Correlations between wear mechanisms and rail grinding operations in a commercial railway

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Rail grinding is a typical maintenance procedure for railways in which an abrasive wheel causes controlled wear in the rail's surface to restore the profile and to eliminate defects such as corrugation and fatigue cracks. In this work, the grinding procedures performed in the rails of twenty two (22) curves of a commercial railway during the last 9 years were studied and classified and the most representative causes of damage were identified. Generally speaking, corrugation was located preferentially on the low rail while fatigue was observed preferentially in the high rail. Corrugation, fatigue and loss of profile were the more representative defects observed in field inspections, being fatigue responsible for 42% of the grinding operations. Also, it was found that most of the rail grinding procedures (58%) was performed in the high rail. As 24% of the studied curves were ground every less than 200 days it can be concluded that the grinding intervals are shorter than those typically found in the literature for similar systems [1, 2].

1. Introduction

Today rail grinding has become a standard maintenance activity in railways [1]. During rail grinding, an abrasive wheel causes controlled wear in the rail's surface to restore the profile and to eliminate defects such as corrugation and fatigue cracks. Since rail surface fatigue and corrugation have become widespread phenomena in railways it is important to study the grinding procedures and their correlations with the wear mechanisms found in the field.

2. Experimental

The grinding procedures performed in the rails of twenty two (22) curves of a commercial line during the last 9 years were studied and classified to understand the most important causes of damage. The defects were classified into corrugation, fatigue and loss of profile, among others, and field inspections were done to identify the main wear mechanisms in the field. The grinding intervals were classified for different curves and related to the main cause of damage and the location of the defects in the line (high rail or low rail).

3. Results

Figure 1 shows the summary of the results of the grinding operations for the high and low rail (figure 1a) and as a function of the main cause of damage (figure 1b). Clearly, grinding the high rail is the most frequent operation in the field and the maintenance procedures are performed mostly because fatigue marks appear on the rail's surface.

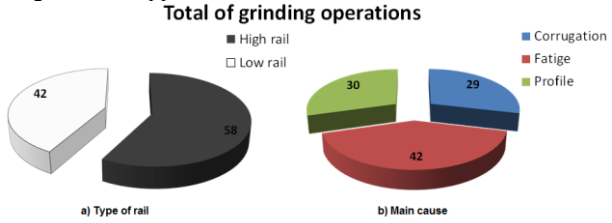
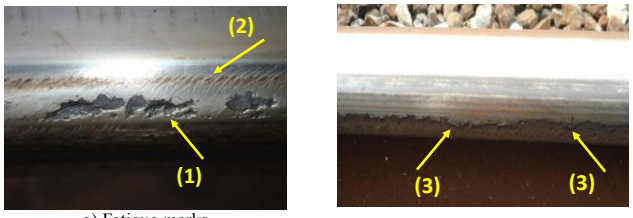


Figure 1. Details of grinding operations performed in the field during the last 9 years

Figure 2 shows typical examples of the most important defects found in the field inspections. Figure 2a shows marks of fatigue detachment (arrow 1) and fatigue cracks known in the literature as head checks (arrow 2) [2, 3]. Figure 2b shows plastic deformation (3) in the rail, which is responsible for loss of profile.



a) Fatigue marks
(1) Fatigue detachment (2) Head-checks

b) Plastic deformation

Figure 2. Defects found in the field inspections

Figure 3 shows the classification of the main causes of rail grinding procedures for several curves with high wear rates. Corrugation appeared preferentially on the low rail while fatigue was dominant in the high rail. The number of grinding procedures is higher for the curves showing corrugation.

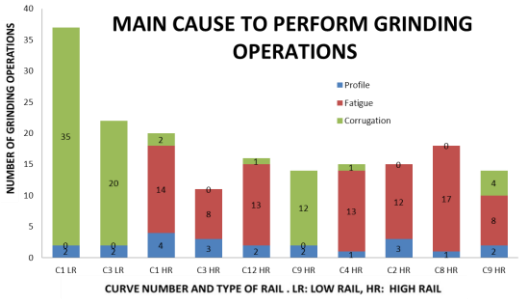


Figure 3. Main cause of rail grinding procedures for several curves with high wear rates.

4. References

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