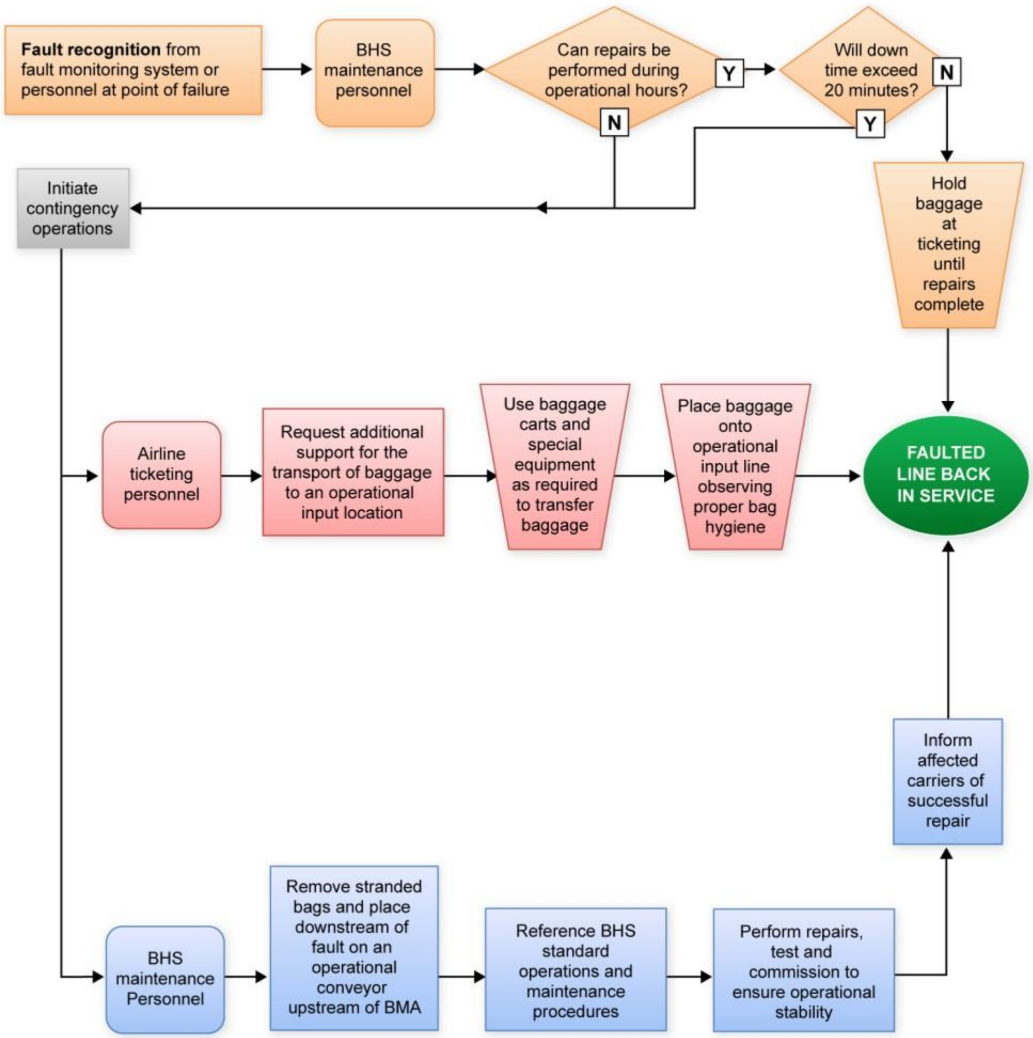
E.2.4.10.1 Procedures for Airline Ticketing Staff

- Request additional help for moving bags to the other ticket counter load belts.
- If necessary, especially during peak loading periods, use small cart to facilitate transfer of bags.
- Carefully place bags lengthwise onto the conveyor in intervals at least eight inches apart.

E.2.4.10.2 Procedures for BHS Maintenance Staff

- Assess fault and time necessary to correct; if more than 20 minutes is needed initiate the contingency operations.
- Remove bags stranded on inoperable conveyors and place them before the BMA on operational downstream conveyors or on the other ticket counter transport line.
    - Follow BHS maintenance standard procedures.

TICKETING OR CURBSIDE FAILURE



E.2.4.11 Main Transport Line (TC1 and TC2) Failure

These two transport lines convey baggage from the ticket counter to the two EDS matrices. The lines together provide a redundant feature and increased load potential for the expected demand on the system. If one of the lines becomes inoperable carriers using the ticket counter will need to use the input points for the other ticket counter. This is obviously an undesirable condition that may provide some relief but during peak periods will require significant coordination between the carriers. It is a high priority that needs to be corrected very quickly.

E.2.4.11.1 Procedures for Airline Ticketing Staff

- Request additional help for ticket agents in moving baggage.
- Use small cart to facilitate transfer of bags to the most convenient working conveyor.
- Carefully place bags lengthwise onto the conveyor in intervals at least eight inches apart.
- Select baggage for flights with departure time greater than one hour for placement later into the system.

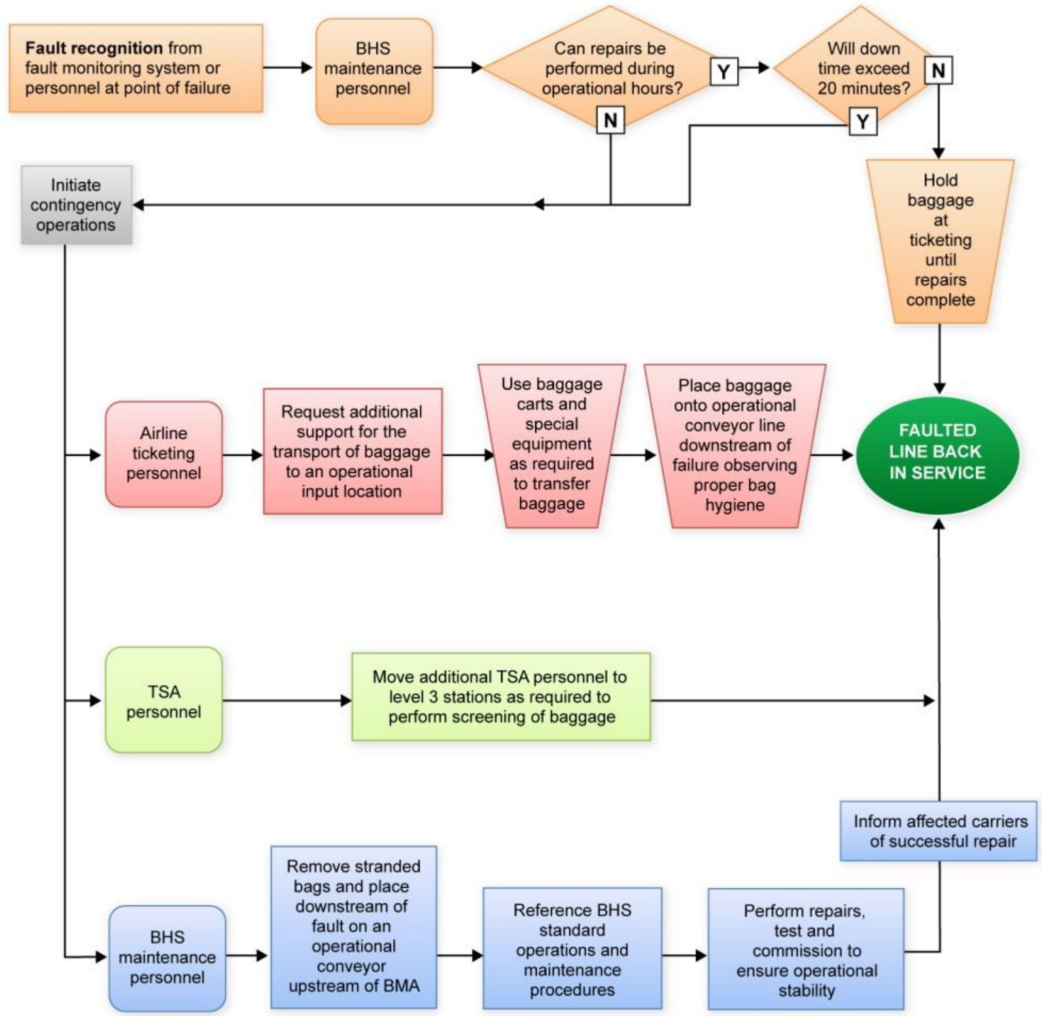
E.2.4.11.2 Procedures for TSA Staff

- Additional personnel in the CBRA may be required for a short period of time for possible jams at the entrance of EDS devices or UNK status bags from the stranded bags placed back in the BHS system.
- During peak hours additional staff may be needed due to potential increase in no decision, suspect, incomplete images or jams in the EDS machines if only one matrix will be used.

