

**POLICY ON THE  
ENVIRONMENTAL  
PROTECTION**

**OF**

**DEVELOPMENT  
ADJACENT TO  
BCRY AND ACDC  
RAILWAYS**

This policy deals with the situation where new residential development is proposed to be built adjacent to railway rights-of-way. It describes standards and procedures that would be appropriate for determining the measures to be incorporated into such developments to minimize the danger posed by the possibility of derailment, collision or spillage and to mitigate the impact of railway noise and vibration. The measures required for these purposes are implicit to the appropriate development of lands effected by railway operations and therefore must be considered early in the planning process to ensure provide the desired end.

The standards, procedures and measures described have been developed through discussion with other railway operators, and in consultation with engineers and environmental consultants retained by the railway. They take into account various government and professional policies and recommendations and have been applied in practice to developments for several years with good results. A.C.D.C. strongly recommend the adoption of the policies and measures described in this document to ensure safety and environmental protection of all lands near its railway rights-of-way.

**Noise Standards, Prediction of Noise Levels, and Mitigation Measures**

Acceptable noise exposure levels are:

	Equivalent sound Level(Leq)	
	Day: 0700 to 2300	Night: 2300 to 0700
Bedrooms, Sleeping Quarters	35 dbA	35 dbA
Living Rooms	40 dbA	40 dbA
Outdoor Recreation Areas	55 dbA	50 dbA

These noise exposure levels are the maximum that should be permitted at the site of any dwelling, without any exception or concession. Where predictions indicate that higher levels will result, measures should be adopted to bring the levels to or below these maximums.

The prediction of noise levels should be made in accordance with the method prescribed by the Ministry of the Environment. This is the same as that set out in Canada Mortgage and Housing Corporation report 5156 81110 entitled "Road and Rail Noise: Effects on Housing."

The measures to be employed to mitigate noise, in accordance with the provisions of this policy, are:

- Outdoor Noise:** Intervening structures, such as berms, acoustical fence or buildings
- Indoor Noise:** Appropriate construction methods as approved by the Ministry of the Environment.

**Vibration Standards, Predictions of Vibration Levels, and Mitigation Measures**

Vibration of a dwelling may result from both ground-borne vibration and airborne sound waves caused by passing trains.

The prediction of ground-borne vibration levels is to be made by taking measurements of the ground surface vertical vibration at the location of the proposed basement or main structure wall closest to the railway right-of-way, or at the minimum setback distance where the location of buildings has not been decided, and allowing for anticipated future changes, in accordance with methods prescribed by the Ministry of the Environment.

The measures to be employed to reduce ground-borne vibration to acceptable levels are rubber isolation pads between the foundation and the occupied structure, or interruption of the transmission of vibrations through the ground, or other effective measures as approved by the Ministry of the Environment.

In the case of vibration induced by airborne sound waves, adequate protection may be provided by intervening structures between the railway source of the sound waves and the receptor. This can be achieved in several alternative ways:

- by constructing the berm and fence, or alternative noise protection structure, required to interrupt the transmission of noise and sound waves,
- by using solid masonry or similar construction, and appropriate protection of openings, for all dwelling walls exposed to the impact of airborne sound waves,
- by an appropriate combination of the preceding measures,

all of which are to be as approved by the Ministry of the Environment

### **Minimum Berm and Setback Requirements**

To minimize the possibility of residents being affected by a derailment, collision or spillage and to provide a useful degree of protection against railway noise and vibration, no dwelling should be allowed within a minimum setback from the railway right-of-way, and a minimum berm or embankment should be constructed adjacent to the railway right-of-way. The required berm and setback should be determined in accordance with the classification of the railway line, as follows:

<b>Classification</b>	<b>Minimum Berm Height*</b>	<b>Minimum Setback**</b>
<b>Principal Main Lines</b>	<b>2.5m (8 ft.)</b>	<b>30m (100 ft.)</b>
<b>Secondary Main Lines</b>	<b>2.0m (6.5 ft.)</b>	<b>30m (100 ft.)</b>
<b>Principal Branch Lines</b>	<b>2.0m (6.5 ft.)</b>	<b>15m (50 ft.)</b>
<b>Secondary Branch Lines</b>	<b>2.0m (6.5 ft.)</b>	<b>15m (50 ft.)</b>

\* The height is to be measured from the elevation of the top of rail or, where tracks are elevated from the ground level at the toe of the berm closest to the tracks. The side slopes must be stable and drainage must be satisfactory.

