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Residential Development vs. Railway Yards

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Introduction

A rail yard is comprised of many noise sources. Unlike a highway a rail yard does not generally emit a constant hum but rather produces separate and distinct sounds. A rail yard can have extended periods of time where no activity and consequently no sounds are evident. In the case of a complaint a rail yard is not subject to provincial noise guidelines nor to any municipal noise by-laws. In fact, most noise by-laws provide exemptions for the railways. Rail yards are federally regulated by the Canadian Transportation Act, which is administered by the Canadian Transportation Agency (CTA). While the CTA can and does enforce the act, the rail activities of the rail operators are not regulated by specific numerical limits. Rail operators are permitted to expand their activities within their boundaries without requiring any approvals.

Despite this seemingly "untouchable" existence, rail yard activities are the subject of complaints and as a result of this the CTA has imposed restrictions on rail activities on a case by case basis. In the case of existing residences adjacent to rail yards, often the only mitigation is relocation of the activities and/or curtailment of the activities. Due to the nature of the operation it is often very difficult (if not impossible) and costly to curtail and/or alter the rail operations. For this reason permitting new residential development adjacent to rail yards is short sighted and may result in catastrophic consequences.

As a result of many hours of sound level measurements made within rail yards and at adjacent receptors and observations of rail yard activities, we have gained a better understanding of the nature of rail yards as well as the sound levels associated with each of the activities. Understanding the operations that take place within a rail yard is important to assisting the planners, engineers and municipalities in developing comprehensive plans that do not expose residential receptors to the wide range of noises and do not expose the railways to controls that are not always practicable nor feasible. The discussion that follows provides a brief description of each of the sources, provides the sound levels of the different types of activities that take place within a rail yard and explores some mitigation options.

Rail Yard Sources

Typically rail yards fall into two categories, a flat yard and a hump yard. The most significant distinction is that in a hump yard trains are made up by pushing rail cars over a hump where the momentum created by the fall enables the rail car to roll unassisted into the classification tracks below until contacting another rail car. The force of the impact "couples" the two cars. This process continues until the train is complete. Acoustically the distinction is that in order to control the distance it travels and the speed of its impact, as the rail car reaches the bottom of the hump, computer activated wheel retarders are applied to modify the car's speed to ensure it reaches the last car in the track at only 4 mph. The braking action of the retarders on the wheels emits a very loud squeal.

The types of sources in a rail yard include (but not limited to):

- Coupling;
- Stretching;
- Locomotive repair;
- Locomotive idling;
- Locomotive load testing;
- Bulk transfer (which could include a shaking device);
- Wheel squeal;
- Wheel retarders;
- Bells/whistles/sirens;
- Auto loading;
- Pre-tripping activities; and
- Leased areas for material transfer.

Each of these sources merits a detailed discussion and analysis, which is outside the scope of this paper. However, a brief discussion of the most "notorious" sources is provided below. In addition, a table is provided summarizing the range of sound levels for the various activities. This is a representative list and is not intended to imply that these activities do not or cannot produce sound levels of different magnitudes.

<u>Coupling Noise</u>

The most distinct and most anticipated sound from a rail yard is <u>coupling</u> noise. This sound is created when two rail cars collide. The resultant sound is classified as impulsive. There is a wide variation in the magnitude of the sound, which depends on the type of rail cars being processed, the speed of the impact, weight of the rail cars, whether the cars are empty or full and the method used to couple the cars.

<u>Locomotive Idling</u>

Locomotives idle within rail yards and on rail lines. In a rail yard the locomotive engine is not always turned off between assignments. Therefore one or more locomotives may be idling in any given area within the yard, especially in the winter when automatic shutdown devices are not activated.

<u>Wheel Retarders</u>

Wheel retarders are generally used in a hump yard to slow rail cars down as they accelerate down the hump. A squeal is emitted during this process. Inert retarders are placed at the ends of the classification tracks to keep free rolling cars from running out the ends. After the train is built, all the cars are dragged through the inert retarders which causes a squeal as each wheel passes through.

