

Low Impact Bogies



RWI 2016

- Matched & maintained rail and wheel profiles
- Smarter rail maintenance strategies
- Gauge Face Lubrication
- Top of Rail Friction Management



Can Improved Bogies be More Effective at Preventing Rail Wear Than Gauge Face Lubrication & Top of Rail Friction Management?



HEAVY HAUL SEMINAR • JUNE 7-8, 2017

***pacific*national**

WRI 2017

Presentation Outline

- Outline of two bodies of work conducted by two organisations half a world apart
 - One seeking to prevent high impact wheels (HIW)
 - The other seeking to prevent wheel squeal
- Pacific National (PN) experience with bogies having characteristics found desirable by the two bodies of work



Harry Tournay - TTCl

- Has sought to develop an Improved Freight Car Truck (IFCT) design:
 - to eliminate high impact wheels & loaded car hunting
 - & in the process established low rail T/N of >0.3 = likely RCF damage
- In summary, Harry has identified IFCT bogies with auxiliary warp stiffening and adapter steering pads:
 - Control T/N <0.3 in curves $>230\text{m}$ radius
 - Contain asymmetric wheel flange wear
 - Meet dynamic curving, pitch and bounce and roll performance requirements
 - Provide improved loaded car hunting stability



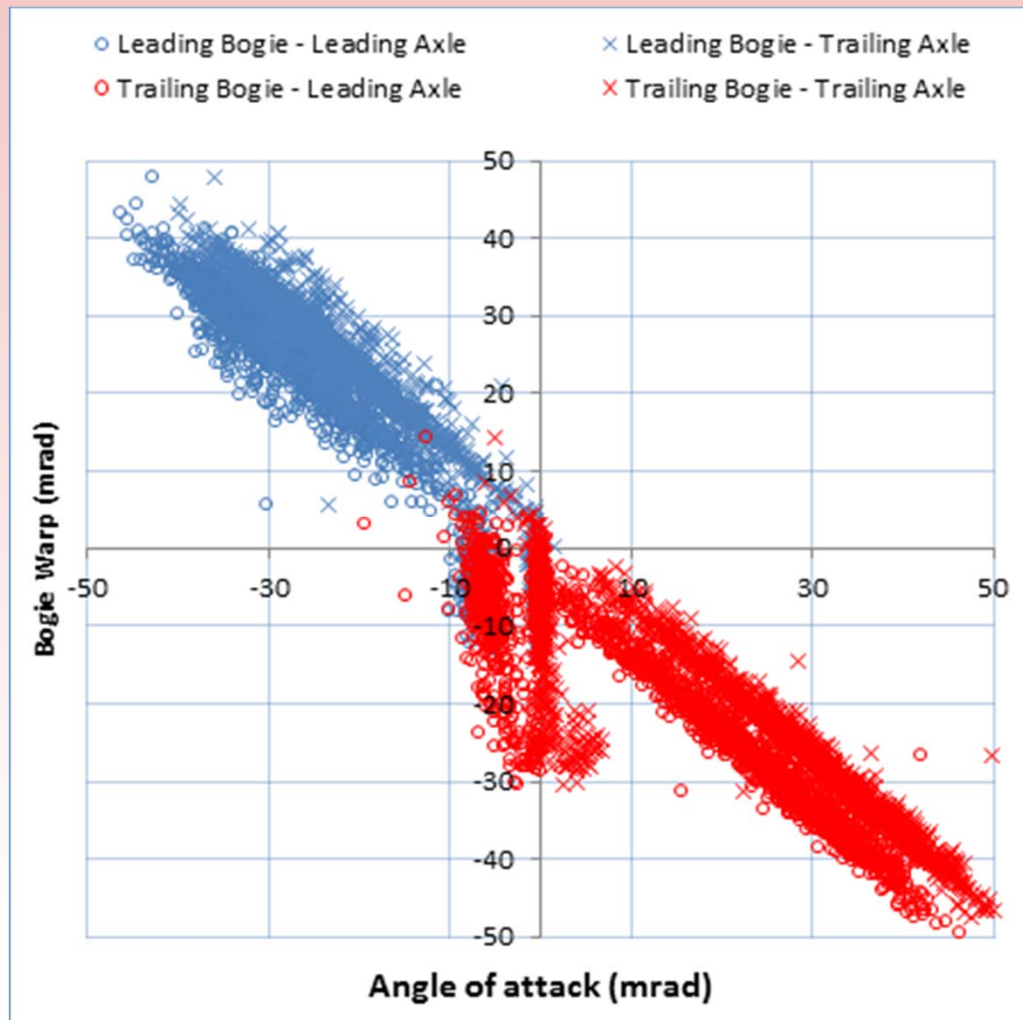
David Hanson – TfNSW

CORE 2016 Paper – Freight Wagon Steering – Insights from Condition Monitoring Measurements