E.2.4.11.3 Procedures for BHS Maintenance Staff

- Assess fault and time necessary to correct and if more than 20 minutes is needed initiate contingency operations.
- Manually remove bags left stranded on any of the failed conveyors and load on the nearest and accessible operating conveyor. Bags can be placed on the ED lines that feed the EDS devices with additional consideration for OOG jams at the entrance of EDS device.
- Ensure the crossover diverter on the faulted line is in “Divert All” mode.
- Follow BHS maintenance standard procedures.
- Coordinate with all parties involved to complete work in a timely and least disruptive manner.

MAIN TRANSPORT LINE FAILURE



E.2.4.12 Baggage Measuring Array Failure (TC2-BMA)

If the baggage measuring array fails, bags cannot be sized appropriately for the EDS machine. The automatic control of the BHS will recognize the fault and place the OOG diverter into "Divert all" mode. Bags will be transferred via high speed diverter to the OOG line for reinsertion of "in-gauge" baggage and Level 3 screening of all OOG bags.

In the event that the baggage measuring array fails, bags shall continue to divert to the EDS shunts. In the event that conveying or screening equipment failures occur down-line of the OOG diverter, the OOG diverter may be manually set to operate in a "limited operation" mode in which all baggage is conveyed directly to the CBRA for manual screening. Engaging the "limited operation" mode shall only occur with concurrence from local TSA..

E.2.4.12.1 Procedures for Airline Ticketing Staff

- Ticket counter agents should take extra care to ensure Out-of-Gauge bags are not placed into the system. Ensure that only bags that will pass through the EDS machines are placed on the ticket counter lines.
- Move Personnel to the CBRA to assist TSA with increased demand as a result of excess bags with UNK status arriving in the CBRA.
- Use small cart to facilitate transfer of OOG bags to CBRA for Level 3 screening.

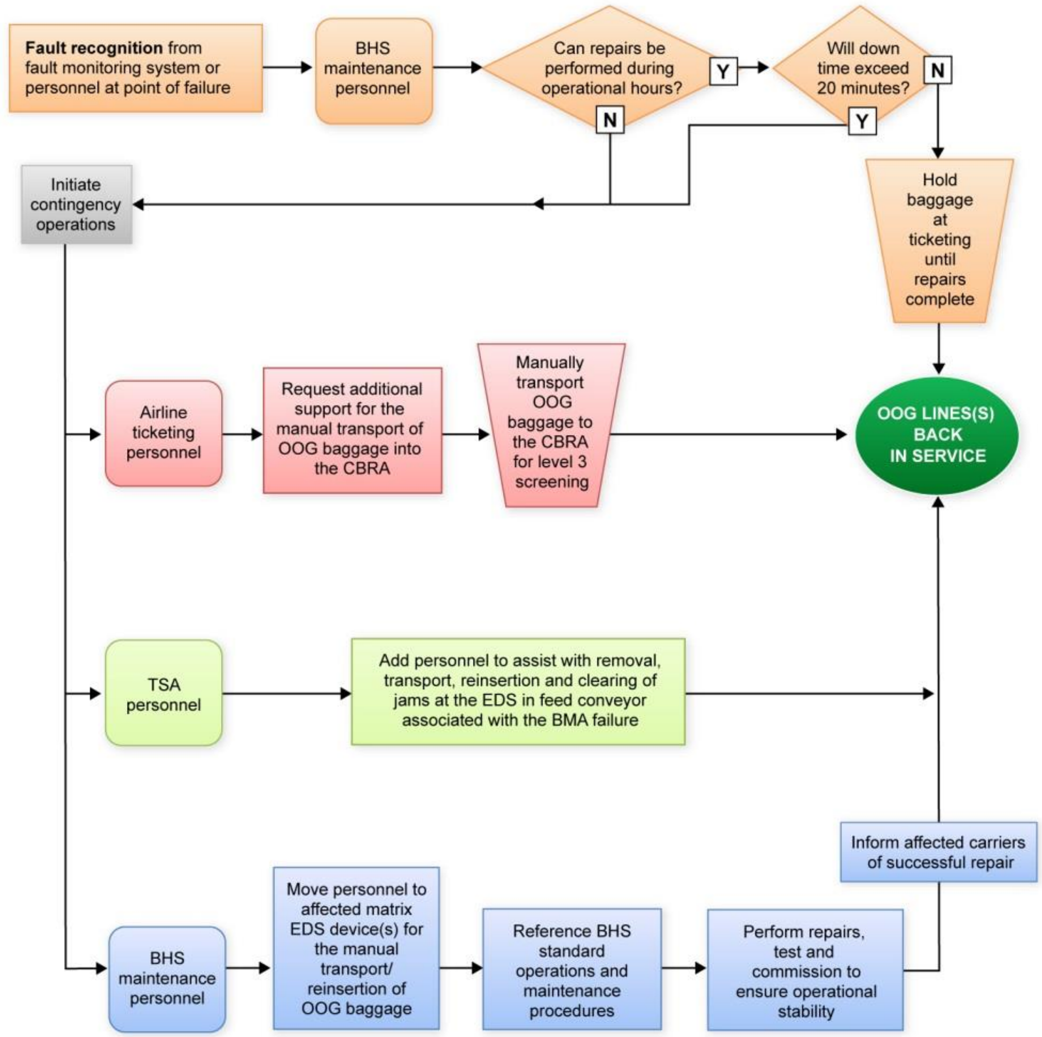
E.2.4.12.2 Procedure for TSA Staff

- Add staff for increased demand in CBRA to assist with the reinsertion or search of bags with incomplete images during peak hours.
- Add staff to assist with jams at the EDS devices in feed conveyors.

E.2.4.12.3 Procedures for BHS Maintenance Staff

- Assess fault and time necessary to correct; if longer than 20 minutes is needed initiate the contingency operations.
- Ensure that the crossover high speed diverter on the subsystem OG1 is placed into Divert all mode if bag screening demand is low.
- Upon direction from TSA place the OG1 conveyor into "divert none" mode. Simultaneously place the SS1 thru SS3 HSPD's into "divert all" mode.
- Provide additional staff to Monitor and assist the TSA in clearing jams at the in feed conveyor of the EDS device(s).
- Follow BHS maintenance standard procedures
- Complete work quickly as this fault condition seriously damages the ability to use the automated features of the matrix.

BMA FAILURE



Fault recognition from fault monitoring system or personnel at point of failure
BHS maintenance personnel
Can repairs be performed during operational hours?
Y
N
Will down time exceed 20 minutes?
N
Y
Initiate contingency operations
Hold baggage at ticketing until repairs complete
Airline ticketing personnel
Request additional support for the manual transport of OOG baggage into the CBRA
Manually transport OOG baggage to the CBRA for level 3 screening
OOG LINES(S) BACK IN SERVICE
TSA personnel
Add personnel to assist with removal, transport, reinsertion and clearing of jams at the EDS in feed conveyor associated with the BMA failure
Inform affected carriers of successful repair
BHS maintenance personnel
Move personnel to affected matrix EDS device(s) for the manual transport/ reinsertion of OOG baggage
Reference BHS standard operations and maintenance procedures
Perform repairs, test and commission to ensure operational stability

E.2.4.13 Out of Gauge Line Failure (OG1)

The system's monitoring software will recognize the fault condition. BHS personnel will inform the Airlines ticketing staff of the failure and the expected duration of the fault.

E.2.4.13.1 Procedure for Airline Baggage Handling Staff

- Add baggage handling staff to the location of fault to manually remove bags and load back downstream on the first operational conveyor to be transported to CBRA.
- Ticket counter agents should take extra care to ensure Out-of-Gauge bags are not placed into the system. Ensure that only bags that will pass through the EDS machines are placed on the ticket counter lines.
- Use small cart to facilitate transfer of OOG bags to CBRA for Level 3 screening.

