

Distributed power on ORELINE

Distributed Power



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Background

Single track:

- **1:250 up, 1:100 down**
- **216-wagon Head end Power = 1320 kN in-train forces**
- **Direct release brake system (AAR system):**
- **Brake pipe approaching limit in length**

Throughput:

- **Train configuration and Train slots limit throughput**

Operational and Technological limitations:

- **Require higher order of train technology**

=> Distributed power

Background

International Users (of Locotrol DP equipment):

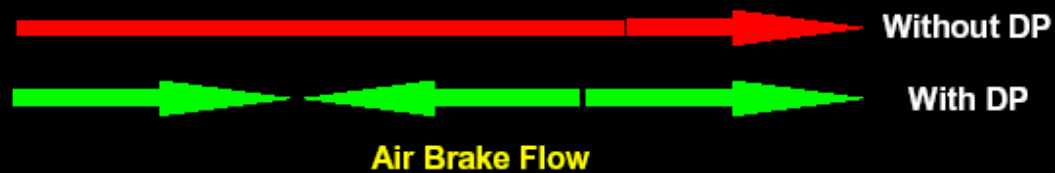
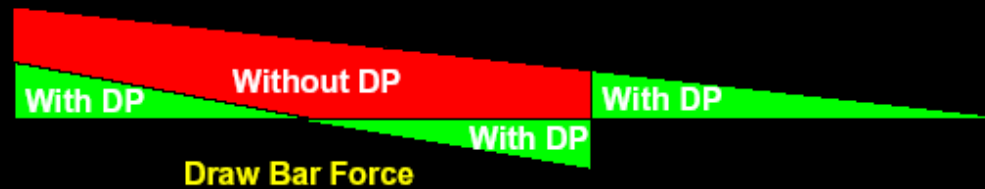
- **CARAJÁS: L = 892 km, G = 1600 mm, 78Mt, 1:250**
 - **Trials with: 312 wagons, DP, L = 3.2 km, T = 39KT's**
- **EFVM: 320 wagons, DP, T = 31KT's**
- **BNSF, CPR, UP, BHP and others**

Advantages of DP



The LOCOTROL® Concept

GE Transportation Systems Global Signaling, LLC, Proprietary & Confidential



Enhanced Throughput / Reduced Operating Cost

Advantages of DP



LOCOTROL® — Performance Benefits

GE Transportation Systems Global Signaling, LLC, Proprietary & Confidential

- With LOCOTROL®
- Without LOCOTROL®



22% reduction in stopping time



30% reduction in stopping distance



Up to 60% reduction in brake pipe charging and release time

Throughput, Reliability, Safety

Advantages of DP



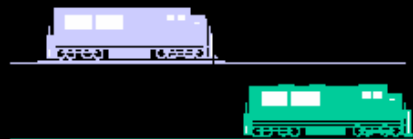
LOCOTROL® — Performance Benefits (continued)

GE Transportation Systems Global Signaling, LLC, Proprietary & Confidential

- With LOCOTROL®
- Without LOCOTROL®



12% reduction experienced in cycle run time on a 48 hour revenue run



90% reduction experienced in "brake-in two's"



5-10% Reduction in Fuel Consumption (depends on territory)

Throughput, Fuel Savings, Reliability, Safety = Cost reduction

Proof of Concept:

Test conducted during August 2004:

Train configuration:

3 x 9E + 228 wagons + 5 x DE + 114 wagons + 2 x DE

Weight = 41 000 tons, Nett = 34 200 ton, Length = 3 900 meters.

Purpose of test:

- Train handling profile
- Radio receptivity
- Brake response and characterisation
- In-train forces
- etc