\*\* Where the railway line is in a cut the minimum setback may be measured from the bottom of the cut embankment, allowance being made for potential changes in track configuration.

The classification of railway lines is to be done by the railways in accordance with the memorandum "Railway Classification for the Application of Standard Impact Mitigation Measures". The railways will also advise on potential changes in track configuration, and on their requirements for berm construction and drainage.

### **Standard Impact Mitigation Measures**

A set of standard measures has been developed that will satisfactorily mitigate the impact of railway noise and vibration and minimize the possibility of residents being affected by derailment, collision or spillage. It is described in the memorandum "Standard Impact Mitigation Measures, to be Incorporated in the New Residential Developments Alongside Railways". Developments that incorporate the measures called for under this provision will be considered to have adequate safety protection and satisfactory environmental insulation against railway noise and vibration impact.

### **Alternative Procedures by Applicants**

Applicants should have the choice of

- a. incorporating the requirements of Standard Impact Mitigation Measures into their developments,
- or

- b. having an evaluation made by professional noise and vibration consultants of the noise and vibration mitigation measures required, in accordance with the provisions of this policy, and incorporate these measures together with the required safety measures into their developments.

In both cases the minimum required setback and berm should be provided. In addition, the construction of the dwellings closest to the railway should meet the specifications of the Ministry of the Environment for noise and vibration reduction measures.

Municipalities could be authorized to require that where an applicant elects to abide by results of an evaluation he shall pay a fee to the municipality and the municipality shall retain consultants or employ its own qualified staff to carry out the evaluation. Where an applicant elects to have an evaluation made, the evaluation and its conclusions should be submitted to the municipality, the Ministry of the Environment and the railway company whose right-of-way adjoins the development, prior to the submission of any application for approval of the development.

### **Implementation of Approved Measures**

An engineer or architect should be required to certify to the Ministry of the Environment that the development is carried out as approved, incorporating the required mitigation measures.

### **Railway Classification for Application of Standard Impact Mitigation Measures**

Railway lines in Ontario are classified by the railway companies into five classes for the purpose of applying the Standard Impact Mitigation Measures to be incorporated in the New Residential Development Adjacent to Railways. The Classification is based on the present and potential traffic using the lines, and other operating characteristics, and is described below.

#### **1. Principal Main Lines**

- Volume generally exceeds 10 trains per day.
- High speeds, frequently exceeding 80 k.p.h. (50 m.p.h.).
- Includes heavy trains with 3 or 4 power units per train.
- Crossings, gradients etc. may increase normal railway noise and vibration.

#### **2. Secondary Main Lines**

- Volume generally exceeds 5 trains per day.
- High speeds, frequently exceeding 80 k.p.h. (50 m.p.h.).
- Trains generally of light or moderate weight, with 1 or 2 power units per trains.
- Crossings, gradients etc. may increase normal railway noise vibration.

#### **3. Principal Branch Lines**

- Regular scheduled traffic, usually less than 5 trains per day.
- Low speeds limited to 50 k.p.h.(30 m.p.h.).
- Generally of light or moderate weight, with 1 or 2 power units per train, but may include heavier trains with more units.

#### **4. Secondary Branch Lines**

- Intermittent, unscheduled traffic, usually less than 1 train per day.
- Low speeds limited to 50 k.p.h.(30 m.p.h.).
- Trains generally of light weight, with 1 power unit per train.