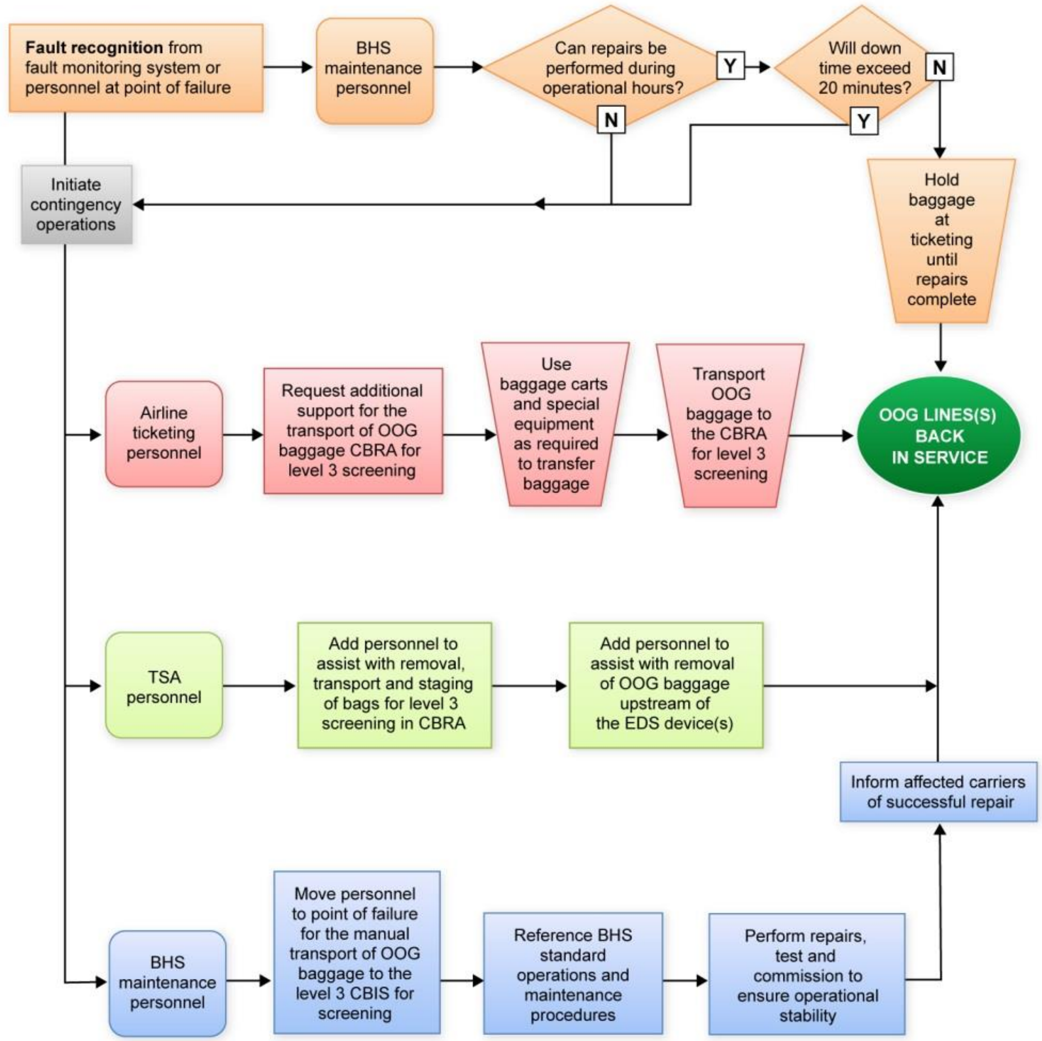
E.2.4.13.2 Procedure for TSA Staff

- Add staff for increased demand in CBRA to assist with the reinsertion or search of bags with incomplete images during peak hours.
- Add staff to assist with jams at the EDS devices in feed conveyors.

E.2.4.13.3 Procedures for BHS Maintenance Staff

- Asses fault and time necessary to correct and if more than 20 minutes is needed initiate contingency operations.
- Determine if the work to repair the fault is more disruptive than the condition itself and if a suitable temporary fix can accommodate TSA until the end of working day, then work should be conducted during close-of-business hours. All parties should agree upon this solution, otherwise repair efforts should be conducted in the earnest.
- Manually transport baggage to CBRA for Level 3 screening.
- Follow BHS maintenance standard procedures.
- Coordinate with all parties involved to complete work in a timely and least disruptive manner.

OUT OF GAUGE LINE FAILURE



E.2.4.14 EDS Machine, EDS-HSD, EDS Lines Failure or Matrix Failure Upstream of Level One Decision Point

If one of the EDS machines becomes inoperable, the diverter or the conveyor line directly feeding the machine fails; the other operable machines will be responsible for all security scanning. This is accomplished automatically by monitoring software that shuts down the diverter feeding that line. This is also true regarding failures occurring on any of the security shunts lines.

In the event that the two lines on the matrix become unavailable, bags already in the system on the affected subsystems will manually be removed and transported to the CBRA for screening. The stranded bags on the security shunt lines will be manually removed and placed on the working matrix before the EDS machines. The system's monitoring software will recognize the fault and place the HSD on the faulted subsystem in "Divert none" mode. In case that the operational security shunt lines become full the bags will continue to CBRA via the OG line.

E.2.4.14.1 Procedure for Airline Baggage Handling Staff

- Monitor the system for potential die back.
- Add staff to the CBRA to assist in taking bags to the ETD station or an area secured for build-up of the bags.

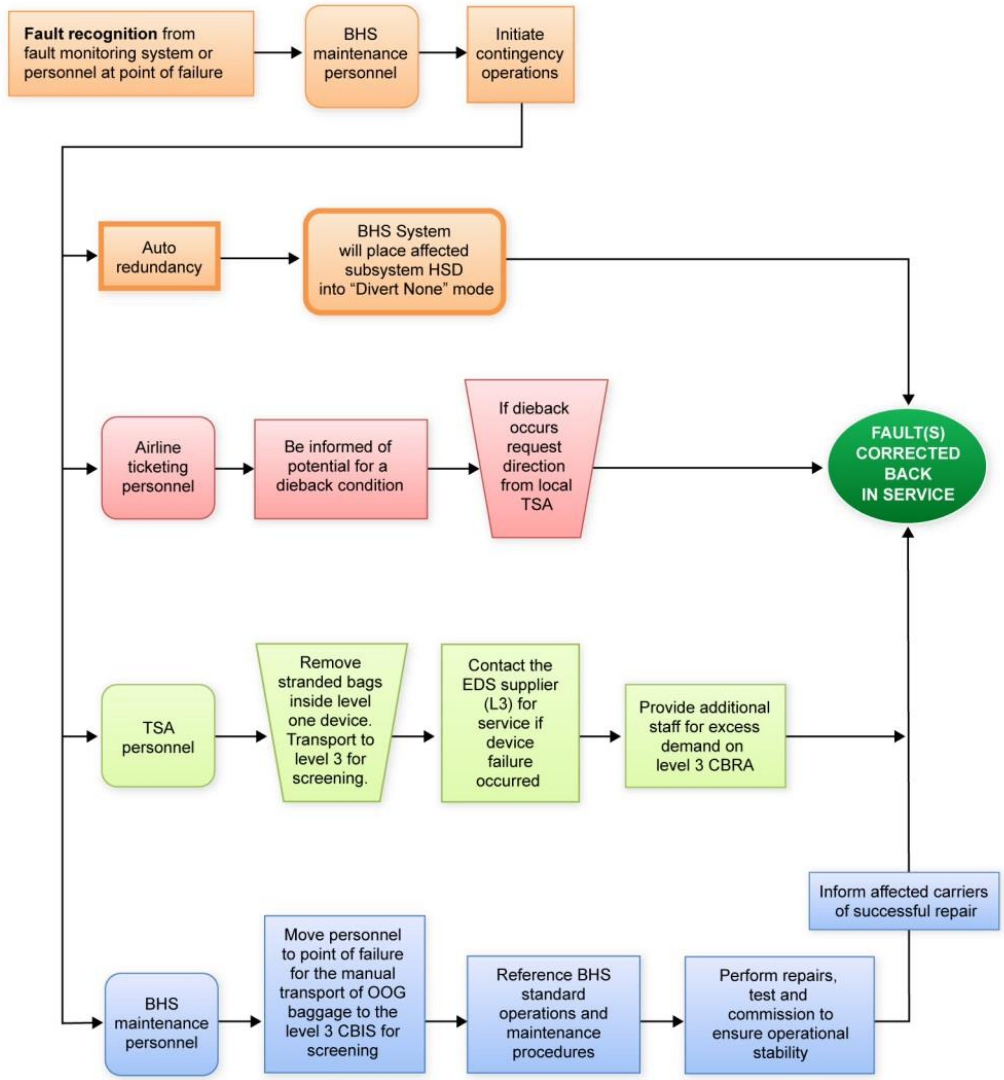
E.2.4.14.2 Procedure for TSA Staff

- Manually remove any bag stranded in the EDS device and place them on alternate operational EDS line upstream of EDS device.
- In case multiple SS lines are faulted add staff in the CBRA to assist in the screening of excess baggage.
- Contact appropriate EDS service vendor if the EDS machine malfunctions and needs maintenance.