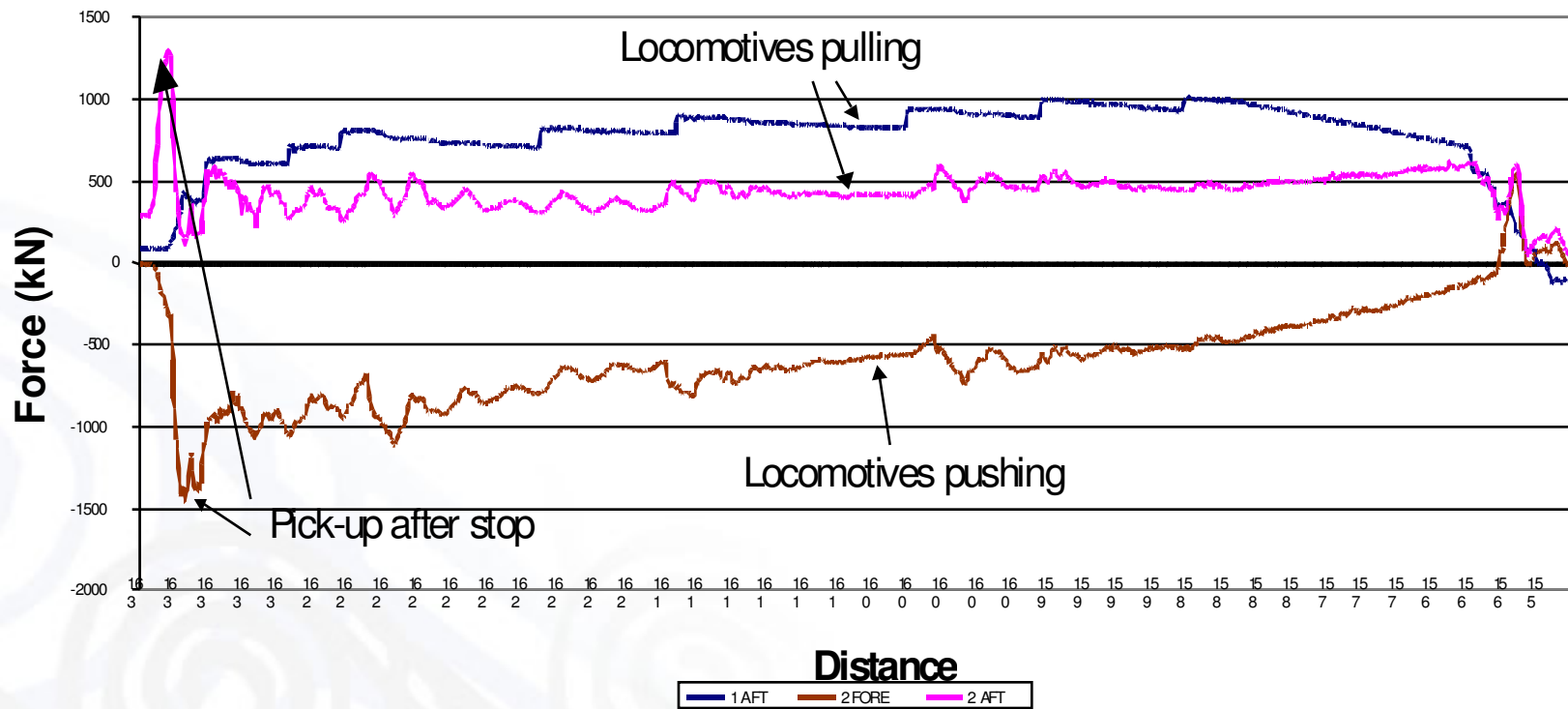
August 04: Braking - Results

Brake Pipe Charging Times : 216 wagon vs 342 wagon

	Recharge Time to 545 kPa After :	216 Wagon Train @ Wagon 216	342 Wagon Train @ Wagon 114	Improvement of DP over Head-End Charge Times
1	Completely empty system (reservoirs manually vented)	55 minutes	34 min 31 sec	37%
2	Emergency application	48 minutes	11 min 25 sec	76%
3	Full service application	29 minutes	9 min 51 sec	66%
4	Minimum application	12 minutes	3 min 24 sec	72%

