A FUNDAMENTAL STUDY ON DERAILMENT OF WHEEL FLANGE UNDER ROLLING-SLIDING AND PURE SLIDING CONDITIONS

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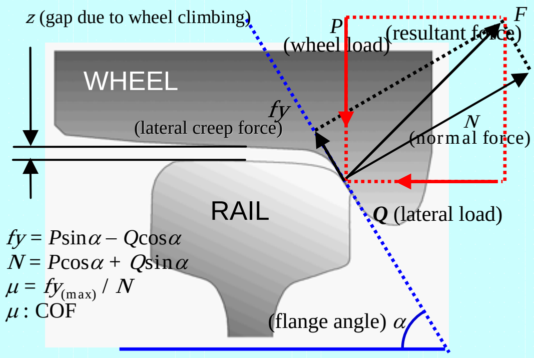
INTRODUCTION

In railway transport system, when a train passes through a sharp curve of railway track at low speeds, wheel flange comes in contact with the gauge corner of the rail, and sometimes wheel climb derailment occurs. Any decisive solution for this problem has not been obtained because of its so complex nature as accompanied by multiple factors. In particular, the coefficient of friction and the phenomena of rolling-sliding contacts between wheel flange and rail at different environmental and lubricating conditions are not clearly discovered.

A newly developed actual scale wheel-rail contact testing machine is used to obtain detailed data on flange climb behavior with covering various loads and displacements at the wheel flange and rail contact under both rolling-sliding and pure sliding conditions. A correlation between different state of the interface (i.e. surface of dry, wet, rust, grease and lubricated condition by solid lubricant, SL) and wheel flange surface roughness (pitch 2mm/rev, Ra: 35.83μm and pitch 1mm/rev, Ra:11.4μm) with rail were drawn.

CONCLUSIONS

- ***The coefficient of friction was greatly influenced by the degree of the asperities on the wheel flange surface at the similar environmental (dry/wet/lubricated etc.) conditions under pure sliding contacts.***
- ***Solid lubricant reduced the coefficient of friction greatly; however, the rust on the rail surfaces was one of the important factors to destabilize the friction behavior.***



$fy = P\sin\alpha - Q\cos\alpha$

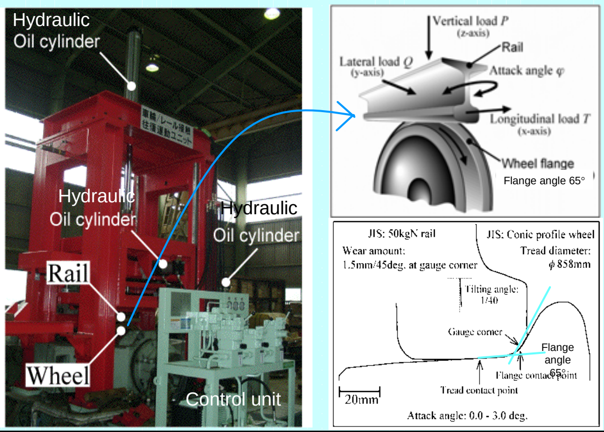
$N = P\cos\alpha + Q\sin\alpha$

$\mu = fy_{(max)} / N$

μ: COF

Figure 1. Interacting forces between wheel flange and rail gauge corner.

ACTUAL SCALE TESTING MACHINE



EXPERIMENTAL OUTPUT

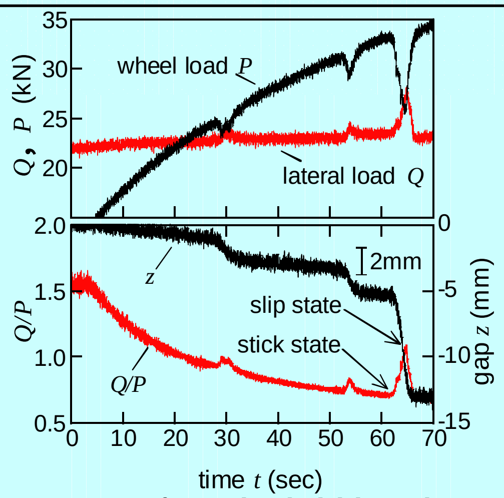


Figure 2. Estimation of *Q/P* under wheel sliding at dry contact.

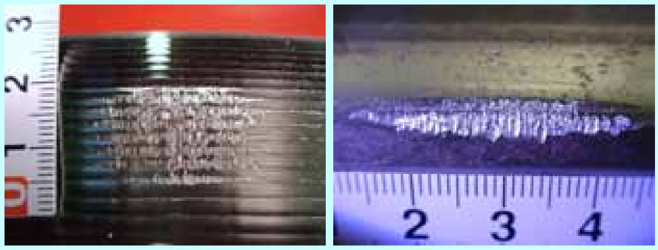


Figure 3. Worn surface of wheel and rail after wheel sliding.

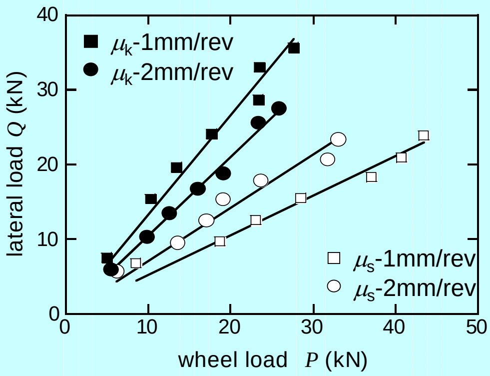


Figure 4. Coefficient of friction and surface conditions.

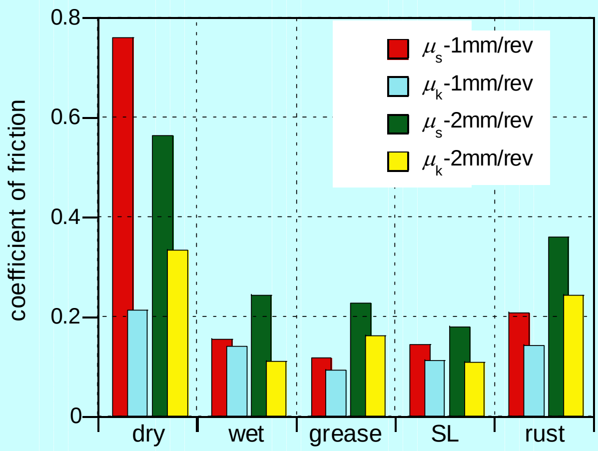


Figure 5. A correlation between coefficient of friction and different state of interface for wheel flange surface roughness with rail.

RESULTS

In rolling-sliding conditions, change of surface roughness did not significantly influence the Coefficient of Friction (COF) at its wheel flange and rail gauge corner under dry contact. However, in pure sliding conditions, the COF was influenced by the degree of the asperities on the wheel flange surface. This occurs because the power demanded for the damage due to the surface roughness asperities in rolling-sliding conditions is smaller than that of its pure sliding conditions and tangential force which acts on the flange in rolling-sliding conditions dose not act on it in pure sliding conditions. Therefore, **pure sliding contact experimental results in which the COF was influenced by the degree of the asperities on the wheel flange surface are only considered here.**

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