SMOOTHER IS . . . . . BETTER, AND QUIETER, AND . . .

LASTS LONGER, TOO!

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TRB 88th Annual Meeting 2009 – Session #282
"Reducing Noise and Vibration with Low-Impact Special Trackwork"
January 12, 2009

Reasons for the Session

- Special trackwork (STW) is recognized as a major source of N&V in rail transit systems
- Designers/specifiers often reject using “premium” STW because of higher first cost
- The high cost is often offset by substantial reductions in Life-cycle Costs (LCC), and . . .
- Cost estimate must also factor in probable avoidable N&V mitigation costs
- This Session will highlight some available STW designs that can reduce N&V while reducing LCC

WHAT THIS SESSION IS ABOUT

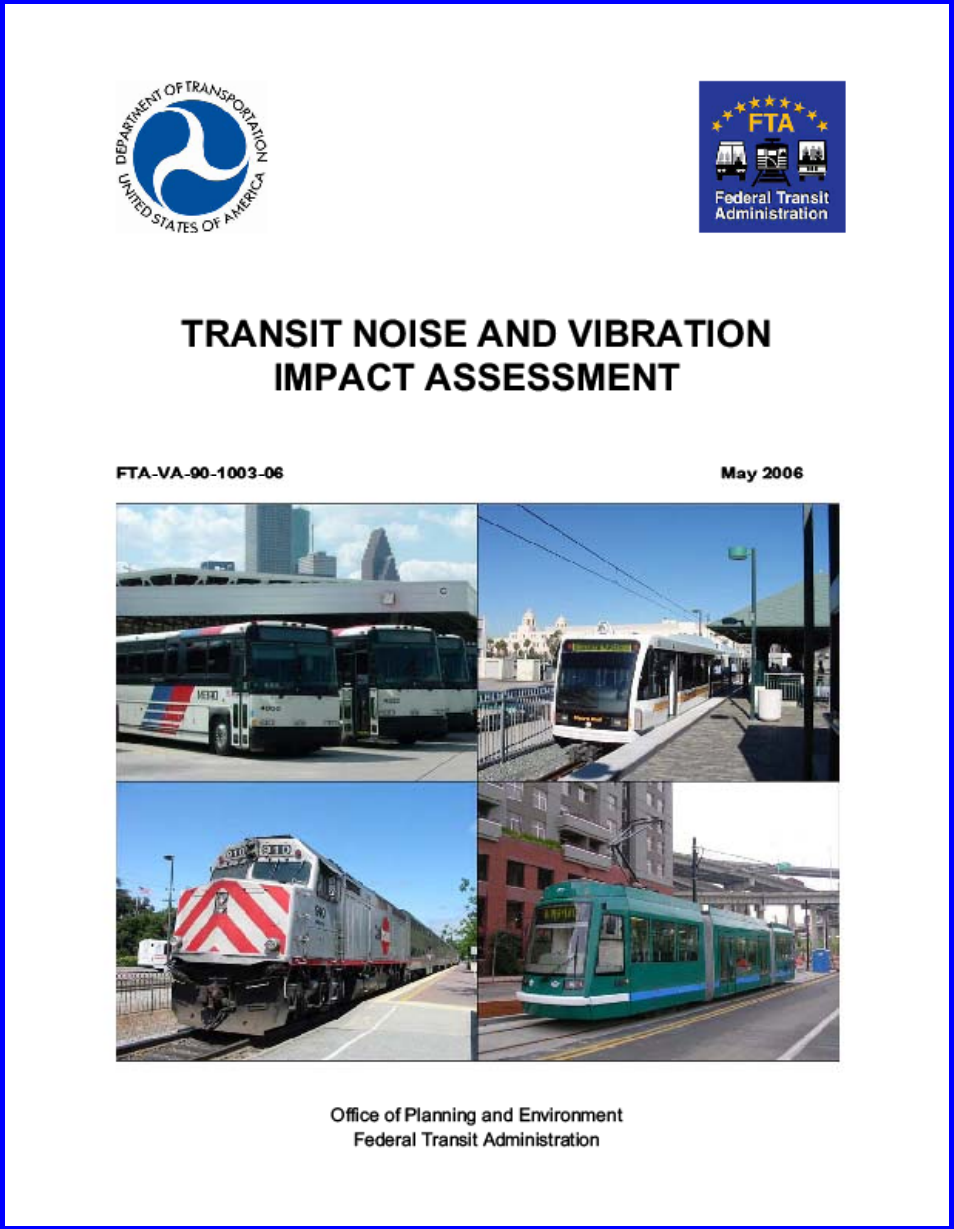
- ✓ Develop understanding of impacts between wheels and special trackwork (STW) that generate Noise & Vibration
- ✓ Explore the possibility of reducing N&V by reducing impacts
- ✓ Demonstrate possible ways of improving the interface with presently available STW designs & components
- ✓ Showing N&V reduction at STW/wheel interface reduces mitigations required

What Will Be Presented

- STW high-impact components, focusing on turnouts and crossing diamonds
- Historic perspective
- Description of present day “premium,” low-impact components & assemblies
- Examples & Results (here & by other Presenters)
- Summary
- Further work needed to prove case

- Why are we even a little bit interested in all this stuff about special trackwork ?