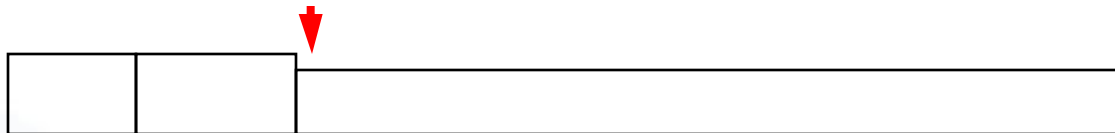
August 04: Coupler forces - Results

Coupler Force From Pull Away on 1:250 Upgrade

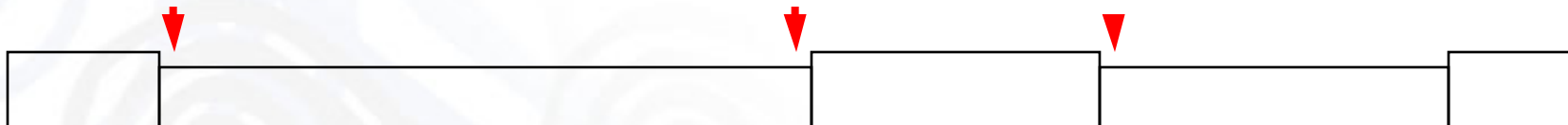


August 04: Fatigue - Results

- TRAIN CONFIGURATIONS
 - **2 X 9E – 4 X 34CLASS - 216 WAGON (HEAD END)**



