

# Case Study

October 23, 2014

## North American Transit Rail Braking and Noise Testing with TOR Armor®

Whitmore Rail's TOR Armor is a top of rail friction modifier designed to provide optimum friction at the wheel-rail interface. High lateral forces lead to loosened tie plates and fasteners and can result in low rail rollover. Engineered for use on freight and transit rail applications, TOR Armor substantially reduces noise, wear and lateral forces.

This field test addressed noise reduction with Whitmore Rail TOR Armor for a transit system that operates both above ground as well as in tunnels. The tunnel lacked sufficient space for trackside measurements, so all testing had to be conducted from on-board the train at the regular track speed of 51 km/hr. At the time of testing, the transit system used a competitor's top of rail friction modifier. This testing was a direct comparison; therefore, all reductions in noise and slip occurrences were because of Whitmore Rail's TOR Armor.

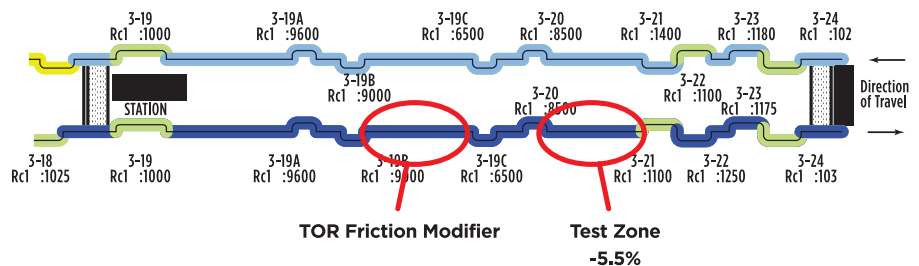


### Braking Test

The first test was the braking test, carried out on a 5.5% down grade with the rail head conditioned with the top of rail product the customer was currently using. The train was run down the gradient at 51 km/hr, and the service brakes were applied. The time taken for the train to stop was recorded at 11.9 seconds for both runs. The testers then hand-applied TOR Armor to the top of both rails for 91 m before the test site. The train ran back and forth over the site three times to spread the product, then the braking test was carried out on the same stretch, again using service brakes. The measurement method used the time taken from initial brake application until the train came to a complete stop. The time for the first stop test on the treated rail was 11.5 seconds, and the second run clocked in at 11.1 seconds. Emergency brakes were not used for this test.

### Safety Assurance Brake Test

	Run	Braking Test (Time in seconds)		Difference
		Before Application	After Application	
Current Product	1	11.9	11.9	
TOR Armor	2	11.5	11.1	0.4

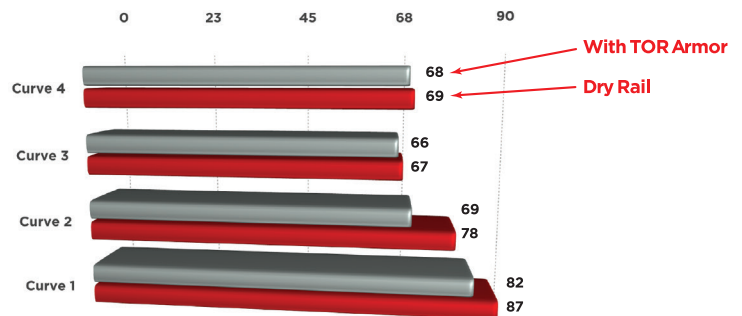


### Noise Readings

Noise readings measured from on-board are considerably lower than noise readings measured from trackside. From trackside, the noise between the wheel and rail is more evident and is illustrated by the stick/slip noise generated from the wheel on the rail; this is the noise that TOR Armor reduces. On-board, other noises occur that TOR Armor has no bearing on and cannot reduce. The average noise reading for four runs on the rail with the previous product applied was recorded as 75.25 decibels. Once again, TOR Armor was

### Noise Readings Before & After TOR Armor Application

The curves have 150 to 200 meter radius



hand-applied to both the rail heads for 91 m just before the noise test site. The train again ran back and forth three times to spread the product, then the noise readings were taken. The average noise reading for four runs with Whitmore Rail's TOR Armor treated rail was 71.25 decibels; the readings

showed an average noise reduction of 3 to 5 decibels. Based on these results, the customer implemented Whitmore Rail's TOR Armor by applying it through a trackside applicator. After three months of operating the system with TOR Armor, the noise level remains low and consistent.

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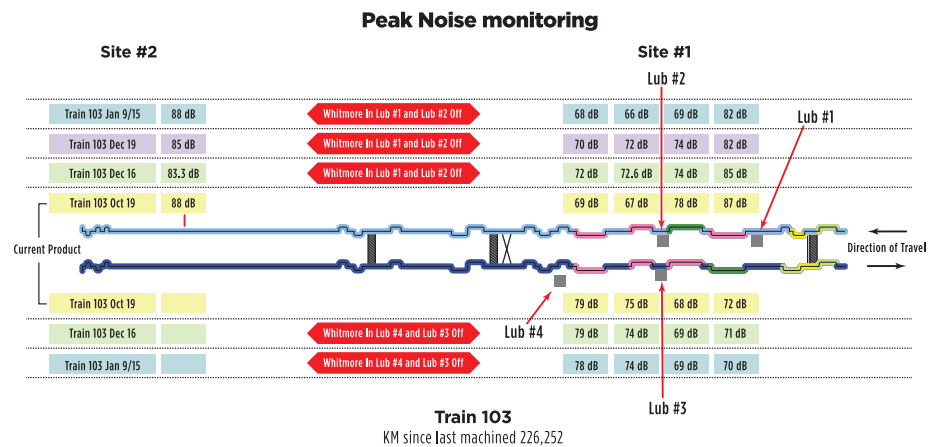
Four applicators were used previously to cover a specified section of track (see the chart here). Once TOR Armor received approval, the customer reduced the number of applicators to two and still achieved and maintained noise reduction.

The transit system also noticed another advantage to Whitmore Rail's TOR Armor—reduced usage. TOR Armor allowed the transit system to reduce the number of applicators by half. Even with fewer applicators, product usage reduced by 66%, offering significant cost savings to the customer.

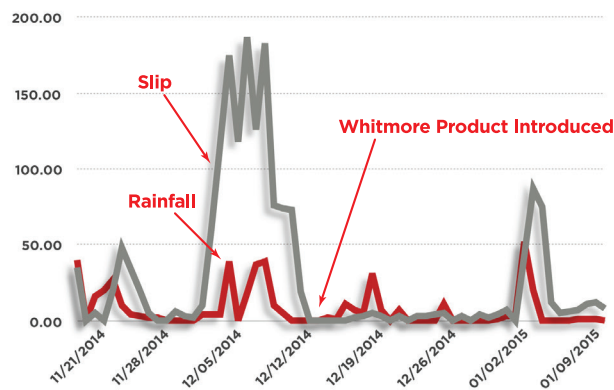
### Slip Occurrence

The final test encompassed the slip occurrence over a given section of track when the rail is both dry and wet from rain. The recorded number of slip occurrences during rain before applying TOR Armor was approximately 180. After TOR Armor implementation, slip occurrences dropped by more than half to approximately 80 for the same section of track.

This series of tests allowed Whitmore Rail and its customer to see how well TOR Armor works for transit applications. The product outperformed the competition and proved itself in less product usage, fewer applicators needed, lower slip occurrences and less noise overall.



### Slip to Rainfall Relationship



### 66% Reduction in Product Use Per Year