- ***Just Because***

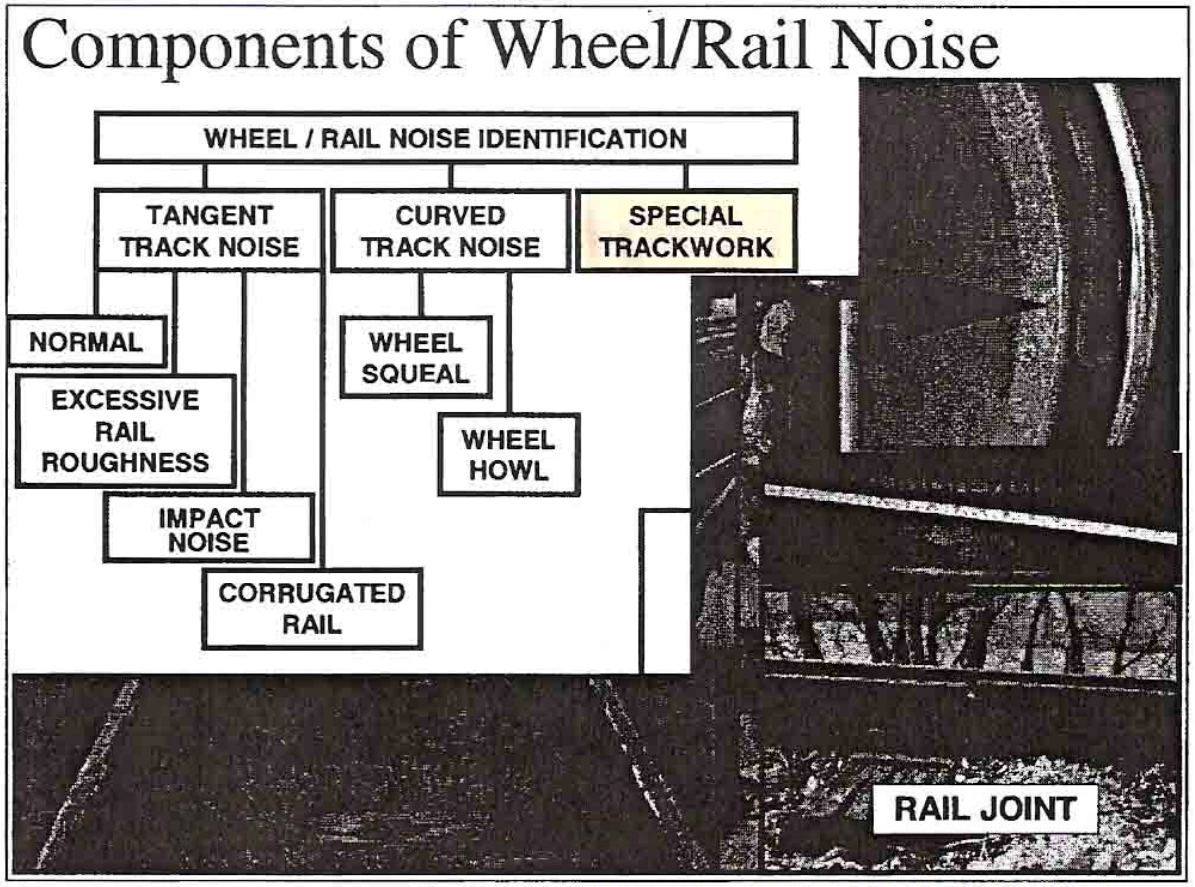


TRANSIT NOISE AND VIBRATION IMPACT ASSESSMENT

FTA-VA-90-1003-06 May 2006

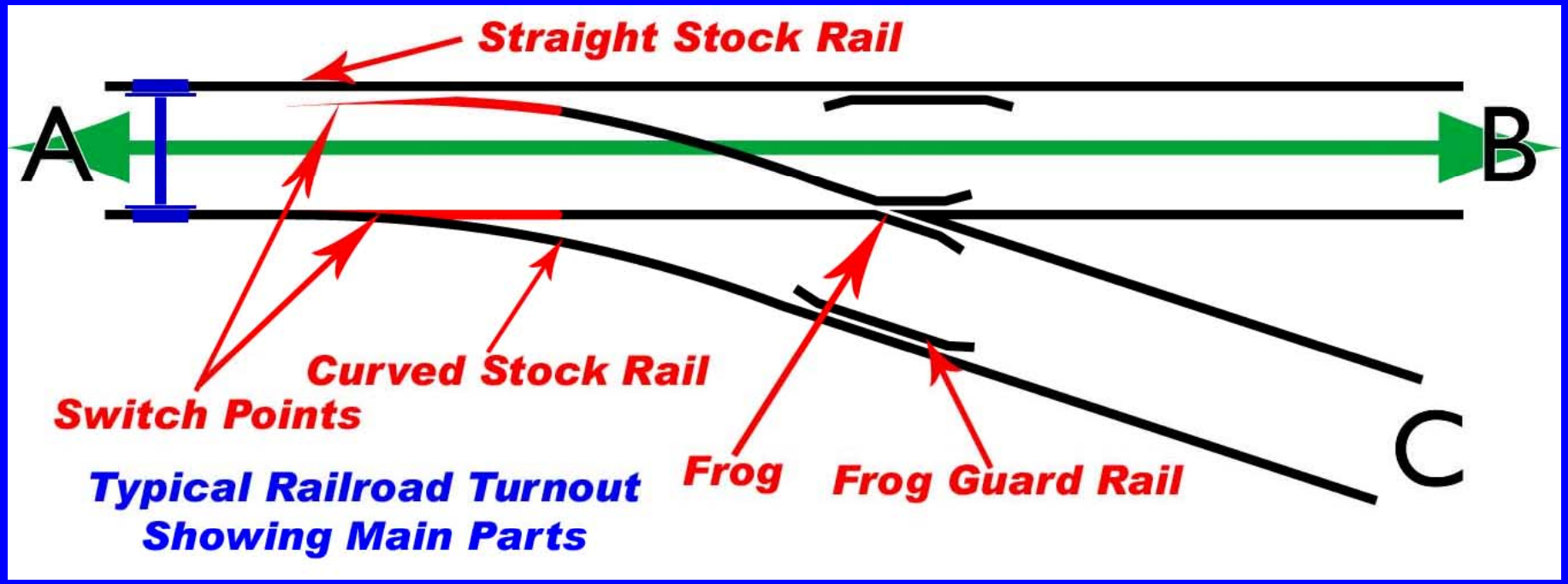
Office of Planning and Environment
Federal Transit Administration

What are the sources of Rail Transit Noise & Vibration?



Thanks to Mike Brown, BART

Special Trackwork – the Turnout



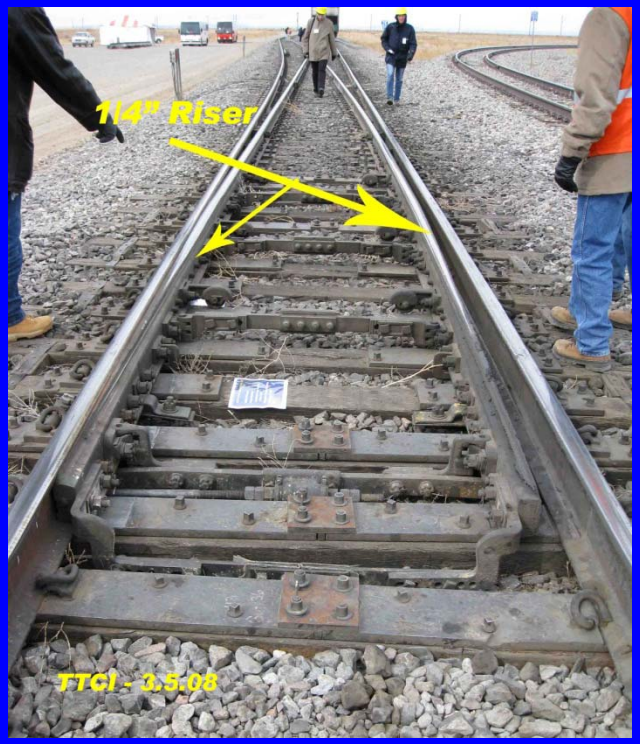
Note: Not all turnouts have frog guard rails

What makes impacts in STW?

- Joints, especially loose ones
- Changes in running surface of rails, such as at frogs and switch points
- Abrupt changes in support modulus, such as at frogs, but also switches
- Impacts at vertical & lateral direction changes, i.e. frog points and switch points
- Abrupt grade change, such as switch point risers

