Preventive maintenance and failure analysis of safety-critical assets in railway rolling stock

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Abstract—**Railway industry is confronted with problems due to premature failure of the railway assets that require costly maintenance and technical servicing. The railway assets are mainly categorized into two classes: the rolling stock which includes assets moving on railroad tracks and the infrastructure which consists of fixed railway assets. In recent years, a great deal of attention has been paid to analysing failure behaviour of the railway infrastructure assets. However, there have been few attempts made by researchers on failure analysis and modelling of the rolling stock assets. A rolling stock is a multi-component system consisting of the wheels, bogies, doors, power unit, pantograph, coupler, etc. Failure of these components may be very costly in terms of monetary loss and/or passenger inconvenience. It may also cause delays to train services or result in catastrophic derailment accidents. For these reasons, it is crucial to prevent and reduce the risks associated with failure of various rolling stock components. Rolling stock maintenance plays an important role in delivering safe, reliable and competitive transport services. It is reported in many studies that the maintenance costs constitute a major part of the life-cycle cost (LCC) for rolling stock. An appropriate maintenance strategy not only reduces the total LCC, but also will ensure high standards of safety and comfort for railway workers and passengers. For this purpose, a wide range of preventive maintenance (PM) approaches including routine inspections, reliability-centred maintenance (RCM), risk-based maintenance (RBM), condition-based monitoring (CBM), and computerized maintenance management system (CMMS) are applied. In this study, the safety-critical rolling stock components are identified and their corresponding failure mechanisms, root causes, and potential impacts on railroad operation are investigated based on failure data gathered from a train operating company. Finally, suitable PM solutions are recommended and provided to best utilise the railway rolling stock assets.**

Keywords—Preventive maintenance; Reliability; Railway; Rolling stock, Failure analysis.