- **3X 9E – 228 WAGON – 5 X 34D – 114 WAGON – 2 X 34D (DP)**

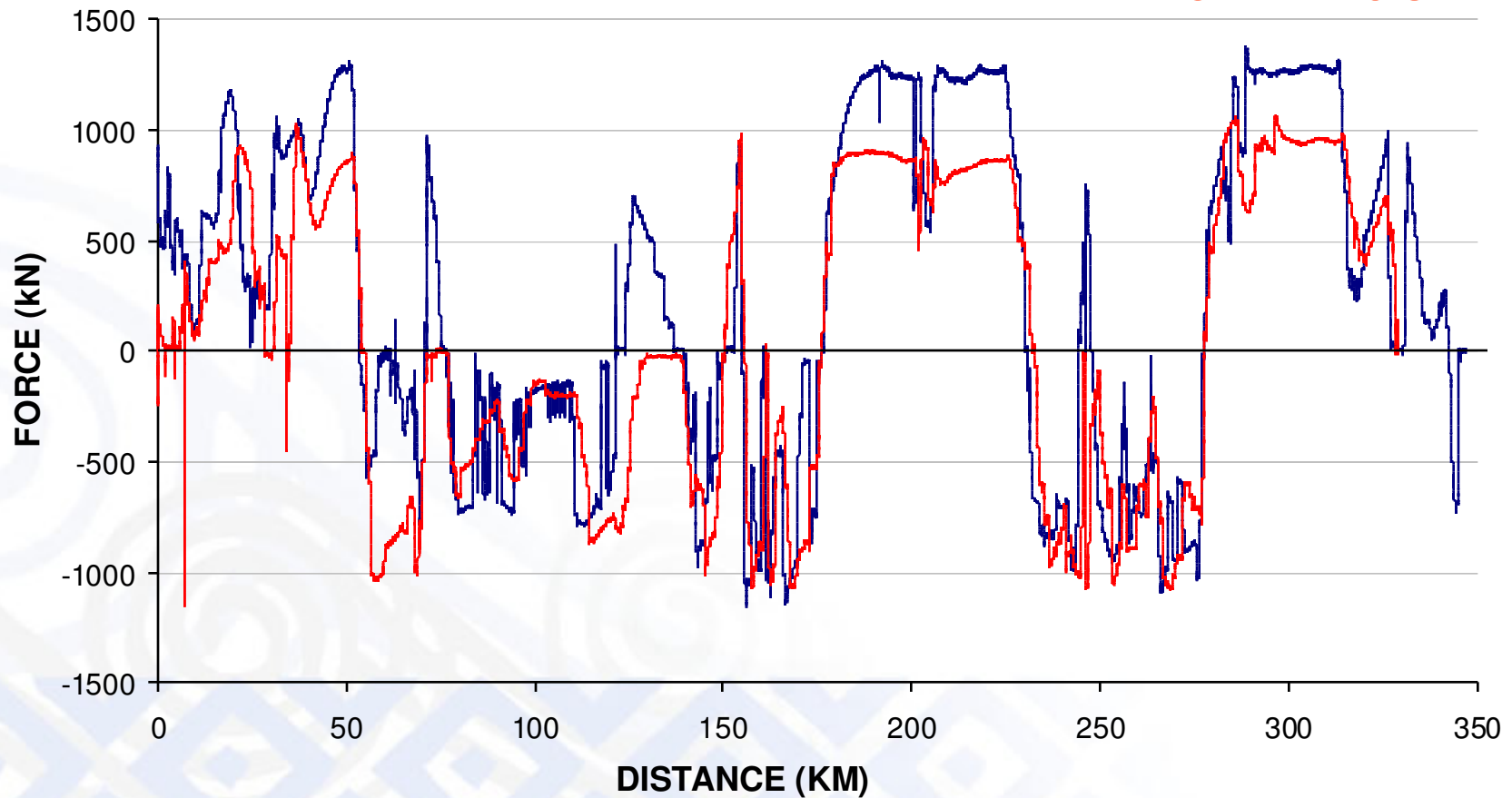


August 04: Fatigue - Results

216 WAGON
HEAD-END

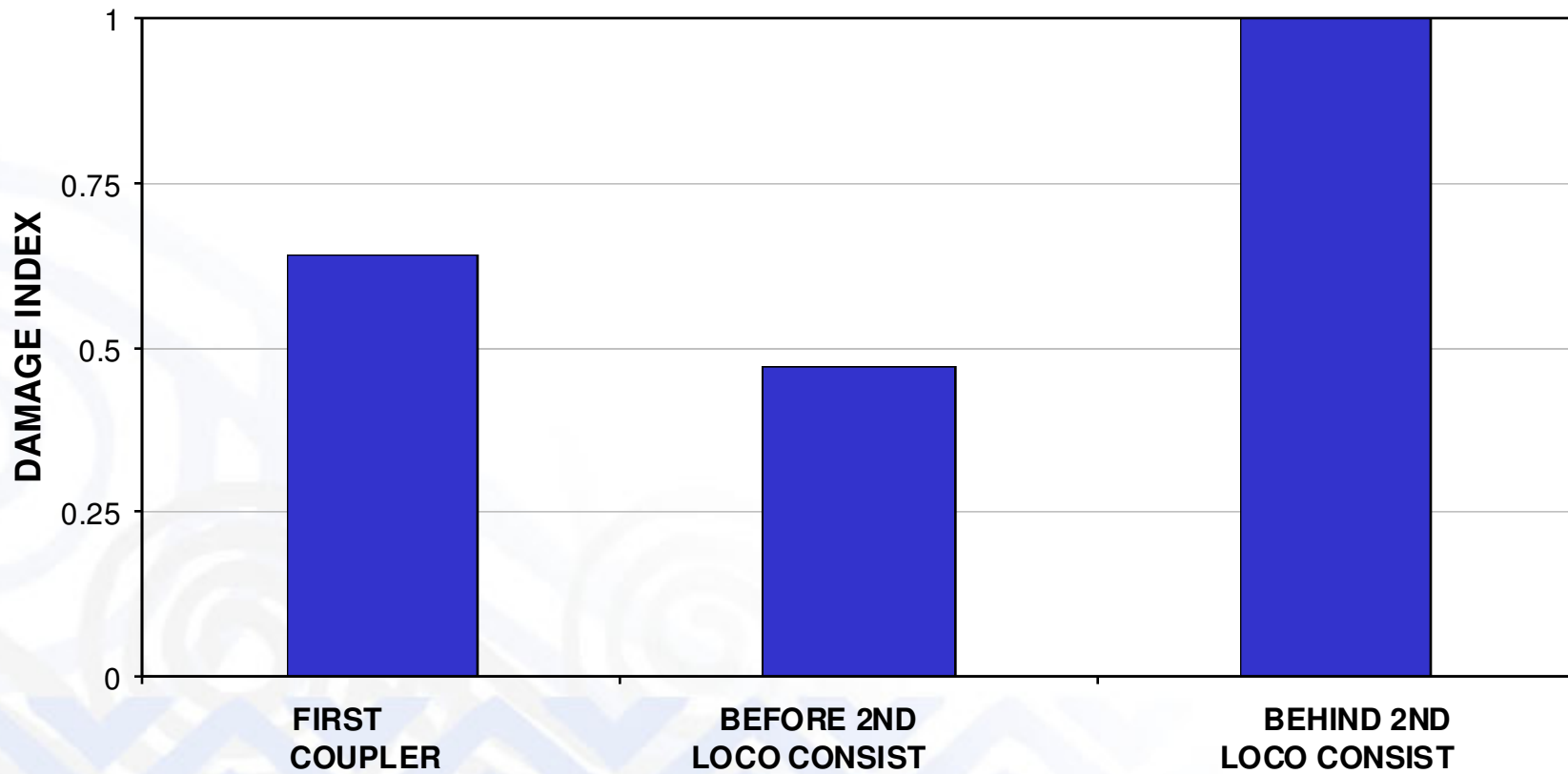
COUPLER FORCE: SISHEN - LOOP 10

342 WAGON DP



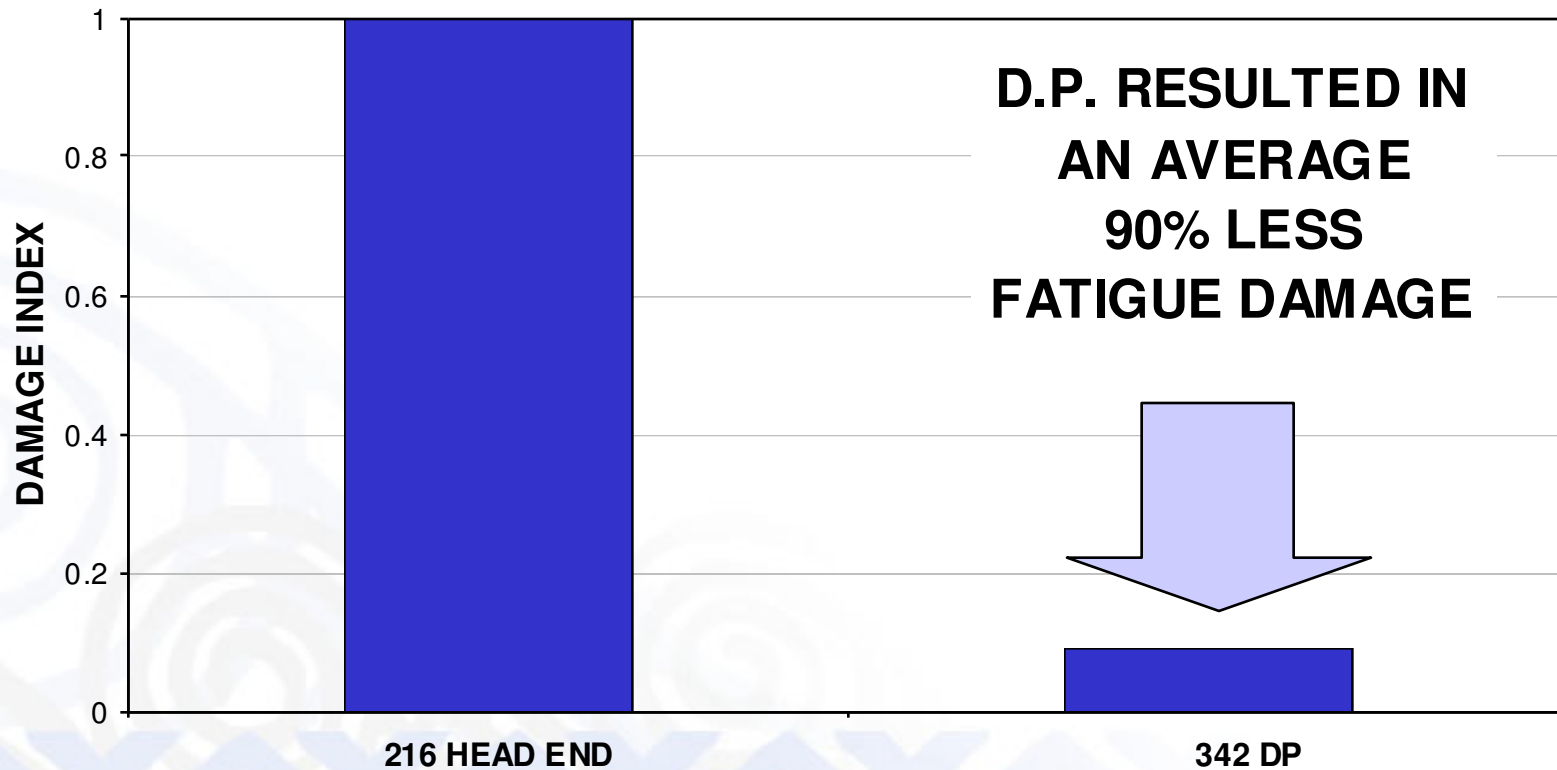