### **5. Tertiary Branch Lines**

- Unscheduled traffic on a demand basis only.
- Low speeds, limited to 50 k.p.h. (30 m.p.h.)
- Trains of light weight, with 1 power unit per train.

### **6. Industrial Spur Lines**

- Unscheduled traffic on a demand basis only.
- Low speeds, limited to 24 k.p.h. (15 m.p.h.)
- Short trains of light weight, with 1 power unit per train.

### **7. Railway Service Yards & Terminal Stations**

- Frequent traffic, day and night.
- Low speeds, limited to 40 k.p.h. (25 m.p.h.)
- Includes light to heavy trains with up to 4 power units per train.
- In Yards, trains may be assembled and re-arranged.

### **8. Railway Classification Yards**

- Frequent traffic, day and night.
- Low speeds, limited to 24 k.p.h. (15 m.p.h.)
- Includes heavy trains with up to 4 power units per train.
- Single cars may be rolled from humps through braking retarders and assembled into trains.

## **Mitigation Measures to be Incorporated in the Design of New Residential Developments**

The measures are graduated in accordance with the operating characteristics of the rail line the dwellings are to be built close to. Five categories are established for the "normal" situation of a fairly flat tract of land with the houses at roughly the same elevation as the railway tracks. Variation would then apply for the cases where the tracks were in cut or on embankment, with the houses at a higher or lower level, and for larger residential buildings.

All of the Railway lines in Ontario should be classified by the railway companies into one of the classes described in "Railway Classifications for Application of Standard Impact Mitigation Measures". Where the Standard Measures call for site testing and evaluation, this should be scrutinized by the Ministry of the Environment to ensure that the appropriate measures are provided.

## **Standard Impact Mitigation Measures**

### **Category 1: Principal Main Lines**

- a. Berm or combination berm and fence, adjoining and parallel to the railway right-of-way and having extensions or returns at the ends:
  - i. Minimum total height; 5.5 metres above top-of-rail.
  - ii. Berm minimum height; 2.5 metres and side slopes not steeper than 2.5 to 1.
  - iii. Fence, or wall, to be constructed without openings and of a durable material weighing not less than 20kg per square metre (4 lb/sq.ft.) of surface area.
- b. Setback of dwellings from the railway right-of-way to be a minimum of 30 metres.
- c. Ground vibration transmission to be estimated through site testing and evaluation to determine whether it will produce unsatisfactory vibration conditions in dwellings, in excess of the acceptable level. If so, residential buildings within 75 metres from the railway right-of-way to be protected so as to reduce vibration to the acceptable level. The measures employed may be:
  - i. Support the building on rubber pads between the foundation and the occupied structure so that the maximum vertical natural frequency of the structure on the pad is 12 Hz.
  - ii. Insulate the building from vibration originating at the railway tracks by an intervening discontinuity or by installing adequate insulation outside the building, protected from compaction that would reduce its effectiveness so that vibration in the building would become unacceptable, or
  - iii. Other suitable and adequate measures that will retain their effectiveness over time.

### **Category 2: Secondary Main Lines**

- a. Berm or combination berm and fence, adjoining and parallel to the railway right-of-way and having extensions or returns at the ends:
  - i. Minimum total height; 4.5 metres above top-of-rail.
  - ii. Berm minimum height; 2.0 metres and side slopes not steeper than 2.5 to 1.
  - iii. Fence, or wall, to be constructed without openings and of a durable material weighing not less than 20kg per square metre (4 lb/sq.ft.) of surface area.
- b. Setback of dwellings from the railway right-of-way to be a minimum of 30 metres.
- c. Ground vibration transmission to be estimated through site testing and evaluation to determine whether it will produce unsatisfactory vibration conditions in dwellings, in excess of the acceptable level. If so, residential buildings within 75 metres from the railway right-of-way to be protected so as to reduce vibration to the acceptable level. The measures employed may be:
  - i. Support the building on rubber pads between the foundation and the occupied structure so that the maximum vertical natural frequency of the structure on the pad is 12 Hz.
  - ii. Insulate the building from vibration originating at the railway tracks by an intervening discontinuity or by installing adequate insulation outside the building, protected from compaction that would reduce its effectiveness so that vibration in the building would become unacceptable, or
  - iii. Other suitable and adequate measures that will retain their effectiveness over time.