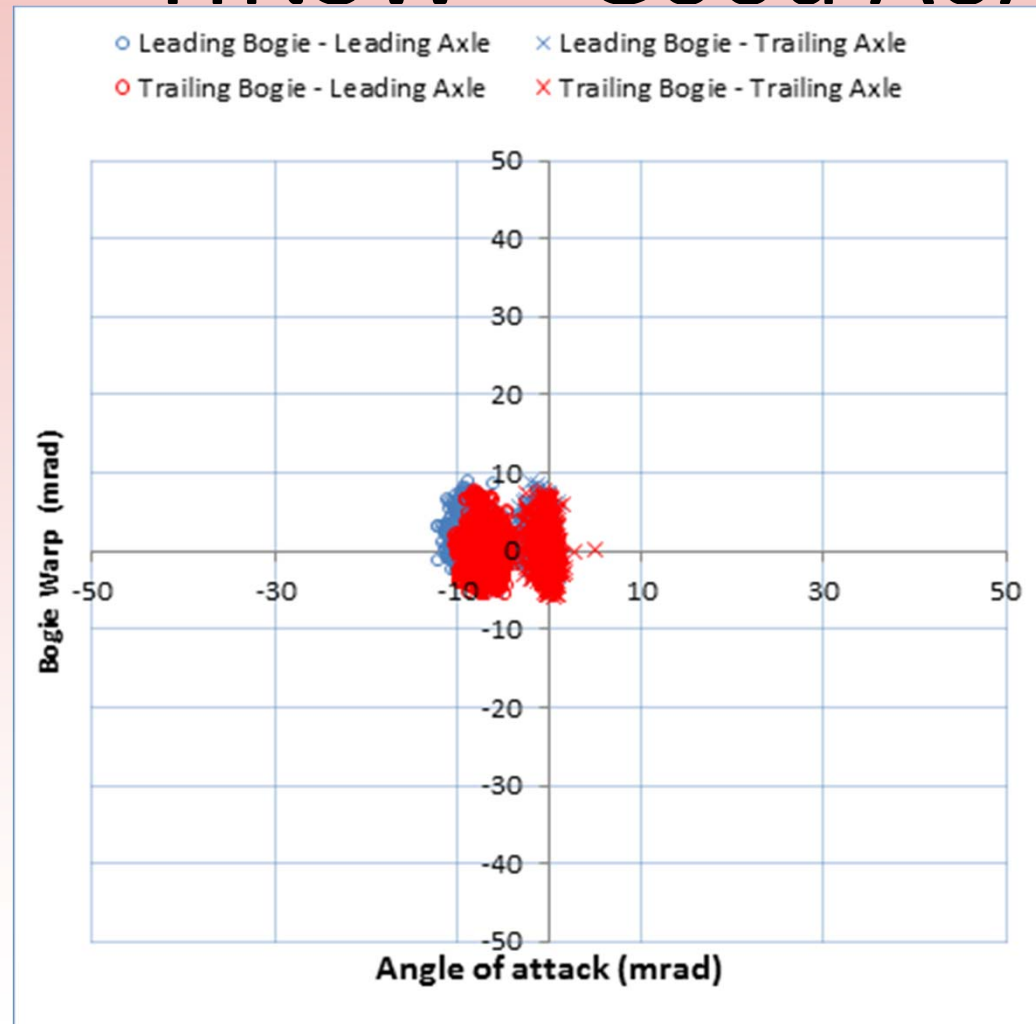
- Investigated causes of wheel squeal in suburban areas
- Established wheel squeal relationship to angle of attack (AoA)
- Identified that bogies with effective warp restraint produced low angle of attack
- Developed algorithms for calculating bogie warp
- Identified that all other factors are secondary to bogie warp stiffness in preventing wheel squeal