August 04: Fatigue - Results

COMPARISON OF FATIGUE LIFE THROUGHOUT TRAIN
Sishen - Saldahna



August 04: Fatigue - Results

COMPARISON OF FATIGUE DAMAGE - HEAD END vs DP
Sishen - Saldahna



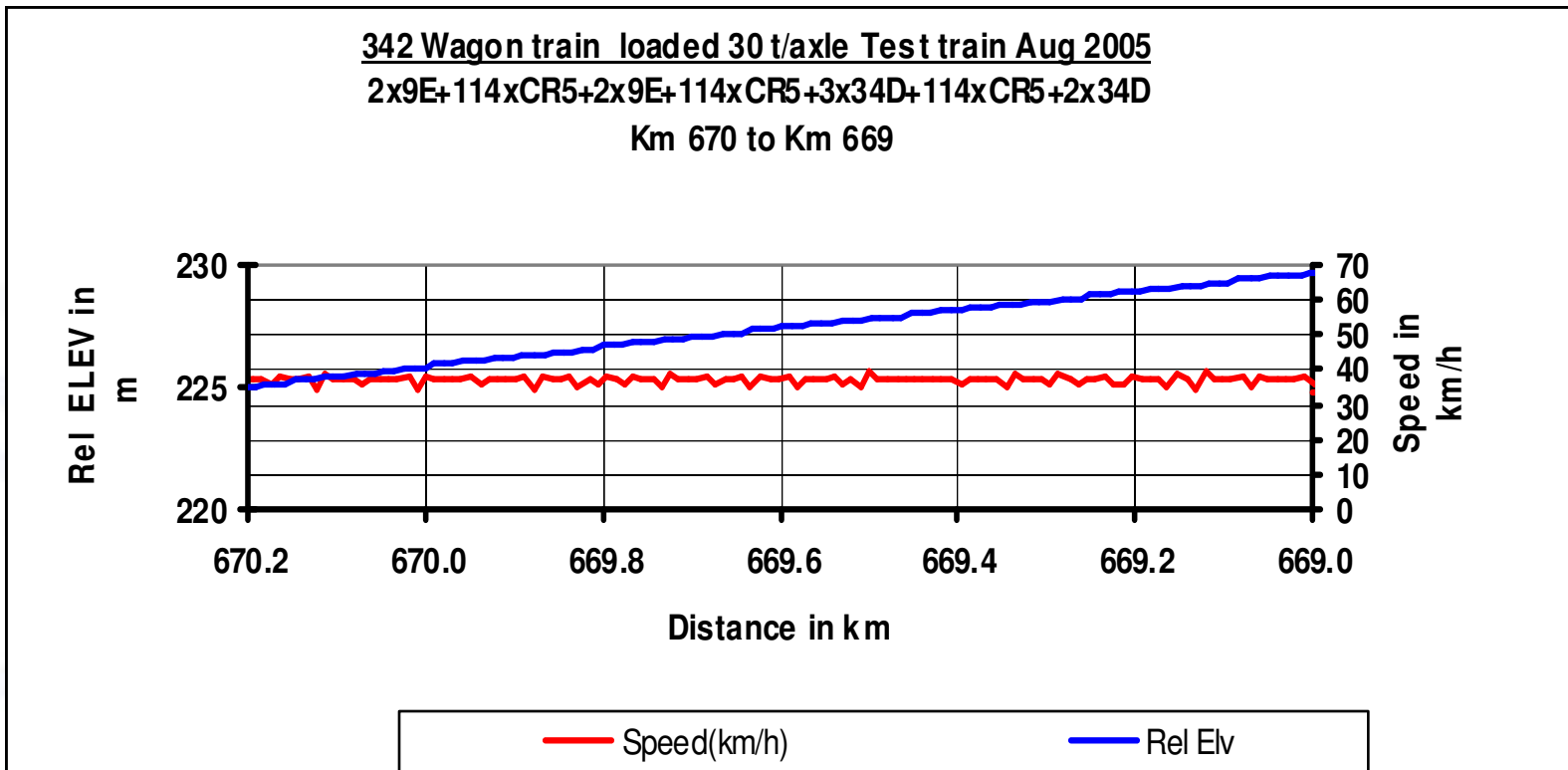
August 04: Conclusion - Results :