### **Category 3: Principal Branch Lines**

- a. Berm or combination berm and fence, adjoining and parallel to the railway right-of-way and having extensions or returns at the ends:
  - i. Minimum total height; 4.0 metres above top-of-rail.
  - ii. Berm minimum height; 2.0 metres and side slopes not steeper than 2.5 to 1.
  - iii. Fence, or wall, to be constructed without openings and of a durable material weighing not less than 20kg per square metre (4 lb/sq.ft.) of surface area.
- b. Setback of dwellings from the railway right-of-way to be a minimum of 15 metres.
- c. Ground vibration transmission to be estimated through site testing and evaluation to determine whether it will produce unsatisfactory vibration conditions in dwellings, in excess of the acceptable level. If so, residential buildings within 75 metres from the railway right-of-way to be protected so as to reduce vibration to the acceptable level. The measures employed may be:
  - i. Support the building on rubber pads between the foundation and the occupied structure so that the maximum vertical natural frequency of the structure on the pad is 12 Hz.
  - ii. Insulate the building from vibration originating at the railway tracks by an intervening discontinuity or by installing adequate insulation outside the building, protected from compaction that would reduce its effectiveness so that vibration in the building would become unacceptable, or
  - iii. Other suitable and adequate measures that will retain their effectiveness over time.

### **Category 4: Secondary Branch Line**

- a. Berm adjoining and parallel to the railway right-of-way, minimum height; 2.5 metres and side slopes not steeper than 2.5 to 1.
- b. Setback of dwellings from the railway right-of-way to be a minimum of 15 metres.
- c. Ground vibration transmission to be estimated through site testing and evaluation to determine whether it will produce unsatisfactory vibration conditions in dwellings, in excess of the acceptable level. If so, residential buildings within 75 metres from the railway right-of-way to be protected so as to reduce vibration to the acceptable level. The measures employed may be:
  - i. Support the building on rubber pads between the foundation and the occupied structure so that the maximum vertical natural frequency of the structure on the pad is 12 Hz.
  - ii. Insulate the building from vibration originating at the railway tracks by an intervening discontinuity or by installing adequate insulation outside the building, protected from compaction that would reduce its effectiveness so that vibration in the building would become unacceptable, or
  - iii. Other suitable and adequate measures that will retain their effectiveness over time.

### **Category 5: Tertiary Branch Line**

Setback of dwellings from the railway right-of-way to be a minimum of 15 metres.

### **Category 6: Industrial Spur Line**

Setback of dwellings from the railway right-of-way to be a minimum of 15 metres.

**Category 7: Railway Service Yards & Terminal Stations**

- a. Berm or combination berm and fence, adjoining and parallel to the railway right-of-way and having extensions or returns at the ends:
  - i. Minimum total height to achieve required outdoor noise standards to be recommended by a noise consultant and to be submitted for review.
  - ii. Berm minimum height; 2.0 metres and side slopes not steeper than 2.5 to 1.
  - iii. Fence, or wall, to be constructed without openings and of a durable material weighing not less than 20kg per square metre (4 lb/sq.ft.) of surface area.
- b. Setback of dwellings from the railway right-of-way to be a minimum of 15 metres.
- c. Ground vibration transmission to be estimated through site testing and evaluation to determine whether it will produce unsatisfactory vibration conditions in dwellings, in excess of the acceptable level. If so, residential buildings within 75 metres from the railway right-of-way to be protected so as to reduce vibration to the acceptable level. The measures employed may be:
  - i. Support the building on rubber pads between the foundation and the occupied structure so that the maximum vertical natural frequency of the structure on the pad is 12 Hz.
  - ii. Insulate the building from vibration originating at the railway tracks by an intervening discontinuity or by installing adequate insulation outside the building, protected from compaction that would reduce its effectiveness so that vibration in the building would become unacceptable, or
  - iii. Other suitable and adequate measures that will retain their effectiveness over time.