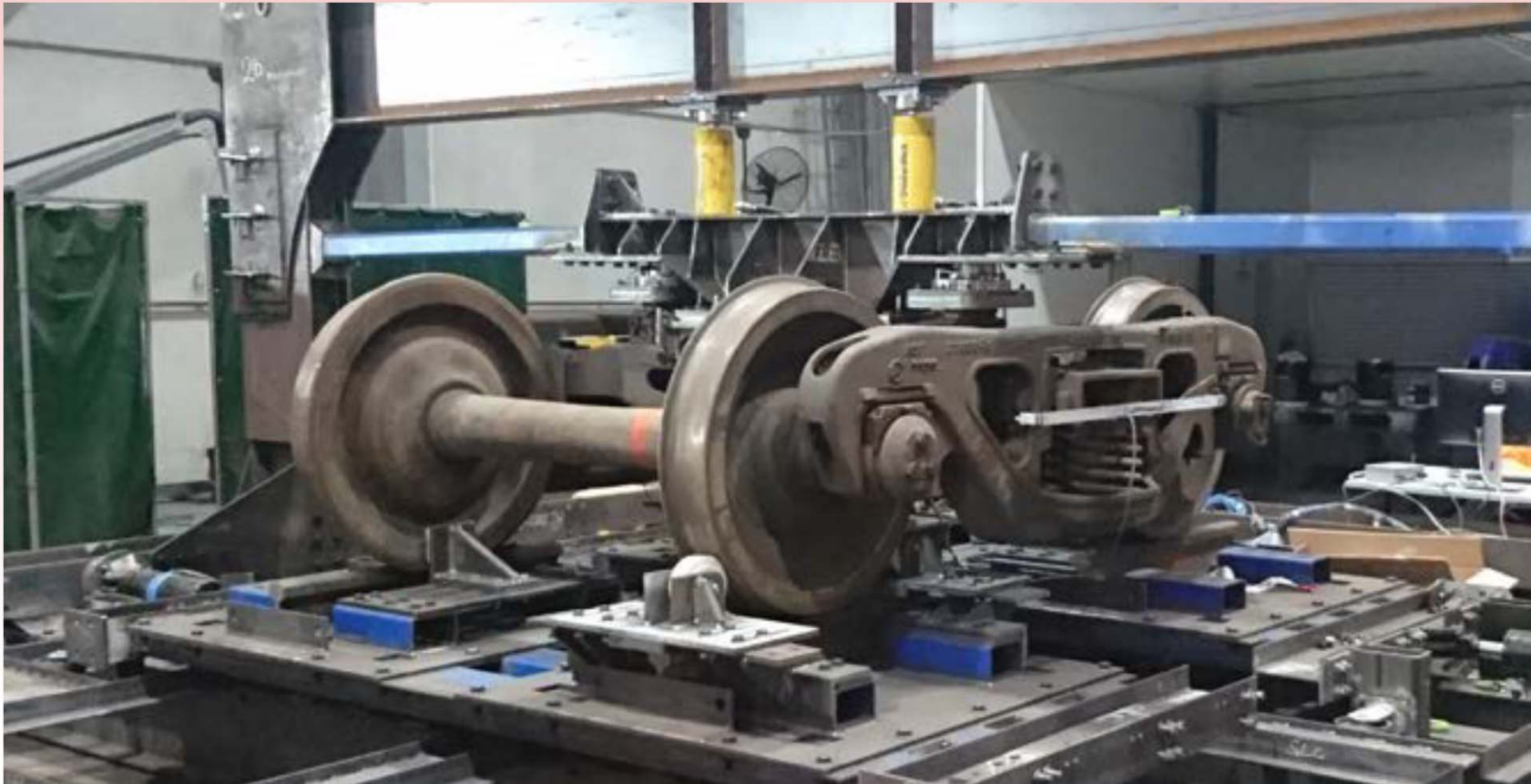
TfNSW – Bad AoA



TfNSW – Good AoA



TfNSW – Bogie Warp Testing



HEAVY HAUL SEMINAR • JUNE 7-8, 2017

pacific*national*

WRI 2017

Bogie Warp Resistance Testing

Bogie Type	Tare	Gross	Bogie Condition
3 Piece Variable Damped with Frame Bracing	17.4kN/mrad	45.4kN/mrad	Overhauled
3 Piece Variable Damped	0.2kN/mrad	3.6kN/mrad	Overhauled
3 Piece Ride Control	2.3kN/mrad	5.4kN/mrad	Worn
3 Piece SSRC	17.6kN/mrad	38.3kN/mrad	Worn

- Warp resistance is not necessarily dependent on auxiliary warp stiffening
- Bogie design, not bogie condition matters