**Test conducted during August 2004:
Technology deemed to be acceptable and feasible**

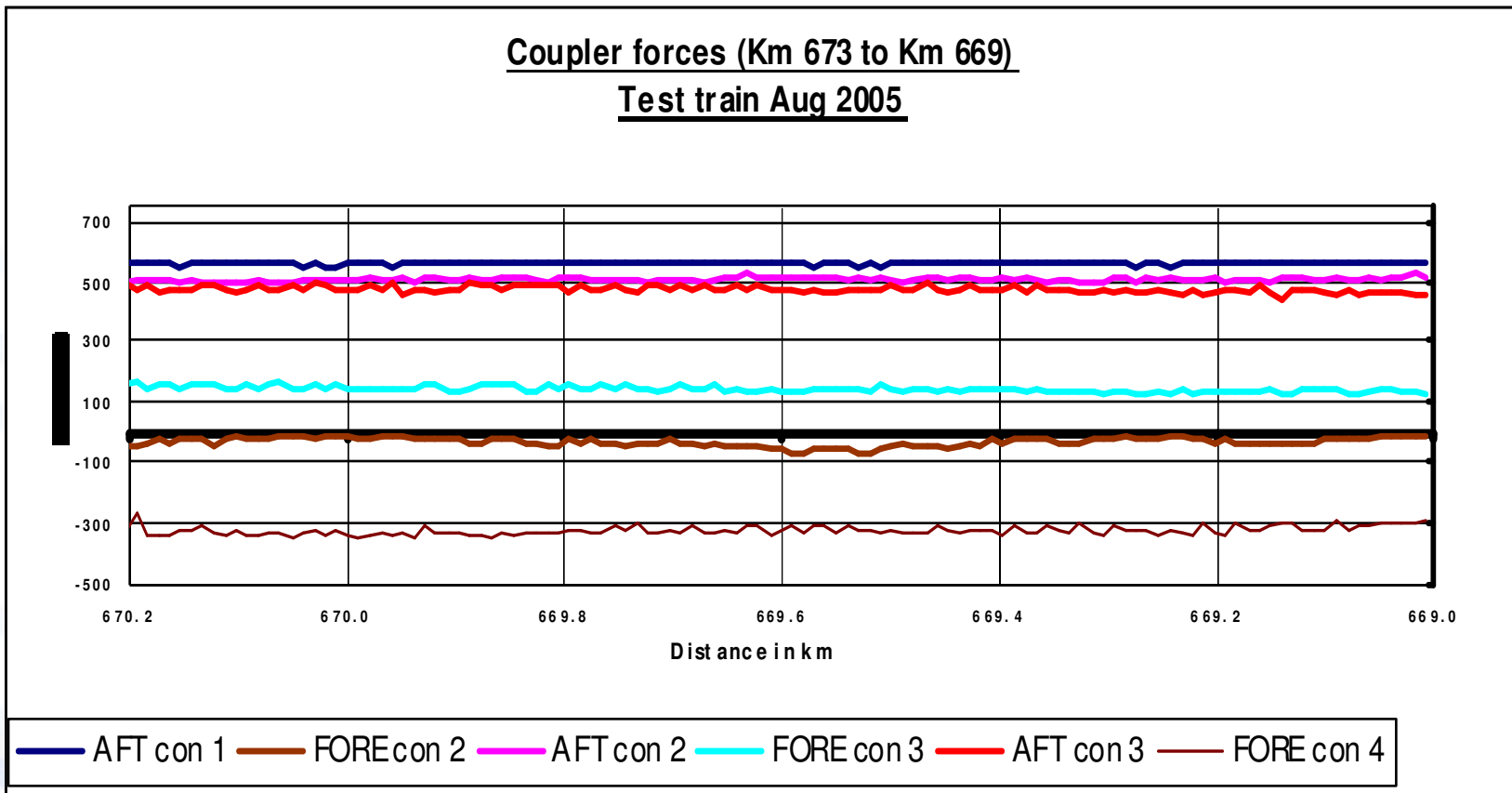
NEXT STEPS:

- **User requirement**
- **Specification**
- **Tender**
- **Adjudication and approval**
- **Issue of works order for Pilot Train (In-service evaluation)**
- **Repeat test of August 2005**
 - **Confirmation of repeater positions (Higher capacity radios)**
 - **Alternative train configuration, more friendly for operating**

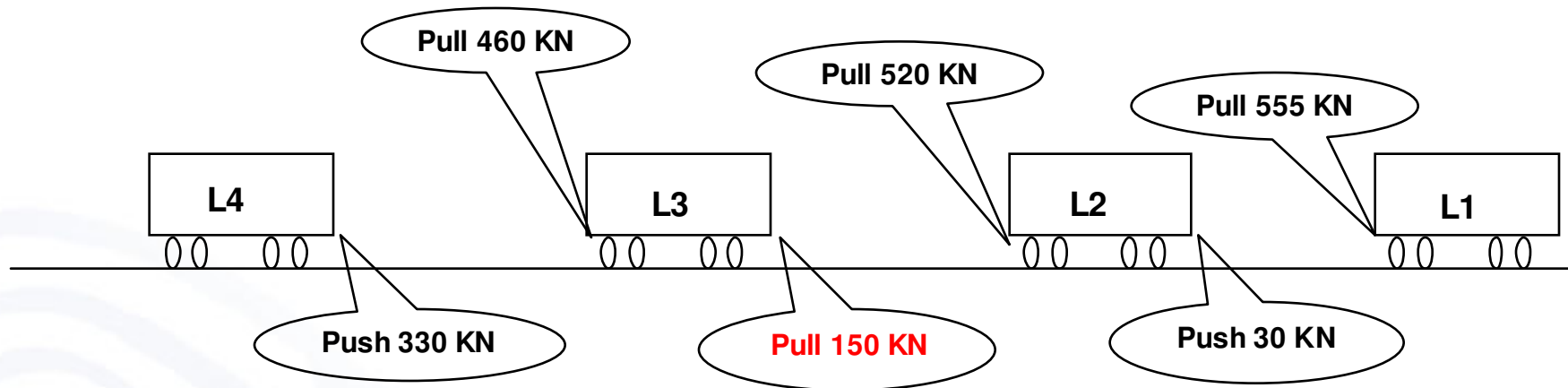
August 2005: Result [Upgradient]



August 2005: Result [Upgradient]