Let's look at some of these troublemakers

Joint

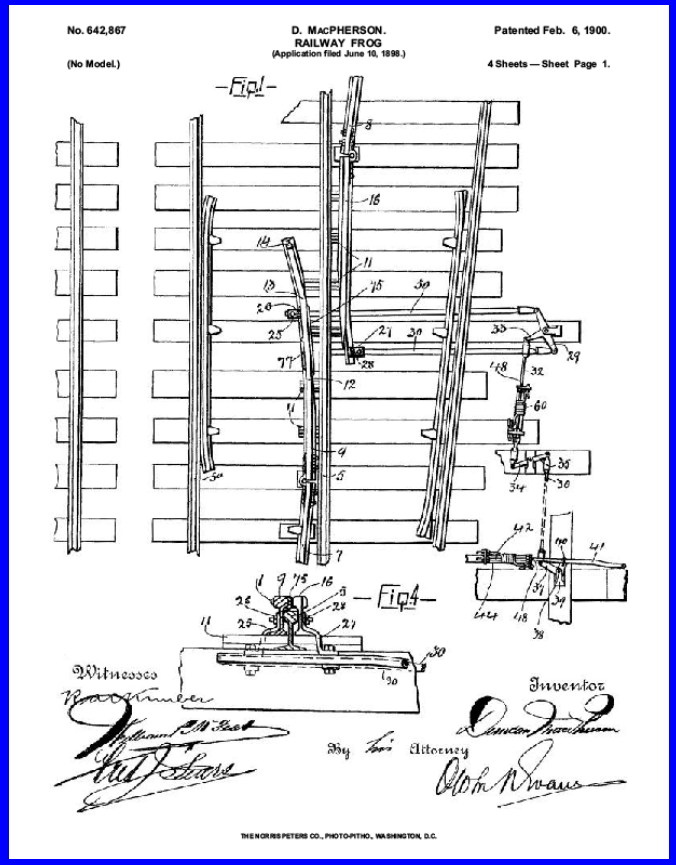


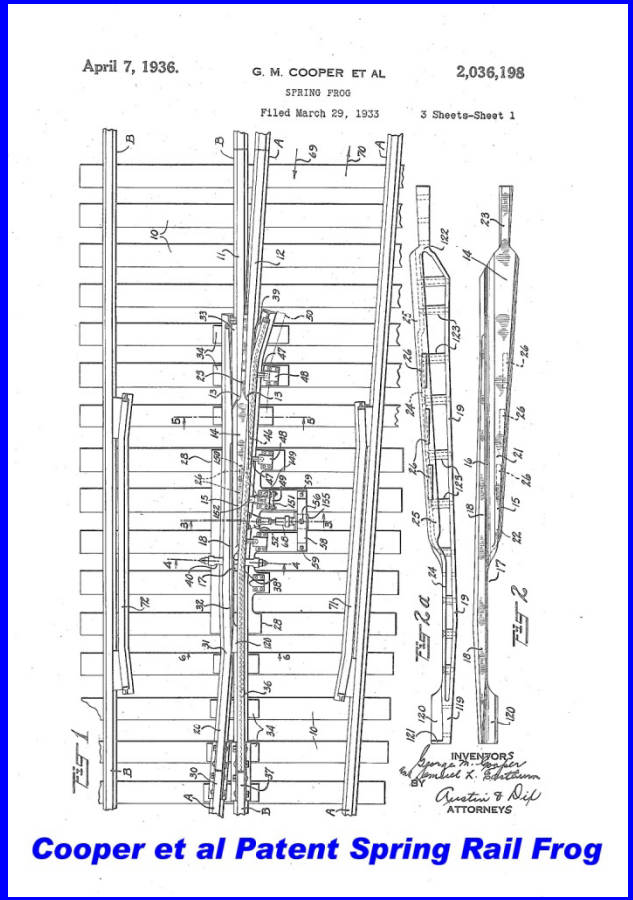
Switch Points

RBM Frog

We'll look at frogs, as they are the arguably the worst offenders

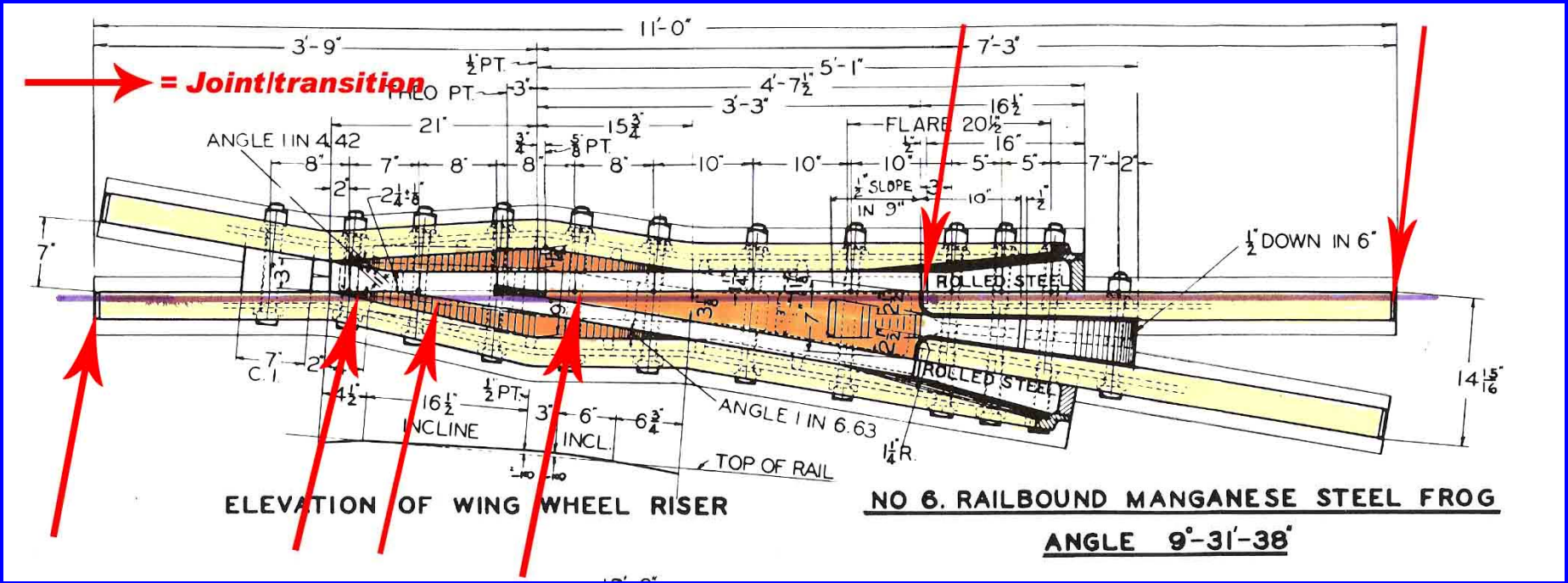
Some earlier attempts to solve the problem . . .