E.2.4.14.3 Procedures for BHS Maintenance Staff

- Follow BHS maintenance standard procedures.
- Ensure that HSD for the failed line is bypassed and placed back into use once the fault is corrected.
- Remove bags stranded on the failed feeding line to the EDS machines and manually place them on the other operable EDS line upstream of EDS device.
- Carefully monitor the system to ensure that baggage system does not back up and cause cascading shutdowns of the system.

EDS DEVICE, EDS HSD, SS LINE OR MATRIX FAILURE



E.2.4.15 First Decision Point Vertical Sorter Failure (SS1-VS through SS3-VS)

This will be treated much the same as for the failed security shunt lines or EDS machine. Crossover lines can be used for load balancing.

E.2.4.15.1 Procedure for Airline Baggage Handling Staff

- Monitor the system for potential die back.
- Add staff to the CBRA to assist in taking bags to the ETD station or an area secured for build-up of the bags.

E.2.4.15.2 Procedure for TSA Staff

- Manually remove any bag stranded in the EDS device and no decision bags after the EDS machine and place them onto working EDS lines before the EDS machines.
- Contact appropriate EDS service vendor if the EDS machine malfunctions and needs maintenance.

E.2.4.15.3 Procedures for BHS Maintenance Staff

- Follow BHS maintenance standard procedures.
- Ensure that HSD for the failed line is bypassed and placed back into use once the fault is corrected.
- Remove bags stranded on the failed feeding line to the EDS machines and manually place them on the other operable EDS line.
- Carefully monitor the system to ensure that baggage system does not back up and cause cascading shutdowns of the system.

E.2.4.16 EDS Clear Line Failure (CL1, CL2, CL3) Prior to CL5

EDS cleared bag lines face the same considerations as EDS machines and security shunt lines failure. The monitoring software should recognize the fault and the other operable machines will be responsible for security screening. This is accomplished automatically and the respective line will be shut down by placing the diverter in divert all. The line will not be used while the condition is in effect, alternative shunt lines will be used instead and load balancing use of the crossover lines will be employed.

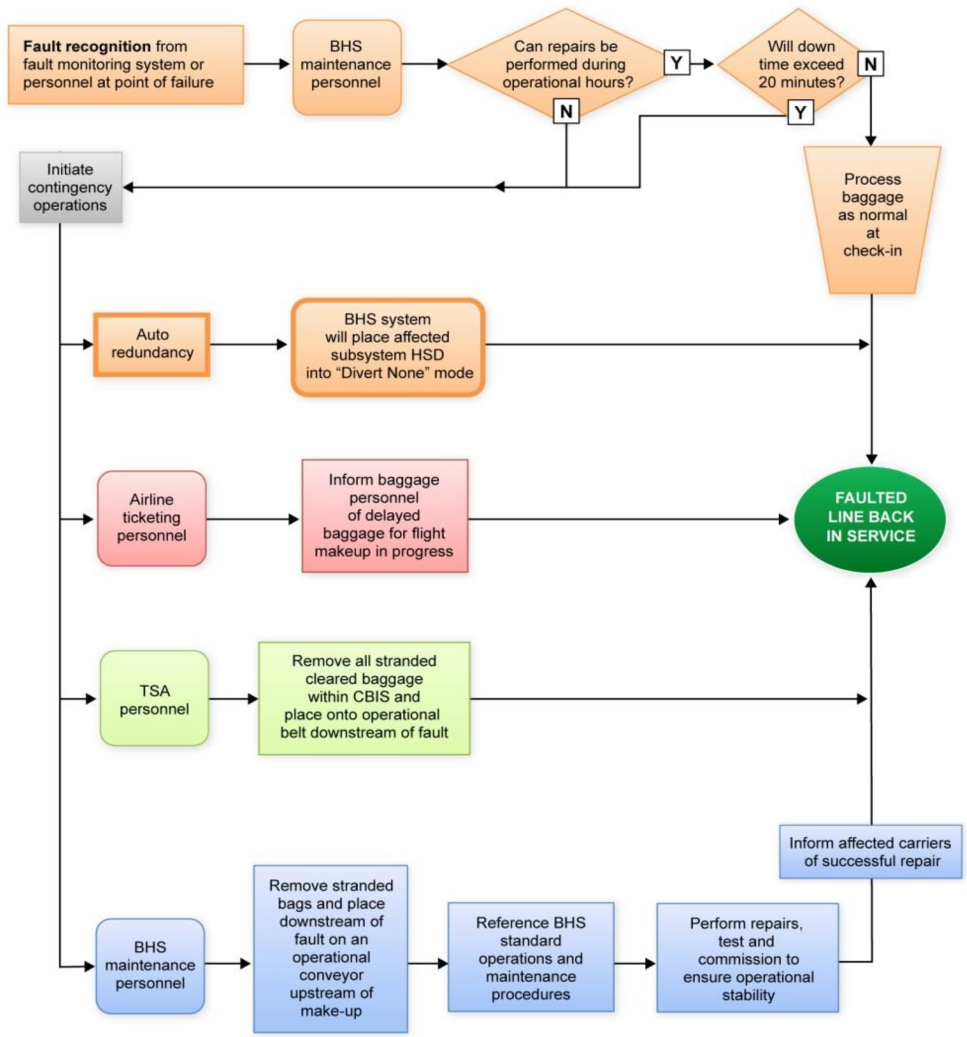
E.2.4.16.1 Procedure for Airline Baggage Handling Staff

- Manually remove any cleared bags on the faulted conveyors and place them on first downstream operational conveyor on Clear Line or sortation transport line.
- Request additional staff for transport of cleared bags on operational conveyor on alternate Clear Line or sortation line.

E.2.4.16.2 Procedures for BHS Maintenance Staff

- Follow BHS maintenance standard procedures.
- Ensure that HSD for the failed line is bypassed and placed back into use once the fault is corrected.
- Assist in moving cleared bags downstream of the fault on operational conveyor on alternate Clear Line or sortation line.
- Carefully monitor the system to ensure that baggage system does not back up and cause cascading shutdowns of the system.

CLEAR LINE FAILURE UPSTREAM OF MERGE



E.2.4.17 OSR Decision Line Failure (OSR1, OSR2, OSR3, OSR5)

Alarm Lines failure face the same considerations as EDS machines and security shunt lines failure. The monitoring software should recognize the fault and the other operable machines will be responsible for security screening. This is accomplished automatically and the respective line will be shut down by placing the diverter in divert all. The line will not be used while the condition is in effect and alternative shunt lines will be used instead and load balancing use of the crossover lines will be employed.

Only the OSR5 line downstream of the OSR line merges create a complete shut down in the event of a failure.

E.2.4.17.1 Procedure for Airline Baggage Handling Staff

- Add staff to the CBRA to assist in taking bags to the ETD station or an area secured for build-up of the bags.