Similarities/Differences of Studies

- AoA and high T/N ratios are measures of the same issue – wheel squeal is RCF in formation & RCF can result in HIW's
- Agreement that effective bogie warp restraint prevents AoA & high T/N ratios
- TfNSW found effective warp restraint can be achieved without auxiliary warp stiffening, however Harry's work finds that friction saturation at the wedges can occur leading to loaded car hunting



The PN Heavy Haul Experience

- PN operate a fleet of 2400 x 30 TAL standard gauge coal hopper cars in the Hunter Valley
- Cars run approximately 130,000km/year
- Hauled tonnage currently ~110M T/year
- Planned wheel change every 3 years
- 6 different wagon builders & 5 bogie types
- 230m radius tightest curves (Approx. 30% curve density \leq 600m radius)



PN Bogies – What Work's

Bogie Type: Frame Braced Sample 1		
Count of WST's In Service	2080	
Reason for Removal	Count of WST's	% of WST's in Service
Thin Flange	6	0.29%
Wheel Impacts	111	5.34%
Hollow	3	0.14%
Brakes	6	0.29%
Bearing	12	0.58%
Total OOC Replacements		6.6%

Bogie Type: Frame Braced Sample 2		
Count of WST's In Service	720	
Reason for Removal	Count of WST's	% of WST's in Service
Thin Flange	5	0.69%
Wheel Impacts	64	8.89%
Hollow	1	0.14%
Brakes	5	0.69%
Bearing	6	0.83%
Total OOC Replacements		11.3%



PN Bogies – What Doesn't Work

Bogie Type: Ride Control Sample 1		
Count of WST's In Service	128	
Reason for Removal	Count of WST's	% of WST's in Service
Thin Flange	50	39%
Wheel Impacts	127	99%
Brakes	26	20%
Bearing	6	5%
Total OOC Replacements	163.3%	

Bogie Type: Ride Control Sample 2		
Count of WST's In Service	72	
Reason for Removal	Count of WST's	% of WST's in Service
Thin Flange	52	72.22%
Wheel Impacts	64	88.89%
Brakes	21	29.17%
Bearing	3	4.17%
Total OOC Replacements	194.4%	



PN Bogies – More of What Works

Bogie Type: SSRC with Steering Pads		
Count of WST's In Service	1312	
Reason for Removal	Count of WST's	% of WST's in Service
Thin Flange	1	0.08%
Wheel Impacts	41	3.13%
Brakes	4	0.30%
Bearing	16	1.22%
Total OOC Replacements	5%	

Bogie Type: SSRC with Steering Arms		
Count of WST's In Service	1560	
Reason for Removal	Count of WST's	% of WST's in Service
Thin Flange	16	1.03%
Wheel Impacts	58	3.72%
Hollow Tread	41	2.63%
Brakes	102	6.54%
Bearing	30	1.92%
Rim Cracks	22	1.41%
Total OOC Replacements	17.2%	



Learning's

- Two separate studies have concluded bogie warp stiffness is key to effective bogie steering
- AoA and low rail T/N ratios are effectively the same measures of steering performance
- Pacific National data shows bogies with effective warp stiffness have low flange wear & low rates of HIW's
- It is not simply all about warp stiffness though



How Bogies with Effective Warp Restraint Save on Rail Maintenance?

- Wheel and rail wear mirror one another - If wheel wear is low, so too must be rail wear
- If I take the interest in the rail maintenance industry compared to wheel/bogie industry at these events as a gauge, if the above is true, the rail maintenance savings could dwarf the wheel savings



Where Do the Savings Come From?

- High Wheel & Rail Wear results in:
 - frequent wheel maintenance/replacement
 - Frequent inspection/grinding (lost freight volumes)
 - Rail replacement
 - Broken rails
 - GFL installation/maintenance
 - ToR Friction Management installation/maintenance
- Higher fuel/energy consumption
- Community resentment (noise pollution)
 - Restricted/reduced train paths



Can Improved Bogies be More Effective at Preventing Rail Wear Than Gauge Face Lubrication & Top of Rail Friction Management?

- Balance speed is a consideration
- But PN data shows low flange wear & tread defects on effective bogies regardless
- Flange wear & tread defects are precisely the wheel & rail wear/defect characteristics GFL & ToRFM are installed to prevent



How Can the Industry Foster 'Improved' Bogies as an Initiative?

- Inhibitors
 - Horizontal Railway Integration
 - Cost of some 'IFCT' bogies?
 - Relatively long life of a bogie
- Enablers
 - Government incentives
 - Discounted track access fees to complying operators
 - Staged plan for implementation
 - Bogie volumes can lower price



QUESTIONS?