Cooper et al Patent Spring Rail Frog

Let's look at the RBM Frog so commonly used in both freight and transit tracks



Note the number of joints and transitions – red arrows

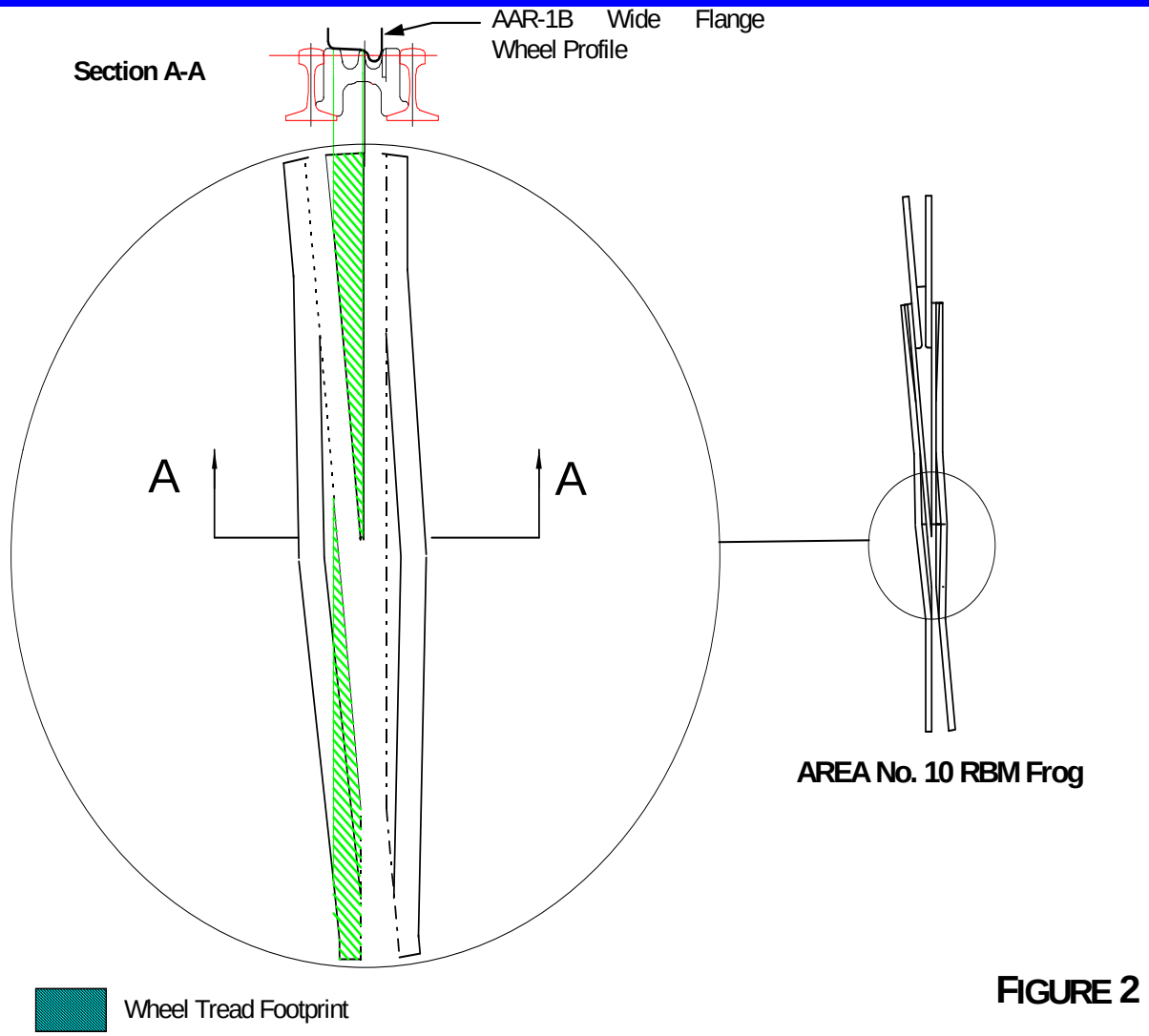


FIGURE 2

Thanks to Larry Daniels

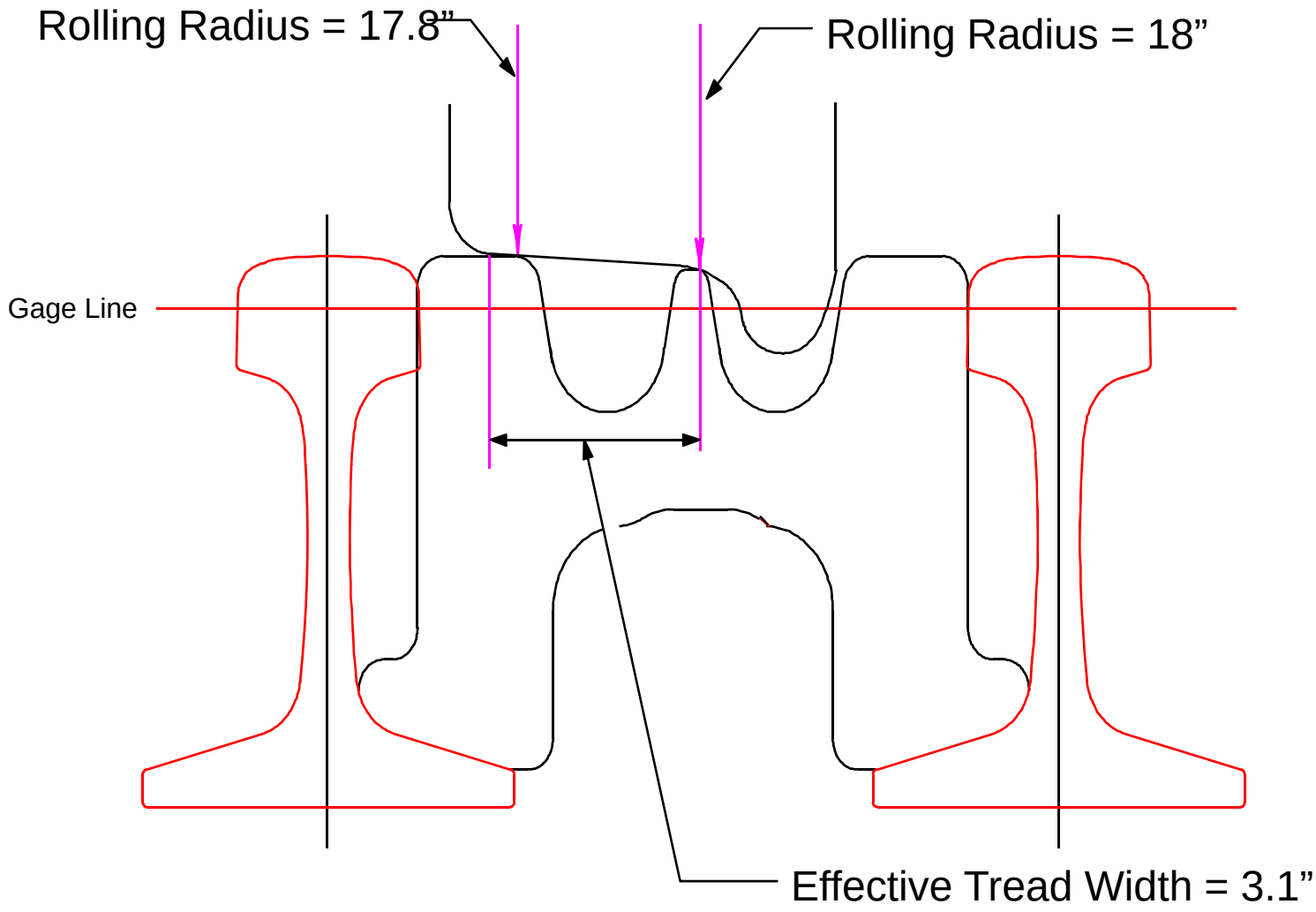
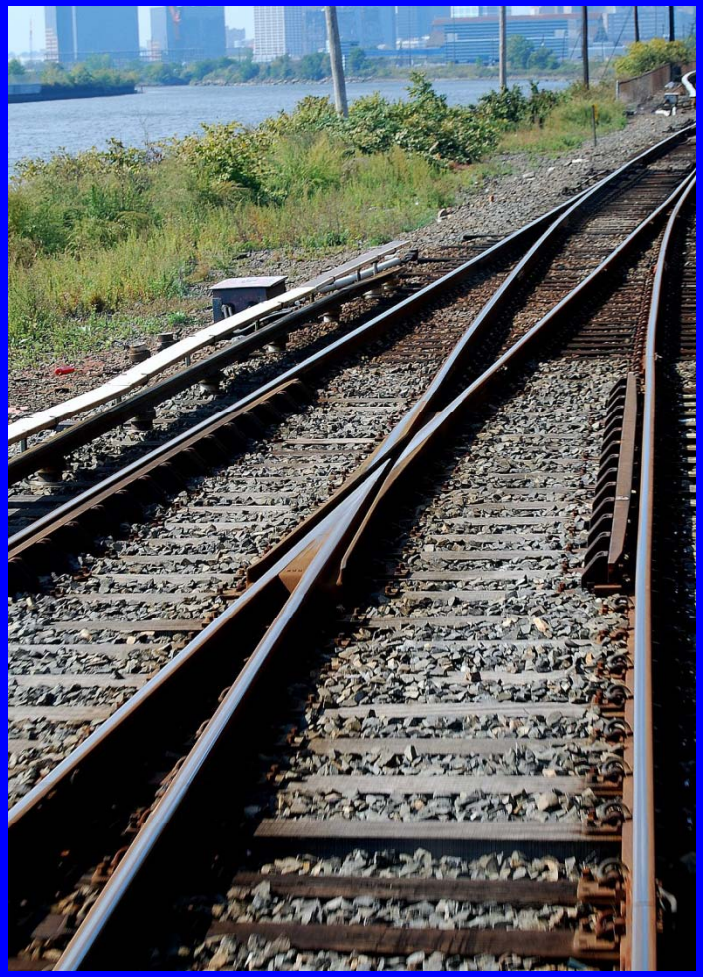