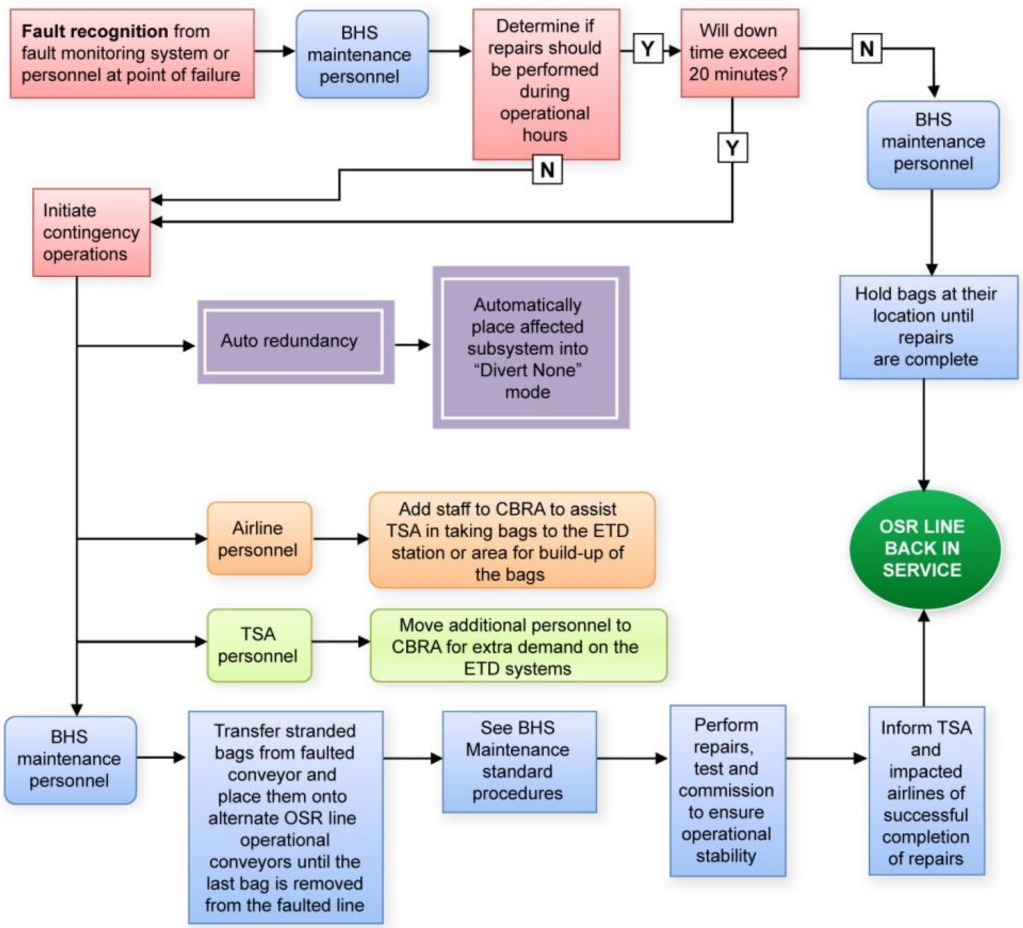
E.2.4.17.2 Procedure for TSA Staff

- Move additional personnel to the CBRA for the extra demand on the ETD systems.

E.2.4.17.3 Procedures for BHS Maintenance Staff

- Follow BHS maintenance standard procedures.
- Ensure that HSD for the failed line is bypassed and placed back into use once the fault is corrected.
- Remove bags stranded on the failed line and place them downstream on the most accessible conveyor that transports bags to CBRA or carry to CBRA until the last bag is removed from the faulted line.
- Carefully monitor the system to ensure that baggage system does not back up and cause cascading shutdowns of the system. Use load balancing techniques with the crossover lines if necessary.

OSR DECISION LINE FAILURE PRIOR OF MERGING ONTO OSR5



E.2.4.18 Main OSR Decision Line Failure (OSR5)

E.2.4.18.1 Procedure for Airline Baggage Handling Staff

- Move additional personnel to the CBIS/CBRA for unloading bags from the Alarm Line and taking them to the ETD stations.
- Assist O & M and TSA to reposition bags from the failed conveyor to the most accessible functional conveyor downstream of the failed conveyor. These bags would enter the CBRA with an UNK status.
- Place excess bags in an area secured for build-up of the bags.

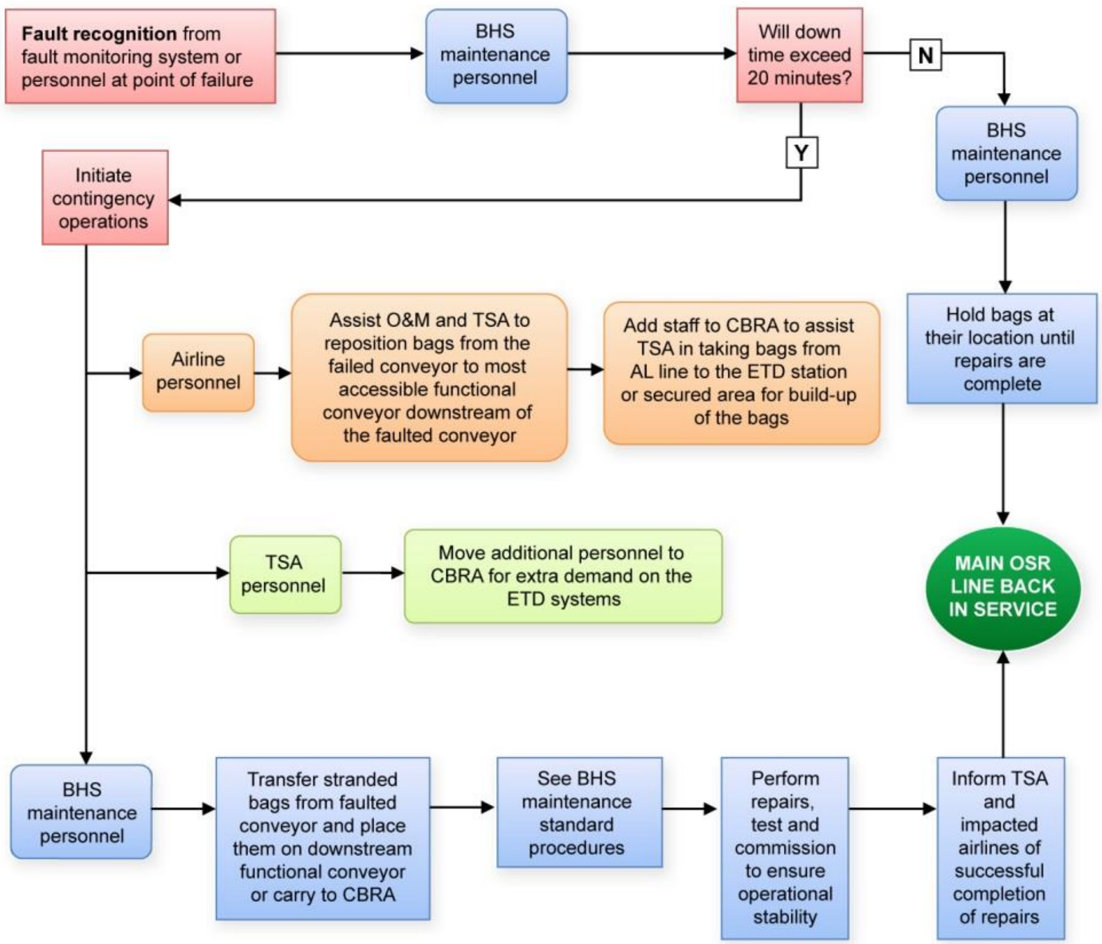
E.2.4.18.2 Procedure for TSA Staff

- Move additional personnel to the CBRA for the extra demand on the ETD systems.

E.2.4.18.3 Procedures for BHS Maintenance Staff

- All bags stranded on the inoperable line should be removed and placed in the CBRA.
- Place excess bags in an area secured for build-up of the bags.
- Follow BHS maintenance standard procedures.
- The faulted conveyor should be repaired quickly.

MAIN OSR DECISION LINE FAILURE (OSR5)



E.2.4.19 Second Decision Point Failure (OSR5-VS)

If the OSR5 vertical sorter fails then all baggage not cleared and with an associated image from an EDS machine will continue to the CBRA for resolution if the sorter can be locked in the alarm position. This is a temporary fix until BHS maintenance is prepared to fix the sorter that can be accomplished during the airport's non-operational hours. Bags cleared at Level 2 will be conveyed to the CBRA where they can be transferred to CL6 line. TSA will need to provide extra staffing in the CBRA until the sorter is fixed. If the sorter cannot be used, then BHS maintenance or baggage handling personnel will need to remove bags from the line prior to the sorter and place bags back on the Alarm Line after the sorter. Tracking will be lost and all related images will not be associated with the bags. A dedicated area will be used for the collection of bags awaiting resolution.