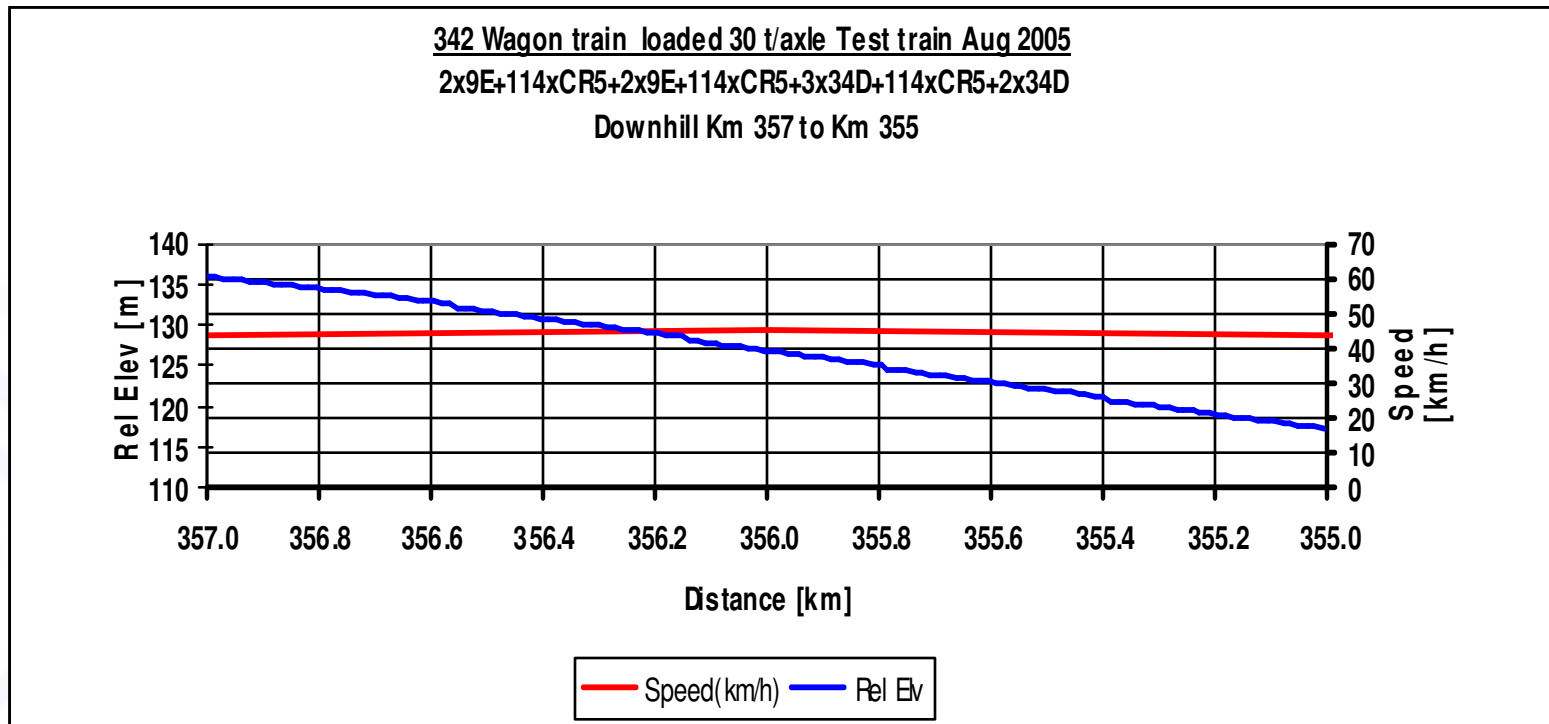


August 2005: Result [Upgradient]

