

1. Condition monitoring for airport baggage handling in the era of industry 4.0

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Abstract: Purpose: The purpose of this paper is to present the findings of a recent study conducted with the objective of addressing the problem of failure of baggage carts in the high-speed baggage tunnel at Heathrow Terminal 5 by the development of an innovative condition-based maintenance system designed to meet the requirements of twenty-first century airport systems and Industry 4.0. Design/methodology/approach: An empirical experimental approach to this action research was taken to install a vibration condition monitoring pilot test in the north tunnel at Terminal 5. Vibration data were collected over a 6-month period and analysed to find the threshold of good quality tires and those with worn bearings that needed replacement. The results were compared with existing measures to demonstrate that vibration monitoring could be used as a predictive model for condition-based maintenance. Findings: The findings demonstrated a clear trend of increasing vibration velocity with age and use of the baggage cart wheels caused by wheel mass unbalanced inertia that was transmitted to the tracks as vibration. As a result, preventative maintenance is essential to ensure the smooth running of airport baggage. This research demonstrates that a healthy wheel produces vibration of under 60 mm/s whereas a damaged wheel measures up to 100 mm/s peak-to-peak velocity and this can be used in real-time condition monitoring to prevent baggage cart failure. It can also run as an autonomous system linked to AI and Industry 4.0 airport logic. Originality/value: Whilst vibration monitoring has been used to measure movement in static structures such as bridges and used in rotating machinery such as railway wheels (Tondon and Choudhury, 1999) this is unique as it is the first time it has been applied on a stationary structure (tracks) carrying high-speed rotating machinery (baggage cart wheels). This technique has been patented and proven in the pilot study and is in the process of being rolled out to all Heathrow terminal connection tunnels. It has implications for all other airports world-wide and, with new economic sensors, to other applications that rely on moving conveyor belts. © 2019, Emerald Publishing Limited. (45 refs)

Main heading: Condition monitoring

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