FIGURE Nominal Wheel and Frog Relationship at Actual Frog Point
(AAR-1B Wide Flange Wheel, AREA No. 10 RBM Frog with Sloped Point).

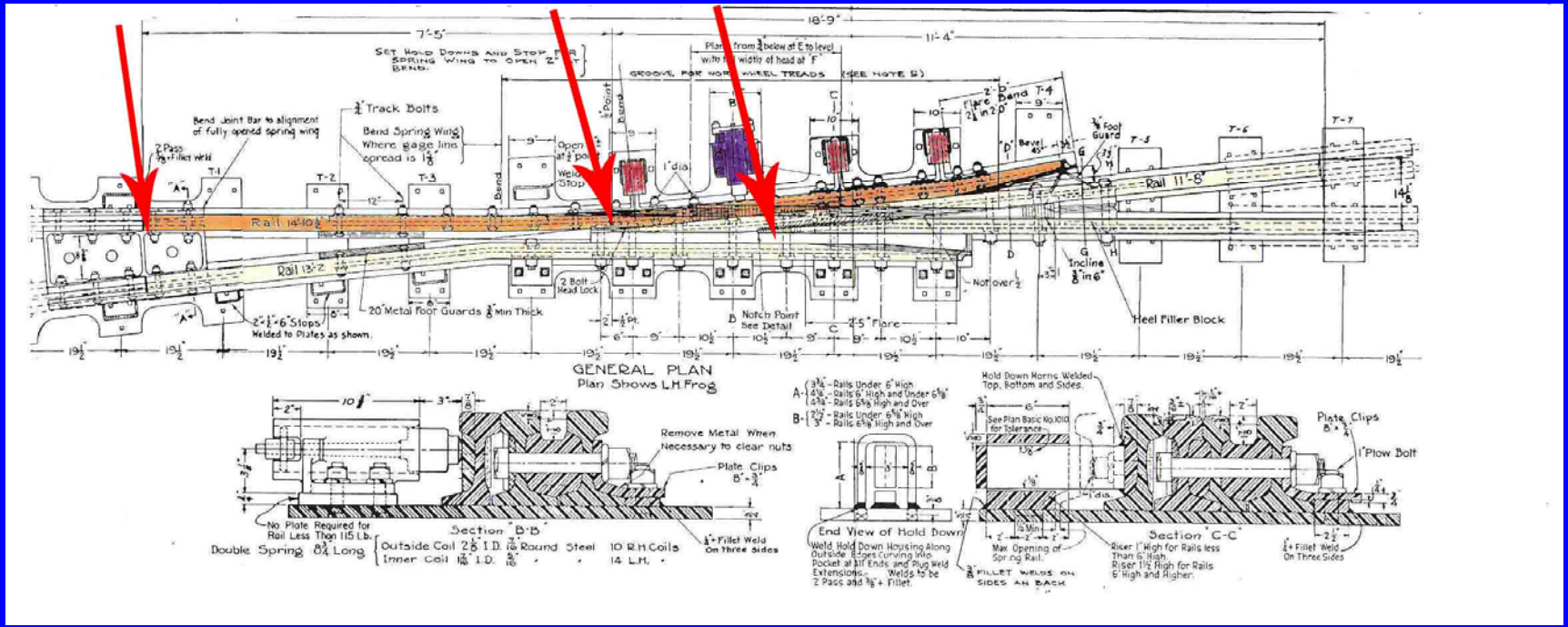
Thanks to Larry Daniels

Other Frog Types Commonly Used

Cast Monoblock with narrow flangeway



The spring-rail frog, #10 shown



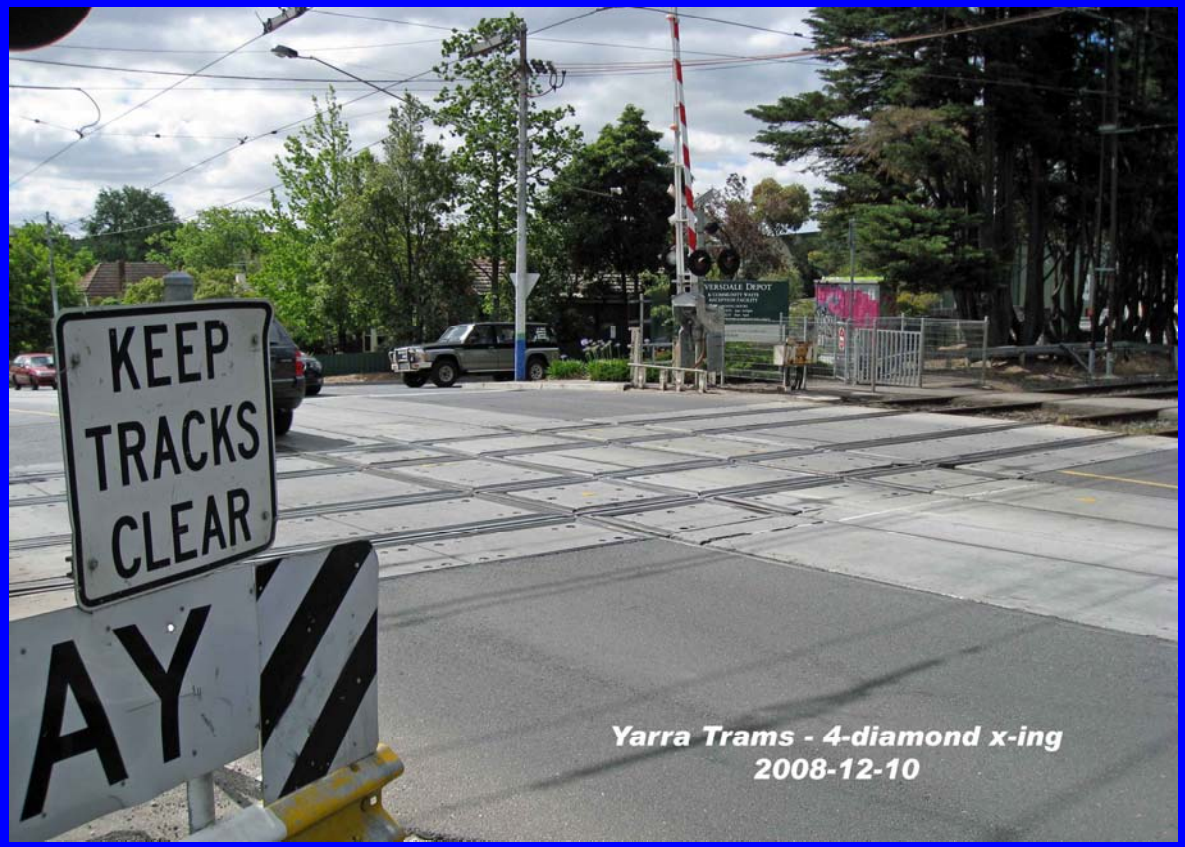
Note there are less joints & transitions on the main move side

Some other frogs, important to know about

The bolted, rigid rail frog, left
The flange-bearing frog, right

And, last but not least, the DIY frog

And, last, last, but not least, the flange-bearing 4-way diamond



Yarra Trams, Melbourne, is considering using an OWLS-type crossing to replace this type

Well, you've probably got the idea about frogs by now . . .

But wait, there's more . . . . .

For the frog Fanatic . . .

So, now that we knew all this, we decided to try to prove it . . .

There's good news and bad news . . . We decided to test out this concept on PATH

PATH was receptive, so with Lansmont's help, we did a Ride Quality run over the system

General setup in PATH cab car, left
Instrument mounting detail, below

We covered the whole system, sometimes a little confused . . .

A little bit lost, but making good time!

Results: “Inconclusive, but promising”

1. Not sure of exact location correlation with recorded event data
2. Carbody produced background “noise”
3. Train speed varied considerably over STW
4. GPS only worked part-time outdoors, not in tunnels
5. Verdict: we need test it again with knowledge gained from this jaunt

SUMMARY & FURTHER WORK

- Empiric data from domestic & European experience indicates “premium, low-impact” STW can have a favorable effect on reducing N&V significantly
- Controlled experiments must be performed to quantify the N&V benefits of using premium, low-impact STW
- The LCC benefits must also be quantified to prove the use of premium STW is a well-justified, Win-Win deal for the Owner