

**Wheel-squeal mitigation measures implemented on the
Mission Valley West extension of the Light Rail Transit
system of San Diego, CA, USA**

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Wheel-squeal mitigation measures implemented on the Mission Valley West extension of the light rail transit system of San Diego, USA



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On 23 November 1997, San Diego Trolley Inc. (SDTI) started revenue services on the 6.1 mile-long (9.7 km) Mission Valley West extension of its light rail transit system (Fig. 1). Soon afterwards, it became apparent that nearby residences and businesses experienced noise caused by the wheels of the light rail vehicles (LRVs) rolling over the new rails, which featured scale and pitting as a result of rolling during their manufacture. In December 1997, rail grinding was carried out to alleviate the problem.

However, shortly afterwards, the Metropolitan Transit Development Board (MTDB) of San Diego and SDTI again started to receive complaints from nearby residents. This time it concerned noise caused by squealing of the wheels of the LRVs. Resolved to reduce and, hopefully, to eliminate this problem, MTDB and SDTI diligently set out to address it.

First, a study was carried out to locate the noise areas on the line. It was found that wheel squeal was produced on curves featuring a radius of less than 1200 feet (365 m) and a grade of 3% or more, as on a rigid track (concrete sleepers and direct fixation) (Figs. 2 and 3).



Fig. 1: The alignment of the Mission Valley West extension

SDTI also found that when grease is applied to new rails, the LRVs do not carry and spread the grease evenly, or very far, over the system. In an effort to overcome this, a portable rail-mounted grinder was used to give the inside gauge corner of the rail a slightly worn profile. Within 24 hours it was clear that the grease was spreading much better, especially through curved track.