<u>Bulk Transfer</u>

The bulk transfer operation involves the use of vacuum systems and/or gravity systems to transfer dry goods from rail cars to trucks or storage areas and visa versa. The noise sources associated with this activity include the vacuum pumps and shakers/vibrators.

Wheel Squeal

Wheel squeal can be emitted any time a rail car moves on the rails, but generally occurs when a rail car goes around a curve, through switches, an incline and when brakes are applied.

Table 1
Sample Sound Levels

Activity	Distance (m)	Range of Sound Levels
Coupling	6	101 dBAI
	15	93 to 101 dBAI
	20	92 dBAI
	35	82 dBAI
	40	81 dBAI
	70	77 dBAI
	100	67 dBAI
	115	65 dBAI
	200	57 to 59 dBAI
Coupling (Llm)	50	82 dBAI to 86 dBAI
Locomotive Idling	50	68 dBA
Stretching	50	79 dBAI
Auto loading	30	79 dBAI
Wheel retarders	50	72 dBA to 116 dBA (max)
Bulk transfer		
vacuum pumps	5	95 dBA
Shakers	13	84 dBA
Gas transfer	20	101 dBA
Pre-tripping activities	20	90 dBAI
Wheel squeal	200	60 to 80 dBA
Locomotive moving	200	62 to 73 dBA
Air brake release	200	73 dBAI

Mitigation Options

The activities and sound levels provided above are only some of the noise sources associated with rail yards. The variation in the location of the activity, magnitude of the sound level and characteristic of the sound does not lend themselves to adequate mitigation. In addition, intervening development, atmospheric conditions and type and elevation of the intervening topography will all affect the propagation of the sound as well as the effectiveness of the mitigation. The various options for mitigation are discussed below.

- relocation of the activity;
- sound barriers;
- modifications to the operation;
- lubrication of the tracks and wheels;
- cessation of the activity;
- no residential receptor permitted adjacent to a rail yard. Separation distances many vary from 300 m to 1000 m plus additional intervening mitigation;
- in the case of new housing, modifications to the house design.

By their very nature, rail yard activities do not easily lend themselves to mitigation at source. The activities are generally all external and take place over very large distances. A rail yard can be 2 to 8 km in length and 300 m to 3.5 km in width. In addition a rail yard operates 24 hours per day, 7 days per week.

The least desirable options, from the railways' perspective are the ones that limit the operation. This includes limitations on the method of operation, type of operation, location of the operation and hours of operation. The use of sound barriers also has its limitations because the magnitude of the sound level is often too great to permit a sound barrier to be effective. The other limitation of sound barriers is that because of the large distances covered by a rail yard, the sound barrier would need to be very long to adequately provide the required coverage. The height, length and maintenance issues associated with sound barriers often make them cost prohibitive, particularly when compared to the overall benefit. However, in the case of existing residences these may be the only options.

The situation is entirely different in the case of new residential developments proposed adjacent to rail yards. The most simplistic and effective mitigation is to not permit residential development adjacent to rail yards or to permit residential development, but with large separation distances. From a municipal and developers' perspective these are the least desirable options. However, acoustically it is not always possible to achieve the desired attenuation through the use of sound barriers and special house designs. In addition these solutions may not be desirable for the following reasons:

- prohibitive cost of tall sound barriers;
- undesirability of tall sound barriers;
- restrictions to the house design that are difficult to sell and ultimately are not enforceable.

The magnitude of the sound, in combination with the characteristic of the sound and the unpredictability of when and where the sound will occur are the fundamental reasons that even with the incorporation of mitigative measures residential developments and rail yards are incompatible uses. Understanding the nature of the rail activities as well as the variability in the sound level is imperative to ensuring that the proper degree of mitigation is incorporated into any proposed residential development.