

Case Study

April 7 – 10th, 2014

Union Pacific TOR Armor Trial at Moffat Sub Division

The Moffat sub test site was very different than other test sites we have tested the product on. It has severe 10 degree curves, from east to west it is mostly gradients of up to 2% and from west to east it is mostly down-grade. Therefore, we have the locomotives in full power going west while in dynamic braking going east.

Our plan was to replace the existing 16 electric trackside applicators with 3. A competitor's unit was placed at mile post 16.67 (bottom of gradient), another competing unit was placed at mile post 20.25 and a Whitmore unit at mile post 25.29 (top of gradient).

Upon inspection, while wiping the contact patch with a white paper towel, it was evident that the product was evenly spread throughout the entire system. Friction readings were taken at five different locations, on top of high and low rail, as well as gauge face high and low rail before TOR Armor was applied. Friction readings were then repeated once the rail head was coated with TOR Armor.



TOR Armor being carried down track by train.

TOR Armor being carried down track by Hi Railer. Product can clearly be seen in contact patch.

TOR Armor at test site 16.67 UP Railroad.

Average Friction Readings: Dry and Coated with TOR Armor

It was apparent from the top of rail friction readings before the friction modifier was applied, that there are

areas that have top of rail contamination from the gauge face lubricators. There was also a lot of sand used throughout the division to override the grease contamination. It was obvious that after only four days

of applying TOR Armor that the product was overriding the grease contamination on the rail head, friction levels had increased and are getting close to the ideal level of 0.4 and positive.

MP	Top High Rail		Top Low Rail		GF High Rail		GF Low Rail	
	DRY	FM	DRY	FM	DRY	FM	DRY	FM
19.71	0.27	0.31	0.35	0.35	0.20	0.20	0.32	0.32
20.50	0.31	0.35	0.33	0.35	0.19	0.39	0.15	0.38
21.55	0.36	0.44	0.34	0.38	0.25	0.32	0.35	0.32
22.65	0.25	0.36	0.37	0.39	0.18	0.26	0.33	0.33
23.17	0.34	0.35	0.36	0.35	0.30	0.27	0.39	0.34

DRY - before the TOR Armor was applied to the system. FM - after the TOR Armor was applied to the system.

Lateral Force Readings

Lateral force readings were taken at two sites, mile post 19.8 and mile post 23.51. Both sites are in a 10 degree curve. There are roughly 12 to 15 trains per day, some traveling east and some traveling west. There is a difference between the lateral forces when trains are under full power or dynamic braking.

We selected the last 16 eastbound trains at MP 19.8 and the last 12 eastbound trains at MP 23.51.

We managed to get trains that were recorded at both sites, this showed that with two applicators the product traveled from MP 16.6 through MP 19.8 and still had some



TOR Armor filling holes in rail head.

force reductions at MP 23.5, a distance of 5.9 miles, and from MP 25.3 down to MP 19.8, a distance 5.6 miles. There is a slight increase in forces changing from 3 to 2 applicators. However, when trains move from west to east, the force readings between MP 19.8 and 23 are very consistent for the same trains through from MP 19.8 to MP 23. After running with only two applicators for three days and even turning the rate up on the two applicators, it was decided to turn the applicator at MP 20.25 back on again. This showed a good reduction in forces again. The trial using only two applicators over the ten mile stretch was not totally successful, however, we learned a lot from this exercise.

MP	Average Lateral Force Dry		Average Lateral Force with TOR Armor	
	High Rail	Low Rail	High Rail	Low Rail
19.8	14.26	9.42	8.84	5.46
			38% Reduction on High Rail	42% Reduction on Low Rail
23.51	12.25	8.96	8.82	6.09
			28% Reduction on High Rail	32% Reduction on Low Rail

The Results

The final overall results for the average force reduction for all trains on both high and low rail, with three applicators being used through this ten mile sub division are as follows:

- MP 19.8 East bound trains from April 9th to April 15th using three

applicators showed a reduction of 38% in lateral forces.

- MP 19.8 West bound trains from April 9th to April 15th using three applicators showed a reduction of 20% in lateral forces.

- MP 23.0 East bound trains from April 9th to April 15th using three

applicators showed a reduction of 28% in lateral forces.

- MP 23.0 West bound trains from April 9th to April 15th using three applicators showed a reduction of 20% in lateral forces.