E.2.4.19.1 Procedure for Airline Baggage Handling Staff

- Move additional personnel to the CBRA to assist TSA personnel in unloading excess bags from the AL1 Alarm Line and taking them to an area secured for build-up of the bags.
- Help BHS maintenance staff remove stranded bags from the OSR5 line and place them back onto downstream functional AL1 conveyor.

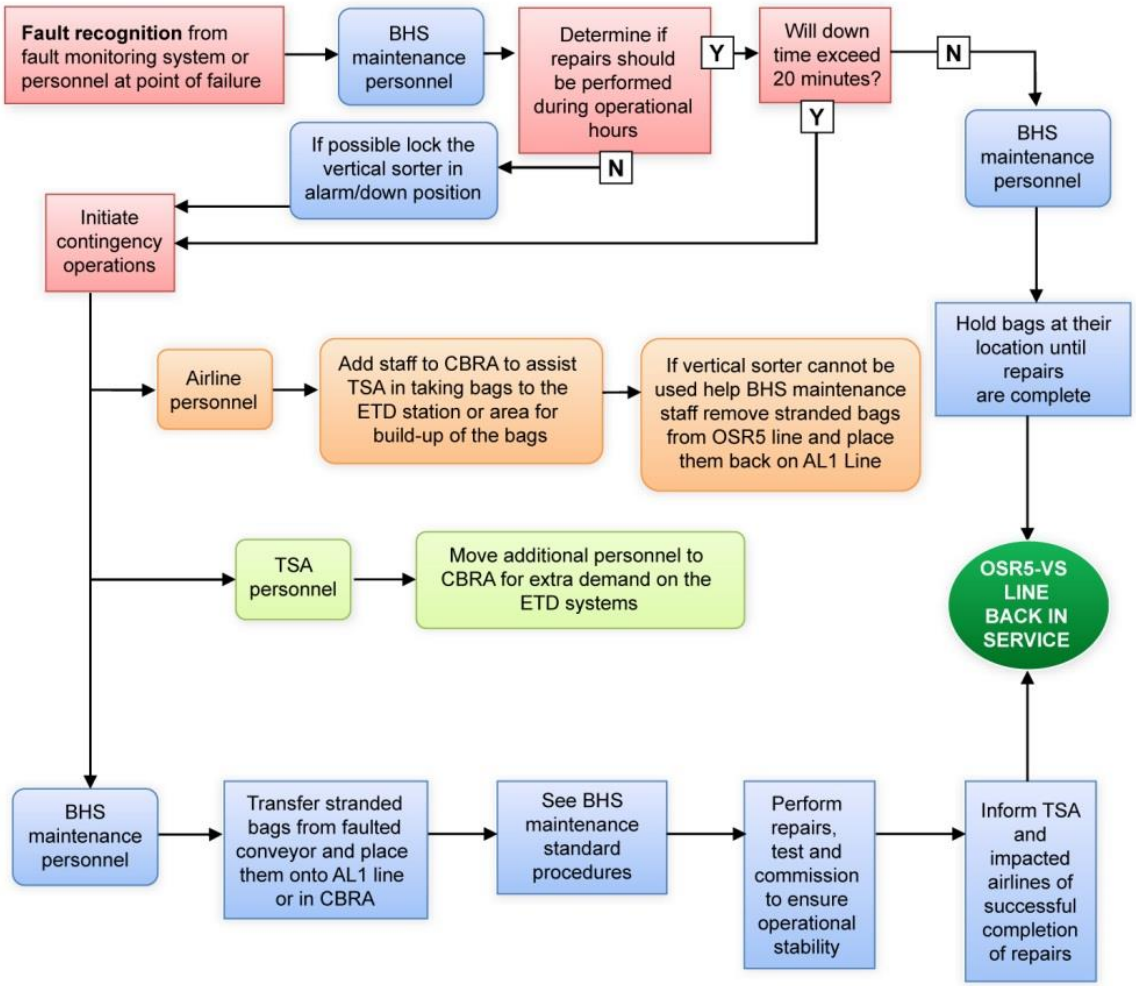
E.2.4.19.2 Procedure for TSA Staff

- Move additional personnel to the CBRA for the extra demand on the ETD systems.

E.2.4.19.3 Procedures for BHS Maintenance Staff

- If possible and desirable place the vertical sorter in manual mode and lock in the divert-to-alarm-line placement. Perform the repair at a more convenient time.
- If not, the failed vertical sorter should be placed out of service and quickly repaired. It will be placed back into service once the fault is corrected.
- All bags stranded on the inoperable line should be removed and placed in the CBRA or on the Alarm Line downstream of the failed vertical sorter.
- Follow BHS maintenance standard procedures.

SECOND DECISION POINT FAILURE OSR5-VS



E.2.4.20 CBRA Clear Line Failure (CL6)

The system is designed with one cleared bag line originating in the CBRA.

E.2.4.20.1 Procedure for Airline Baggage Handling Staff

- Move personnel and baggage tub carts to the CBRA to assist TSA staff in moving cleared bags to CL5 line after the level 2 vertical sorter unit (OSR5-VS).

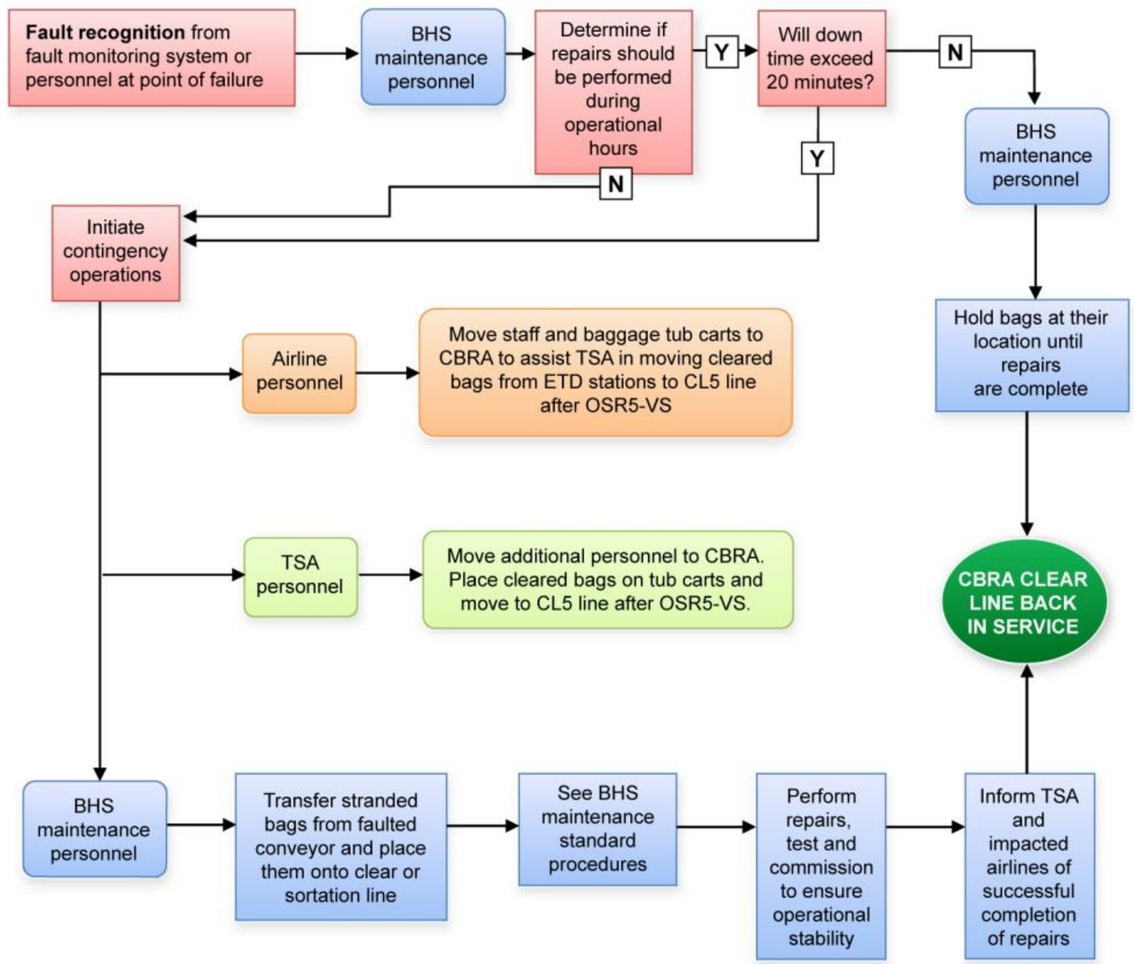
E.2.4.20.2 Procedure for TSA Staff

- Place cleared bags in the CBRA on tub carts and move them to an accessible location on CL5 line after the OSR5-VS.

