Session #604 – Interchanging Locomotives
The Alignment Control Coupler Controversy

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The Issue

Moving non-alignment control Locos at Interchange

Why a Problem? Derailments with non-alignment locos in train

Class I’s prohibit movement of Locos without alignment control

- Have Operating Rules outlining movements of Non-Equipped
- Positioning in a train is key for controlling Buff Forces
- Incidents happened where Class I’s did not follow their own rules
- Some large RR’s will not move “foreign” locos with no alignment
  - Will move their own locomotives within their system
  - Will move yours as a Single Engine Move - expensive
- Rubber Blocks (Pensy) no longer acceptable for interchange
Types of Coupler Arrangements

Four (4) Basic Types

1. Alignment Control – OEM standard since 1964-65 (GP38’s)
2. Abutment Control – developed by joint R&D program 1955-58
   Involved at least one Class I road & one OEM Foundry
3. Non-Alignment Control (older SW-switchers, GP9, 10, 11 etc)
4. Coupler (swing) Limiting Devices
   Temp/Removable Rubber Blocks
   Steel fabrications
   Permanently affixed (welded in place)
   Temporary (pinned in place, remove/affix to pilot)
Alignment Control (self-aligning) Coupler

Has winged ears at back (see arrows)
Mated with NC-390 or NC-391 draft gears
**Alignment Control Draft Gear (NC-390)**

Coupler winged ears compress against draft gear toes
Draft gear spring pressure centers mated coupler ears
Drawing of NC 390 Style DG with Alignment Control Coupler
Solid Abutment Control Coupler (MT)

A. Coupler contact faces compress into draft gear pocket

B. Weld in fixed contact blocks
   Longitudinal Buff movement realigns coupler straight
Solid Abutment Control Coupler (MT)

Coupler pushes into draft gear when compresses

Coupler ears move in to touch fixed contact blocks
Joint R&D program 1955-58

National Castings
Non-Alignment Control Couplers

No Wings to align movement (pre-1965 vintage)
Full lateral swing motion in mouth of coupler pocket
Large Pin (3 1/16” dia) or Small Coupler Pin (2” dia)
Coupler Limiting Devices – Rubber Blocks

Temporary and removable
Wedge shaped Steel Reinforced Rubber
Securement Chain to hold in place
Pennsy Block in Place
Removable Semi-Permanent Steel Blocks
Both Types in Place
What does Alignment Control Look Like?
Another View
M&T E7321 Abutment Coupler & Blocks

Welded in

M&T E7321 Coupler

BLOCK

Standard coupler carrier

31/03/2009 22:34
M&T E7321 Abutment From Further Back

E7321 Installed
The Alternatives and at What Cost? How much are we talking about?

An Order of Magnitude

Modify the locomotive to alignment control
   Full draft gear pocket cut out/replacement
   Approx. $25K-$30K per locomotive (2 ends)

Modify the locomotive to solid abutment control
   Purchase modified MT coupler (use same draft gear)
   Approx. $7K-$9K per locomotive (2 ends)

Light Engine or Dedicated Engine Move over Class I
   Varies widely upon distance.
   ~$15K to ~$30K depending
Chronological order of events

- June 2010 - Movement of non-alignment units becomes critical
- August 2010 - More Class I’s deny movements
- October 2010 - Some Short Lines begin to evaluate alternatives
- May 2011 – Subject brought before the AAR
  - Locomotive Standards Committee members discussed
  - GWI presentation to Class I’s on problems this creates
- June 2011 - GWI (an AAR Member) requests placing on docket
Chronological Order – The Plan of Action

- July 2011 – GWI-AAR open new Docket Item # LM-105 on Agenda
- July 2011 - GWI consults with TUV-Rhineland-start develop testing
- July 2011 – Draft test protocol with FRA, AAR & Rail Science
- July 2011 - Approved Final testing criteria on conference call
  
  Opted for static testing as opposed to dynamic tests
  
  Reason – Require constant & stable compression rates
  
  Maintain constant compressions @ 25,000 lb. increments
  
  VAMPIRE software – dynamic modeling-track geometry
  
  L/V data gathering (Lateral over Vertical) forces on wheels
Determine a Performance Base Line

- July 2011 - Discussed potential funding from FRA with R&D Dept
  To Pay TUV-Rhineland for data modeling $65k

- July 2011 - Discussions with AAR Pueblo Test Track at TTCI
  (Transportation Technology Center Incorporated)
  Does TTCI have capabilities to perform testing
  At what cost? Estimated at about $175k
  Got the AAR (and TTCI’s budget) to pay for cost of tests

- August 2011 – Types of locomotives to test
  SW1500 or MP15 (short switching unit)
  GP9 (longer unit with Blomberg-type road trucks)
Test Modules – Types – Protocols

**Summer 2012 - Determine a Performance Base Line**

- TTCI to perform physical tests and gather raw data
- TUV-Rhineland to model TTCI data results in VAMPIRE
- Test on a 10 degree curve to monitor lateral forces

**Perform Four (4) Types of Static Compression Tests**

- Base Line – test a non-alignment coupler & draft gear
- Base Line – test a standard alignment control (NC-390)
- Test Alternative Design – Solid Abutment Coupler (MT)

**And Then………**

- Test a switcher with all three types of couplers
- Test a GP-style unit with all three types of couplers
What are we testing?

Some facts, some issues, some concerns…..

- Test to establish the Base Line parameters
- Live testing of standard alignment control couplers
- The Model to target is NC-390 draft gear with coupler
- Test coupler alternatives against NC-390
- Compare to see if it performs like NC-390 as a minimum
- Do it at a lower cost and with a drop-in replacement
- How long will it take to test – 4 months - on and off
- What should we expect to see
- What if we get inconclusive data
Curve Testing - Aug 16, 2012 - Nine Pieces of Equipment
One GP40 – One AC Locomotive – One GP9 Slug
Instrumentation Used – Mounted on Coupler
Instrumentation on Trucks – Observe Forces
Extensive Instrumentation on Locomotive Couplers
Hydraulic Compression Fixture – Up to 300,000 lbs
Instrument Monitoring & Data Collection Vehicle
Coupler Compression In Test Under Load

September 7, 2012      TTCI Test Track

Weight Shift

70Mac  GP9  89’Flat

Weight Shift

Photo
Some Results

**August 2012 to November 2012 – Curve Testing**

- Tests done under all scenarios
- Even Tested w/ Pensy Rubber Blocks – Never Touched
- Tested up to 300 Kips (equal to 300,000 pounds of force)

**Perform Four (4) Types of Static Compression Tests**

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**And Then……….**

- Test a switcher with all three types of couplers
- Test a GP-style unit with all three types of couplers
So where are we now?

What did we learn?

- All curve tests are completed under all scenarios
- Yaw motion in trucks – Slight Parallellagramming effect
- One end of locomotive shifted outwards, one end inward
- No violent movements, no derailments
- No wheel lifted off rail
- Class I’s felt tests were inconclusive on the curve

Asked for tangent testing w/o instrumentation

- Tangent testing completed – didn’t change much
March 2013 Tangent Testing at TTCI
March 2013 Tangent Testing at TTCI
The VAMPIRE Model

What did all this testing tell us?

In hands of engineering firm for 6 months

Alignment Control baseline had to be re-evaluated

?
Safety

It’s Not Just a Motto …… It’s our Culture