



Leeds station

KELTRACK[®] Noise Reduction



Leeds station is the fourth busiest UK station outside of London, with over 30 million passengers each year. The station is the terminus of the Leeds branch of the East Coast Main Line (on which London North Eastern Railway provides high speed inter-city services to London King's Cross every half hour from the station) and is an important stop on the Cross Country Route between Scotland, the Midlands and South West England connecting to major cities such as Birmingham, Glasgow, Edinburgh, Derby, Bristol, Exeter, Plymouth and Penzance.

L.B. Foster Rail Technologies were asked in August 2021 to consult on nuisance noise complaints received from neighbouring properties close to the west of the station. The location where the noise complaints originated features six tracks on a tight radius curve of 250m radius with train movements both into and out of the station and a number of different vehicle types.

A number of visits to the site to take noise measurements and analyse the frequency spectra to determine the likely source of the noise and provide recommendations on Friction Management solutions for mitigation.

Requirement

Complaints of excessive high frequency noise being generated by rail vehicles travelling in and out of Leeds station prompted the local infrastructure team to contact L.B. Foster Rail Technologies for assistance in understanding the root cause of the noise and recommendations for friction management solutions to mitigate the noise where possible.

Over the course of two visits to the site, over 60 measurements were taken of trains entering and leaving the station past the measurement point.

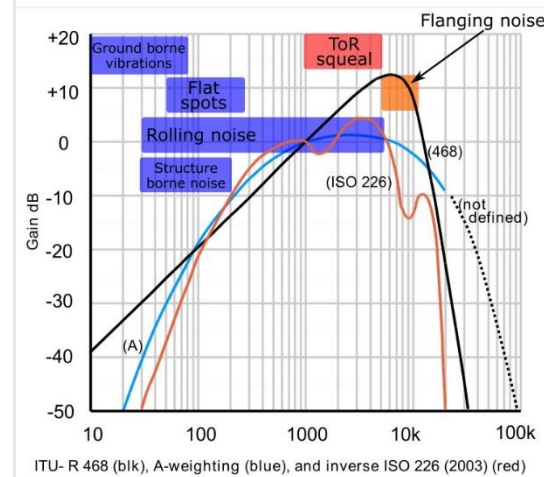
Excessive noise was being generated by all types of vehicles with the average peak noise levels being almost 90dBA at a distance of 7m from the track. Dominant frequencies of the noise were indicative of both curve squeal and flanging noise in the frequency range 1kHz to 10kHz.

Noise caused by rail screech is a mounting issue for railways worldwide as more and more people choose to live alongside these busy transport corridors. The latest data reported by the European Environment Agency (EEA) member countries shows that around 19 million people in the European Union (EU) are exposed to rail noise above 55dB. World Health Organisation (WHO) noise guidelines for Europe strongly recommend reducing noise levels produced by railway traffic below a daytime, evening and night average of 54dB. Noise above this level is associated with adverse health effects including annoyance, sleep disturbance, cardiovascular disease and impairment of cognitive performance in children. The WHO also recommends reducing nocturnal rail noise levels to below 44dB, as night-time railway noise above this level is associated with adverse effects on sleep.*

High frequency noises tend to be the most noticeable and irritating to the human ear and hearing. Rail generated noise such as flanging noise and curve squeal occur in the higher frequencies and therefore are the most common source of noise complaints for the railway.

Fortunately, these two sources of noise can be mitigated with friction management.

Painful Acoustic Trauma	140	Shotgun blast
	130	Jet engine 100 feet away
	120	Rock concert
Extremely Loud	110	Car horn, snowblower
	100	Blow dryer, subway, helicopter, chainsaw
	90	Motorcycle, lawn mower, convertible ride on highway
Very Loud	80	Factory, noisy restaurant, vacuum, screaming child
	70	Car, alarm clock, city traffic
Loud	60	Conversation, dishwasher
	50	Moderate rainfall
Moderate	40	Refrigerator
	30	Whisper, library
	20	Watch ticking
dB levels		



*Source - International Rail Journal

Our solution

Application of KELTRACK® water-based Top of Rail Friction Modifier has been proven to be effective in reducing high frequency noise levels caused by curve squeal and wheel flange contact.

At the Leeds Station site, six lines carry predominantly passenger traffic in and out of the station. The majority of lines being unidirectional with one (Line E) carrying traffic in both directions.

Four L.B. Foster PROTECTOR IV Top of Rail (TOR) units were already in use. Three units were applying KELTRACK® in the inbound direction, whilst the fourth was applying KELTRACK® to only one of the lines in the outbound direction.

Initial noise measurements indicated that the noise levels in the inbound direction were significantly lower than those in the outbound direction and also varied by vehicle type. This is clearly shown for the bi-directional line E on both measurement dates (image middle right) where KELTRACK® was only being applied in the inbound direction. There was also a difference in the frequency distribution of the sound between the inbound and outbound directions, the inbound traffic generating less high frequency noise compared to the outbound direction as shown in the bottom right image.

In order to further improve the noise mitigation and ensure that the KELTRACK® was effective over the entire length of the curve, the application rate was increased on all the units.

The subsequent noise measurements taken approximately one month later under almost identical weather conditions showed a further improvement in noise reduction for all inbound lines of up to 7dBA. (image bottom left)

To reduce noise levels even further, it was recommended to the client that additional units be placed on the outbound lines.

Our research and subsequent deployment of cutting edge friction management solutions are helping Network Rail improve the quality of life for hundreds of people living alongside the railway lines outside Leeds station, whose lives are disturbed by rail screech, caused as trains enter and leave the station.