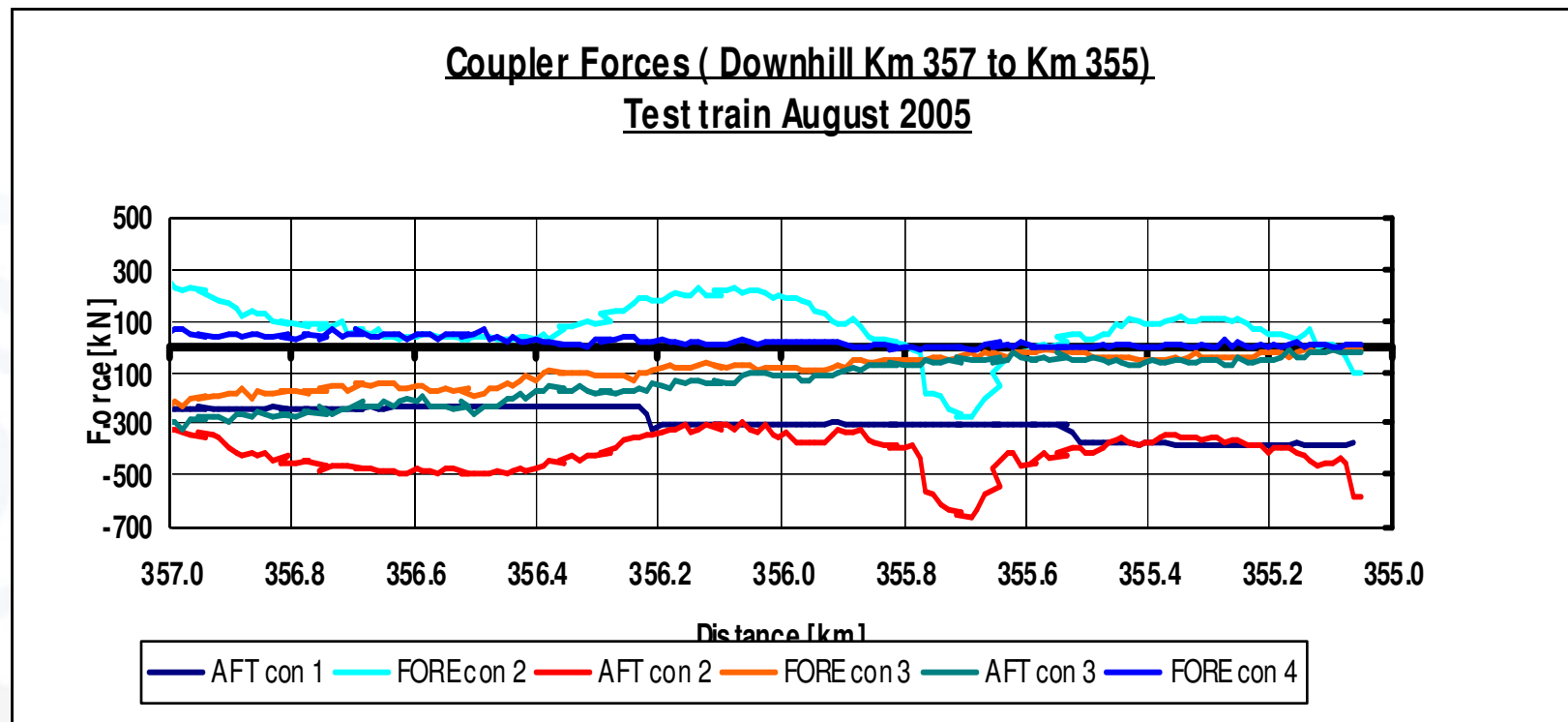


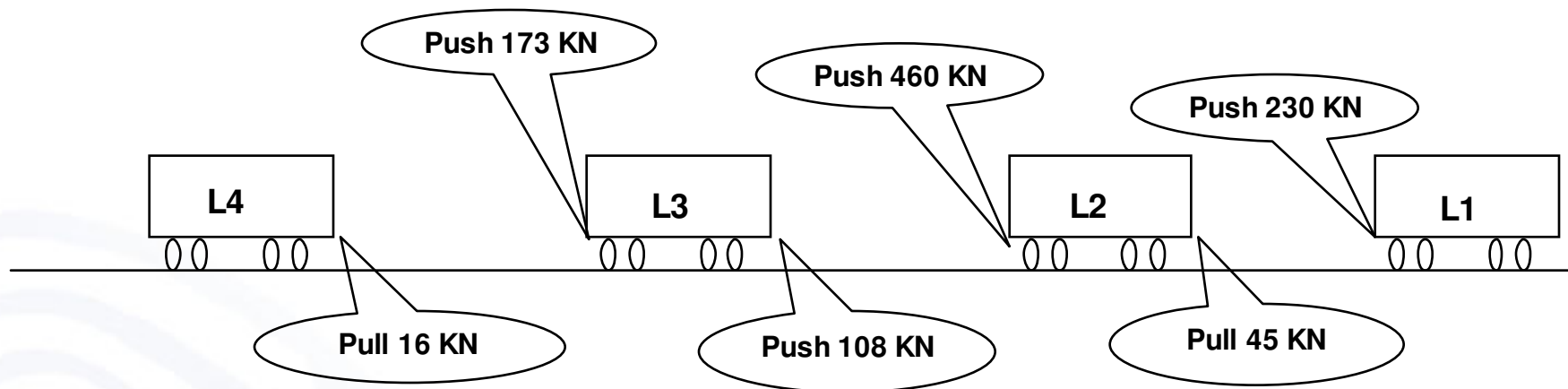
Total = 2045 KN
Theoretical needed = 2093 KN

August 2005: Result [Downgradient]



August 2005: Result [Downgradient]



August 2005: Result [Downgradient]

Total = 1032 KN

Theoretical needed = 3160 KN

Heat input into wheels = 10 KW (Wagon Brakes)

Conclusion of Distributed Power

SUMMARY:

Confirmation that DP Technology deemed to be acceptable and feasible.

- Improved braking performance (Charging and Applications)
- Improved Train Handling
- Controlled Coupler Forces
- Improved Stopping Distances
- Improved Train Compilation and Operations (Time improvements)
- Infrastructure friendly
- Increased throughput
 - Same train slots, same drivers

Future processes:

- **Fitment of RDP Equipment on Locomotives (Locotrol and EBR)**
 - **3 x 9E**
 - **3 x 34 DE**
- **Commissioning test, Evaluation of Pilot train**
 - **Commissioning of Locomotives**
 - **Evaluation of DP performance**
 - **Development of train driver techniques**
 - **Development of train operating procedures**
 - **TRAINING (Driver and Maintenance)**

April 2006

Future processes:

In-service monitoring:

- **One** DP train will be in service for 3 months.
 - Train – Track forces
 - Operational measurements (Cycle time, Speed profiles, Tonnages, etc.)
 - Wheel temperatures
 - In-train forces
 - Braking (charging, applications, stopping distance)
 - Energy usage
 - Drivers reports
- ETC

July 2006

Immediate Challenges and Action:

- Locomotives at back of train:
 - **Communication of RDP, longest distance for supplier**
- EOT, Telemeter at back of train
 - **Communication to front**
- Operational aspects
 - **Procedures**
 - **Loading (“Slow speed loading”)**
- Availability of wagons for commissioning and verification tests.
- **Driver Training:**
 - **Paramount importance = MIND SHIFT**
 - **Need to think of 3 trains, 4 sets of locomotives, stretched over \pm 4 km, as ONE train**

Interesting times ahead

THANK YOU !