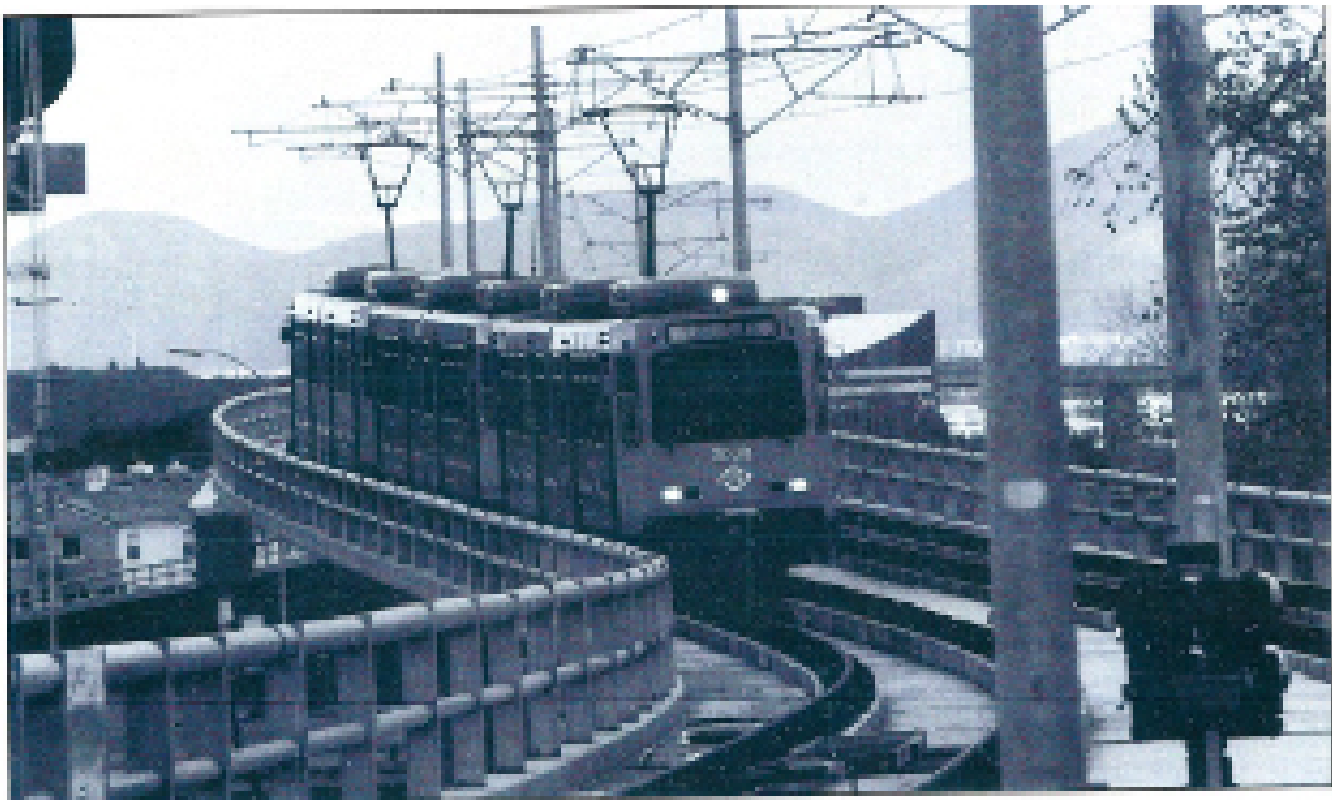


Fig. 2: Light rail vehicle traveling on a deflating curved section of the Mission Valley West extension



Noise could be eliminated for a 24-hour period by hand-applying grease, or using a spray-on graphite lubricant, but this only solved the problem short term as the grease migrated to the top of the rail where it caused wheels to slip thus activating the sanders of the LRVs

Subsequently, the sand would mix with the grease and accelerate the wiping of the grease off the rails. When this was discovered, it was decided to install wayside lubricators

Selection of lubricator location

Initially, the lubricator equipment used to apply the lubricant, and selected based upon:

- service proven technology; and
- low maintenance costs;

was installed on the high rail before curves that produced noise. However, it was found that although in some areas noise was eliminated from the high rail, it was still produced from the low rail in curves, especially in curves featuring tight radii. When contacting the manufacturer with respect to this finding, it was suggested that both rails be treated with wiping bars and that the manufacturer specific formula lubricator lotions be used. The final selection of the current lubricator locations was based on this formula, in combination with experience gained in treating noise.

Selection of lubricants

During the past several years, SDTI has tried many lubricants with varying degrees of success. Problems were experienced when two different lubricating products were used on the same line at the same time. At times, it was found that in areas where the lubricants overlapped, the combination resulted in more noise, rather less. The lubricant finally selected, which has a Teflon base with superb spreading ability and is water resistant, proves to be very effective in mitigating wheel squeal.

Once the lubricators and Teflon-based grease were installed, however, it was found that the problems were not over yet. Fine-tuning by track maintenance personnel was still required. For instance, it was necessary to move some lubricating bars from zero cross level to 1/4-inch superelevation in the track to eliminate the noise. In another area, the wiping car was raised



Fig. 4: Wayside lubricator installation (top), and close-up of attachment to the rail (bottom)

closer to the wheel flange. This allowed the wheels to better spread the grease through the system.

Community involvement and track employee commitment

Throughout the process of implementing the wheel-squeal mitigation measures, MTDB and SDTI were supported by members of the community served by the Mission Valley West extension who, through a spokesperson selected from among them, would report the occurrence of noise to the SDTI Track Supervisor (Fig. 5).

When receiving a complaint, SDTI quickly addressed the situation, reporting back to the spokesperson what had been observed and what measures been taken to remedy the problem. This process helped to speed up problem resolution and, not unimportantly, gain the trust and cooperation of the community.



Fig. 5: Residential properties located very close to the Mission Valley West extension

The Track Department, very much committed to resolve the noise problems, continually monitored and reported any noise that developed on the system. Moreover, personnel was assigned to regularly ride trains and walk the track for the sole purpose of discovering noise and monitoring how the grease was spreading.

On-going inspection and maintenance

SDTI has been keeping records of maintenance inspections for all lubricators installed, detailing what work has been done on each unit. In some areas, the noise suddenly returned. When this happened, the community spokesperson would typically inform the Track Supervisor, whereupon the problem was quickly remedied.

Generally, the called received concerned failure in the lubricator system itself, not a failure of the lubricant applied. A typical lubricator problem has, for instance, resulted from the development of an air gap in the system causing the pumps to cavitate. In other cases, a spring in the activator may have fallen off. All these problems can be very easily remedied.

Currently, the maintenance of the lubricator installations is governed by monthly scheduled inspections and maintenance. Any faults are quickly remedied. Only very rarely now the community spokesperson has to report additional problems.

Conclusions

The wheel-squeal mitigation measures implemented on the Mission Valley West extension have proven to be very effective, and may well prove also to be benefit to other light rail transit systems facing similar wheel-squeal problems.

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