E.2.4.20.3 Procedures for BHS Maintenance Staff

- Manually remove all stranded cleared bags from the line with the faulted conveyor and place them back on operational belts on clear or sortation line downstream of the fault or take them to CBRA.
- Follow BHS maintenance standard procedures.

CBRA CLEAR LINE FAILURE (CL6)



E.2.4.21 OSR Failure

If the ability to use the OSR services fails then all baggage will continue to the CBRA for resolution.

E.2.4.21.1 Procedure for TSA Staff

- Move additional personnel to the CBRA.
- Implement procedures for securing service from the EDS/OSR vendor.

E.2.4.22 Alarm Line Failure (AL1) Post OSR Decision

If an AL1 conveyor fails after the last decision point, bags will be manually removed and taken to the ETD stations for resolution. Tracking will be lost and related images will not be associated with the bags.

E.2.4.22.1 Procedure for TSA Staff

- Move additional personnel to the CBRA.

E.2.4.22.2 Procedures for BHS Maintenance Staff

- All bags stranded on the inoperable portion of the line should be removed and placed on an operable AL1 conveyor downstream of the failed conveyor or in the CBRA.

E.2.4.23 Reinsertion Line Failure (RI1)

If RI1 line fails bags will be removed from the last operational conveyor and placed back on the same line downstream of the fault or on either TC subsystem upstream of the BMA. Quickly correct the fault as this affects the operations in CBRA.

E.2.4.23.1 Procedure for Airline Baggage Handling Staff

- Move personnel and baggage tub carts to the CBRA to assist TSA staff in moving bags from RI faulted conveyor to the next downstream operational conveyor.

E.2.4.23.2 Procedure for TSA Staff

- Move additional personnel to the CBRA to move bags from the faulted RI conveyor to a working RI conveyor.

E.2.4.23.3 Procedures for BHS Maintenance Staff

- Asses fault and time necessary to correct and if more than 20 minutes needed initiate contingency operations.
- All bags stranded on the inoperable portion of the line should be removed and placed on an operable RI1 conveyor downstream of the failed conveyor or on either TC line before the BMA.
- Follow BHS maintenance standard procedures.
- Quickly correct point of failure.

E.2.4.24 Cleared Bag Line Failure (CL5) Post Second Decision Point Failure

If a conveyor fails on the CL5 cleared bag line after the OSR decision point then the bags will need to be manually removed from the line and placed back on it downstream of the failed conveyor. If the line is inoperable for an extended period of time then the Alarm Line AL1 may be used instead and all OSR cleared bags (if faulted conveyor is upstream of the CL5 conveyor that is the take away for CL1 and CL2) will travel to the CBRA where they will be noted as cleared and placed on the CL6 line that merges onto sortation line (SL1).

If the take away conveyor on the CL5 line for CL1 and CL2 lines fails then crossover diverter will be placed in "Divert All", stranded bags cleared at level 1 on EDS Clear Line (CL1 and CL2) will be removed and placed on operational downstream Clear Line or sortation line and SS1-VS, SS2-VS and OSR5-VS will be placed in sort-to-Alarm Line (down position) to travel all bags remained in these subsystems regardless of status to CBRA where the clear bags will be noted as cleared and placed on the CL6 line (that merges onto sortation line SL1).

If the take away conveyor on CL5 line for CL3 conveyor fails then the only alternative for all cleared bags to exit the system is via CL6 thus all bags will be directed (all VSU's will be placed in sort-to-Alarm Line, down position) to CBRA where clear bags will be noted as cleared and placed on the CL6 line (that merges onto sortation line SL1).

E.2.4.24.1 Procedure for Airline Baggage Handling Staff

- Move additional personnel to the affected conveyors to assist BHS maintenance personnel in unloading bags from the CL5 line upstream to the fault and placing them back on the line downstream of the fault.
- If bags remain on the Alarm Line and enter the CBRA then baggage handling personnel will need to assist TSA personnel in loading clear bags onto the CL6 line.

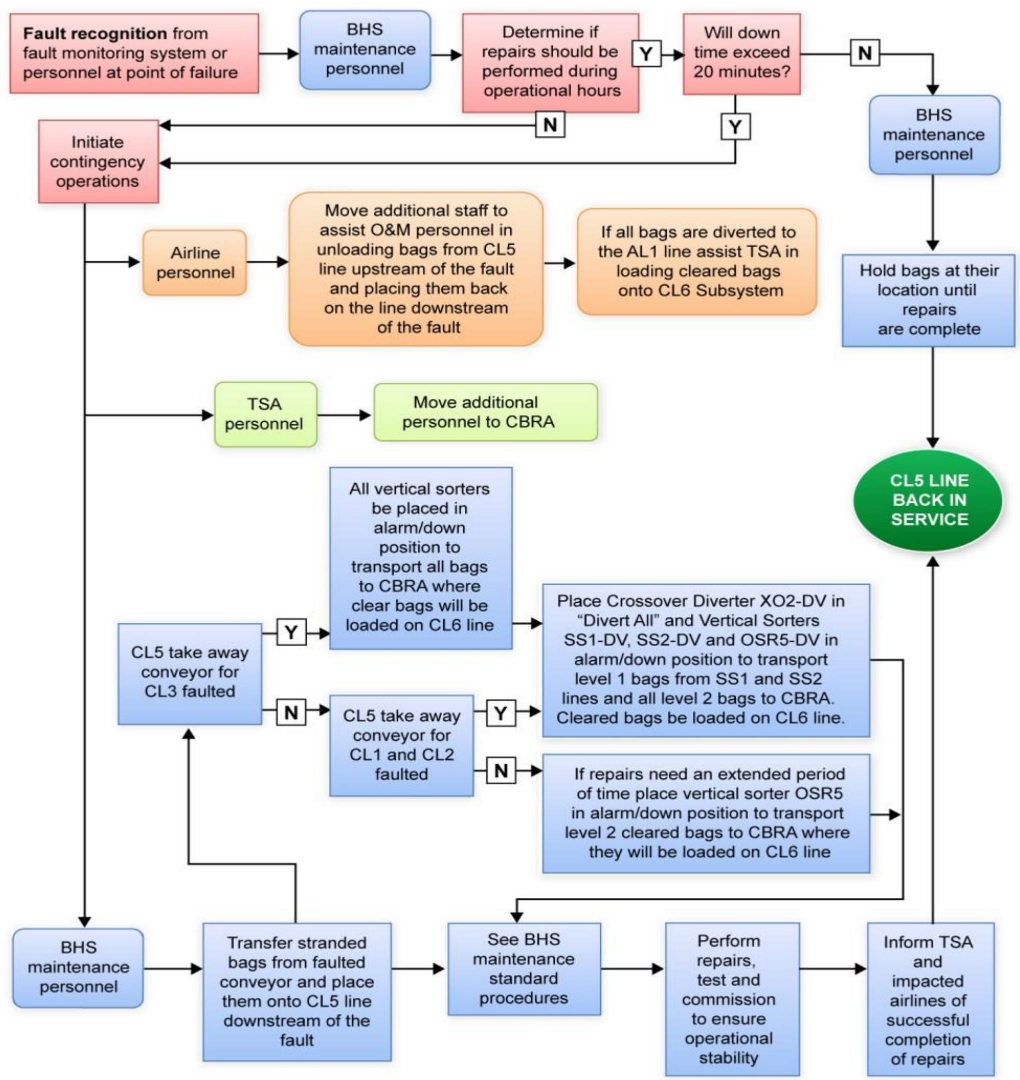
E.2.4.24.2 Procedure for TSA Staff

- Move additional personnel to the CBRA.

