The Stephen Marich lecture:
'Don’t save yourself into trouble'

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Increased operational demands were being placed on railways – axle loads, train speeds, train lengths, the window of opportunity for maintenance on rolling stock and track – and these demands were being seen on a daily basis. These demands usually came together with financial constraints, Dr Robert Fröhling, principal engineer in the technology management department of South Africa’s Transnet Freight Rail, told an audience of railway professionals at the annual Stephen Marich lecture in Melbourne in March.

He said the approach was usually "do this and that but don’t let it cost too much." But what is saying is don’t save yourself into trouble," he said. In his presentation, "Vehicle Track System Dynamics and Long-term Behaviour", he said one needed to be "knowledgeable about the cause and effects in your system so that you spend on the right things to achieve the best result.

“What we have to realise in trying to optimise the system of operating demands and financial constraints and deliver to our shareholders is that the maintenance we have to do to the track is load-dependent," Dr Fröhling said.

“So as the loads increase, we can expect to do more track maintenance. This problem is that this is not usually a linear relationship, rather an exponential relationship, for most of the time. We must be aware of this for we compare a system that has linear degradation to one that has exponential degradation we can see the difference. We have to find a cost-effective balance between operational demands and maintainence. To be able to do this in an effective way we need to understand the short-term and the long-term behaviour of our track. The short-term is defined by catastrophic failures; long-term is fatigue related and the deterioration of the track. We have to understand these two concepts to be able to analyse the interaction between the wheel and the track," Dr Fröhling said.

His overriding message was 'work smarter within economic constraints'.

Dr Fröhling said it was necessary to understand the relationship between the wheel and the track and interaction between the two.

Turning to the importance of design parameters of rolling stock, he said the rail vehicle must not be forgotten as it would ultimately show what was happening between the wheel and the rail.

"On the bogie side, which is our important shock absorber suspension element, we need to look at the structure of the bogie. Can the bogie’s structure itself survive all the forces? Is the suspension tuned for the track structure it will go over? Is it able to last long enough or will it have a fatigue failure? What is the material used for the coil spring of the suspension system well designed? Are we overloading our suspension?"

Turning to wheel profiles, he stressed the importance of a correct profile and pointed out that the difference between a good wheel profile and a bad profile was between 0.1mm and 0.2mm.

He said the other key element of rolling stock was the wheel. Dr Fröhling listed the key requirements of materials used in wheels as:

- resistance to wear (hardness);
- resistance to plastic deformation (yield strength);
- resistance to rolling contacts fatigue (shear strength); and
- toughness against crack growth.

He then talked about the wheel-rail interface and the factors contributing to lateral forces, which he said were:

- flange and lateral creep forces;
- curve radius;
- couple angle;
- rail lubrication;
- speed;
- built-up or draft forces;
- misaligned bogies;
- rail friction wedges and side frame pocket;
- wheel diameter mismatch;
- bogie’s turn resistance;
- track misalignment; and
- traction/braking.

On vertical forces, Dr Fröhling listed:

- 12 factors contributing to these, some of which are the same as those impacting on lateral forces:
  - vehicles weight;
  - curve super-elevation;
  - speed;
  - track misalignment;
  - torsional stiffness of vehicles body;
  - squat or skid load;
  - worn friction wedges;
  - broken or missing springs;
  - suspension stiffness and damping;
  - rigid frame bogies;
  - small/large side burner clearance; and
  - canting and lateral creep forces.
Rail's key role in national development

RAILWAYS TECHNOLOGY: A WAY AHEAD

The importance of railways in national development was highlighted at a recent conference in Australia. Professor Elizabeth Cook, the Head of the School of Civil and Environmental Engineering at the University of Melbourne, gave a keynote address on the future of railway engineering. She discussed the need for sustainable and efficient railway systems to meet the growing demand for transportation.

The conference also featured presentations on various aspects of railway engineering, including track maintenance, signalling and control systems, and safety. Attendees included rail operators, engineers, and researchers from around the world.

Rail experts share knowledge around the world

Professor Cook said that the importance of railway engineering could not be overstated. "In a world that is becoming increasingly urbanized, railways offer a sustainable and efficient means of transport," she said.

Dr. Robert French, a leading expert in railway engineering, highlighted the economic benefits of investing in railway infrastructure. He noted that a well-maintained railway network could help reduce congestion and improve connectivity between cities.

The conference also featured a panel discussion on the future of railway engineering, with experts from around the world sharing their insights and predictions for the industry.

In conclusion, the conference provided a valuable opportunity for rail experts to share knowledge and ideas, and to discuss the challenges and opportunities facing the railway industry.

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Dr. Robert French presents a comprehensive analysis on rail innovation at the conference. He discussed the importance of investing in research and development to improve railway safety and efficiency. French emphasized the need for ongoing investment in infrastructure to meet the growing demand for transport.