Rail Research UK

The universities' centre for railway systems research

Integration of Cross Wind Forces into Train Dynamics

A Bouferrouk and C J Baker (University of Birmingham); J Perez and S Iwnicki (MMU)

Background

Unsteady aerodynamic forces/moments on high-speed trains due to Cross Winds (CW) may cause vehicles to overturn, or cause excessive pantograph/contact wire displacements.

Objectives

- Develop analytical/numerical models of unsteady CW loading
- Assess effects of CW forces/moments on overturning (Flange Climb and Roll Over), and pantograph sway
- Investigate the effects for a variety of CW speeds, train speeds, tracks conditions, etc.

Results: Overturning & Pan sway

- A method to compute forces/moments on train in CW is developed, based on aerodynamic admittance functions
- Models for pantograph/contact wire displacements due to CWs are developed
- **VAMPIRE** train dynamics model, using unsteady aerodynamic loads, is developed to assess overturning for different train/CW winds, and track conditions

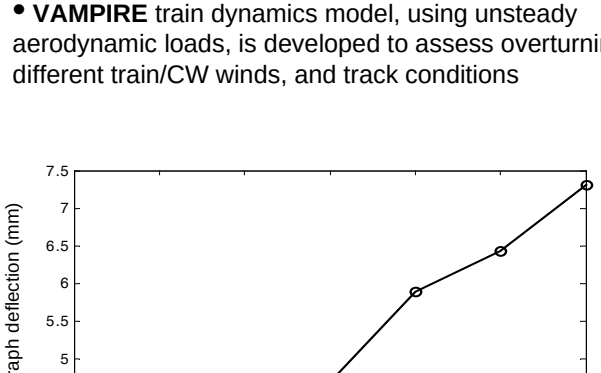

Fig.1: Max pantograph displacements as a function of mean CW speed

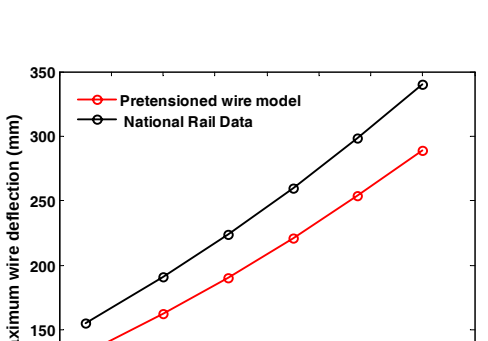

Fig.2: Maximum contact wire displacement due to CW

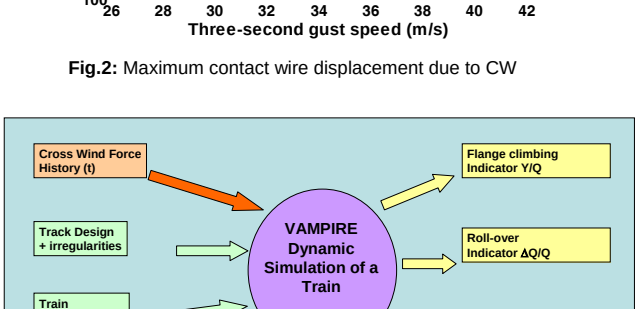

Fig.3: Integration of aerodynamic forces into VAMPIRE simulation

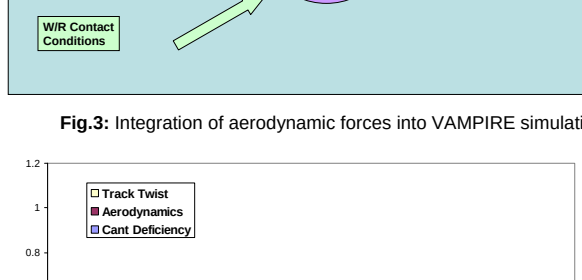

Fig. 4: Relative weight of aerodynamic CW loading in flange climb

Future Work

Review the effects of transient forces caused by passing trains, and from tunnel pressure pulses, and incorporate them in a VAMPIRE dynamics model.

Contact:

Abdessalem Bouferrouk: A.Bouferrouk@bham.ac.uk; Chris Baker: C.J.Baker@bham.ac.uk ; Simon Iwnicki S.D.Iwnicki@mmu.ac.uk