E.2.4.24.3 Procedures for BHS Maintenance Staff

- All bags stranded on the inoperable portion of the line should be removed and placed on an operable CL5 conveyor downstream of the failed conveyor.
- If line is inoperable for an extended period of time then place OSR vertical sorters in a locked position with all bags staying on the AL1 Alarm Line.

CLEAR LINE POST SECOND DECISION POINT FAILURE CL5



E.2.4.25 Sortation Line Failure (SL1)

The Main Terminal sort area does not include redundant transport lines. This reduces some of the contingency possibilities when line and component failures occur. However sortation line starting and continuing very close to where the make up units are located bags can be unloaded from the faulted conveyor and either manually sorted and loaded into tugs if the faulted conveyor is before the make up feed line 1 diverter (MF1-DV) or placed back on the line, downstream of the fault, feeding the default make up 2.

E.2.4.25.1 Procedure for Airline Baggage Handling Staff

- Move personnel and baggage tub carts to the affected conveyors to assist BHS maintenance personnel in unloading bags from the SL1 line upstream to the fault and either placing them back on the line downstream of the fault or carrying them directly to tugs.

E.2.4.25.2 Procedure for TSA Staff

- Move additional personnel to the CBRA especially during peak hours due to possible high number of die backs on the BHS system.

E.2.4.25.3 Procedures for BHS Maintenance Staff

- Asses fault and time necessary to correct.
- Manually remove all cleared bags from the line with the faulted conveyor and place them back on operational belts downstream of the fault and in case that the last conveyor on the line is faulted bags will be placed directly on the make up unit.
- Follow BHS maintenance standard procedures.
- Quickly correct point of failure.

E.2.4.26 ATR Failure

This is a potential disruption of some significance due to lack of mainline redundancy. The MU2 will be considered the primary default for this contingency. This make up does not use a diverter, thus avoids potential missed diverts, subsequently all bags reach this point.

E.2.4.26.1 Procedure for Airline Baggage Handling Staff

- Move personnel and baggage tub carts to designated default MU2.

E.2.4.26.2 Procedures for BHS Maintenance Staff

- Ensure the diverter for MU1 is placed in “Pass All” mode.
- Monitor capacity level at the MU in use.

- Ensure conveyor traffic flows without jams and other fault conditions.

E.2.4.27 MU Failure (MU1 or MU2)

The Terminal sort area does not include redundant transport lines for each make up. In case that one MU device failed the other one will be used. This will demand coordination between the affected carriers.

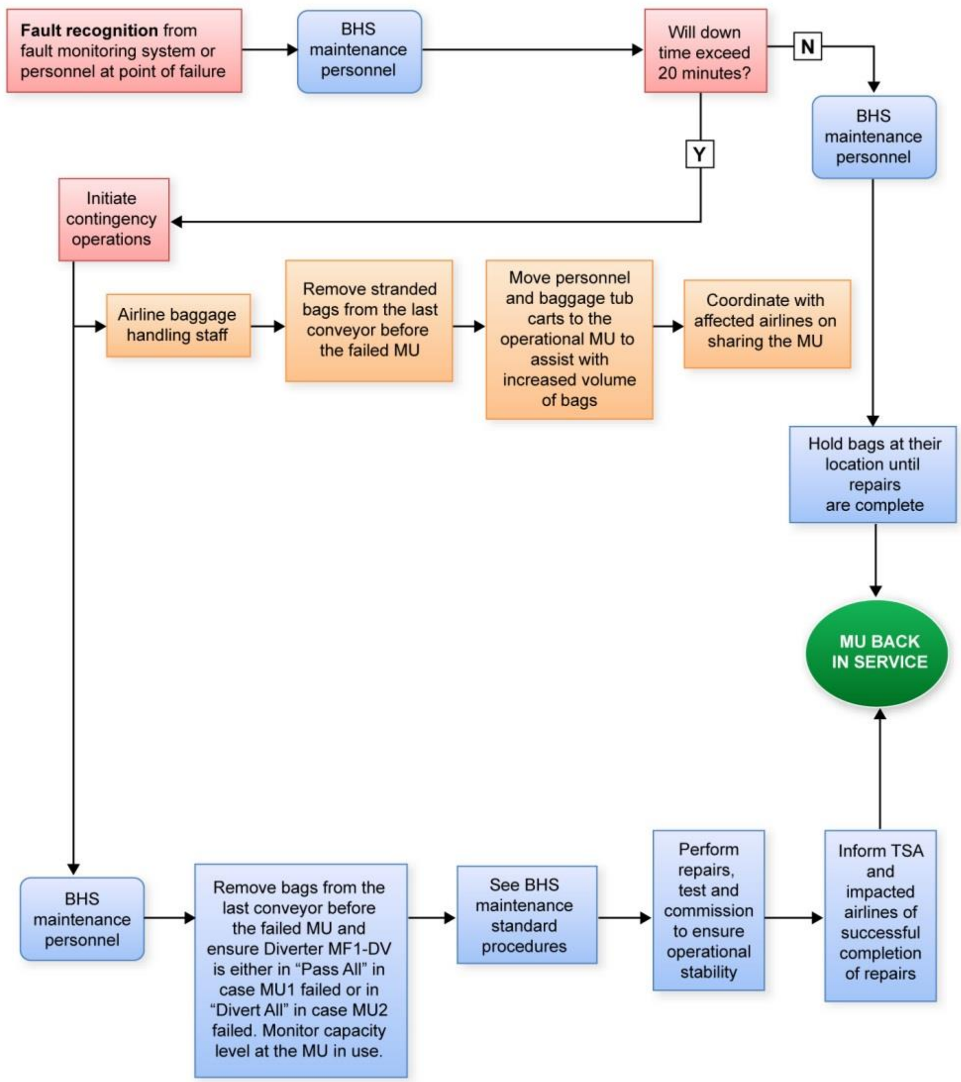
E.2.4.27.1 Procedure for Airline Baggage Handling Staff

- Move personnel and baggage tub carts to the MU in use to assist with the increased volume of bags.

E.2.4.27.2 Procedures for BHS Maintenance Staff

- Follow BHS maintenance standard procedures.
- Monitor capacity level at the MU in use.

MAKE UP FAILURE



E.2.4.28 CBRA Equipment Failure

E.2.4.28.1 Procedure for TSA Staff

- Move additional personnel to the CBRA.
- Alarmed bags entering the CBRA will need to be manually searched without direction if all HMI fails. If trace detection fails then all bags will need to be manually searched.
- Contact appropriate sources/vendors for repairing failed devices.

E.2.4.29 Treatment of Positively Identified Threat Bags by TSA Staff

When TSA staff cannot clear an alarmed bag following Standard Operating Procedures (SOPs) they shall contact the Airport Manager on Duty (MOD) as well as the Airports Designated Law Enforcement Officer (LEO) for resolution of the Identified Threat. Bags identified in the CBRA as a threat would require an immediate evacuation by staff. The Designated Law Enforcement Officer (LEO) then assumes full responsibility of the threat bag and his/her standard operating procedure shall be followed.

An accessible route has been provided to allow for any EOD robot access in and out of the CBRA area where the threat bag will be located.

E.2.4.30 Power Loss

In the event of a system power loss, an Uninterruptible Power Supply (UPS) will allow the PLCs to retain all tracking data for a minimum of two (2) hours.

The UPSs provided for the EDS devices will allow for a controlled shut down of the x-ray gantry and screening computers.

In the event that any power failure results in an extended duration of the non-operable BHS system TSA and MYR will proceed in fall back operations.

APPENDIX F:

RISK BASED SECURITY IMPACTS FOR THE ELECTRONIC BAGGAGE SCREENING PROGRAM

As of the date of this version of the PGDS, EBSP does not anticipate any impacts from RBS on CBIS designs or on the specifications contained in the PGDS that are not already taken into account in this version of the PGDS. The key requirements for RBS according to EBSP's current plans are having ATRs upstream of the EDS units, as detailed in Section 7.2.5.1.1, and having all infrastructure in place to support STIP for all screening equipment, as detailed in Section 7.2.12.