**Category 8: Railway Classification Yard**

Same requirements as Railway Service Yards & Terminal Stations.



### **Variation for Specific Site Conditions**

To take account of variations in topography and in the elevation of the railway tracks relative to the proposed dwellings (e.g. in a cut or on an embankment) the following variations to the Standard Impact Mitigation Measures should be employed where they apply.

#### **a. Height of the Berm and Fence**

- i. To establish the minimum overall height of the berm and fence:
  - Strike a plane from top-of-rail of the track nearest to the property line, where the track is above the dwellings, or furthest from the property line where it is below them, to the ground at the nearest wall of a residential building. Allow for potential new tracks. If the building location has not been established strike the plane from the top-of-rail to the ground at the minimum setback location.
  - Measure the minimum height of the berm and fence above this plane.
- ii. The elevation of the top of the berm should be at least the lesser of:
  - The minimum height of berm above the top-of-rail elevation, or
  - The minimum height of berm above the ground level at the toe of the berm closest to the tracks.

#### **b. Setback of Dwellings**

Where the railway tracks are in cut the minimum setback may be reduced by the length of the face of the cut measured on a vertical cross-section through the proposed dwelling. Allowance should be made for any potential changes in track configuration.

**Note:** Where railway tracks are on embankment at an elevation substantially above the nearest dwelling, and it is not feasible to construct a berm and fence to the required height, the Ministry of the Environment may authorize the construction of block buildings beyond the minimum setback provided the required berm is built. In such cases provision should be made for the required outdoor recreation area on the side of the buildings away from the tracks and the construction of the building should be designed to ensure that the indoor noise and vibration levels are satisfactory, according to the requirements of the Ministry of the Environment.

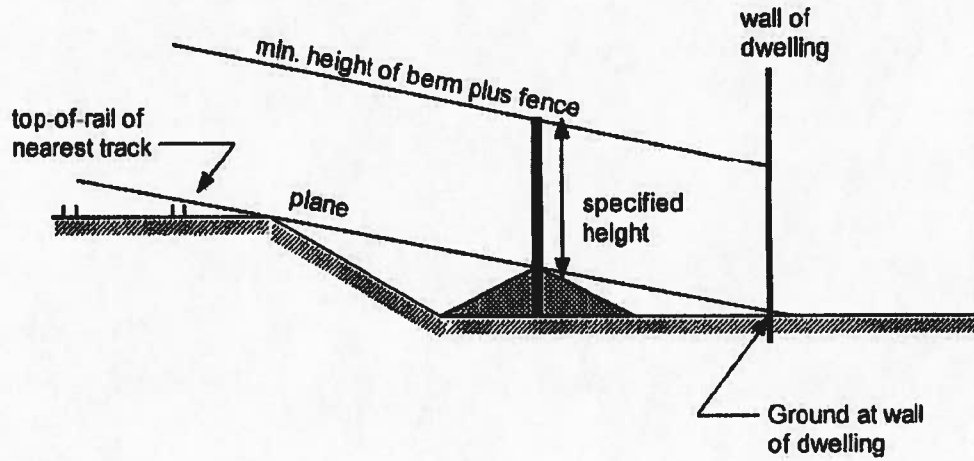
### **Provisions for Building Construction**

- a. An unoccupied building (e.g. garage) may be built as close to the right-of-way as the fence location, and serve the purpose of the fence, provided:
  - an earth berm embankment is provided between it and the right-of-way to the specifications required for the berm.
  - the wall facing the right-of-way is of solid masonry above the berm and without openings to at least the height required for the berm and fence.
- b. The construction of residential buildings should be designed to achieve the required reduction in noise and airborne-soundwave induced vibration from outdoor to indoor conditions in accordance with the Ministry of the Environment specifications. This applies to tall buildings and multiples as well as to detached homes.

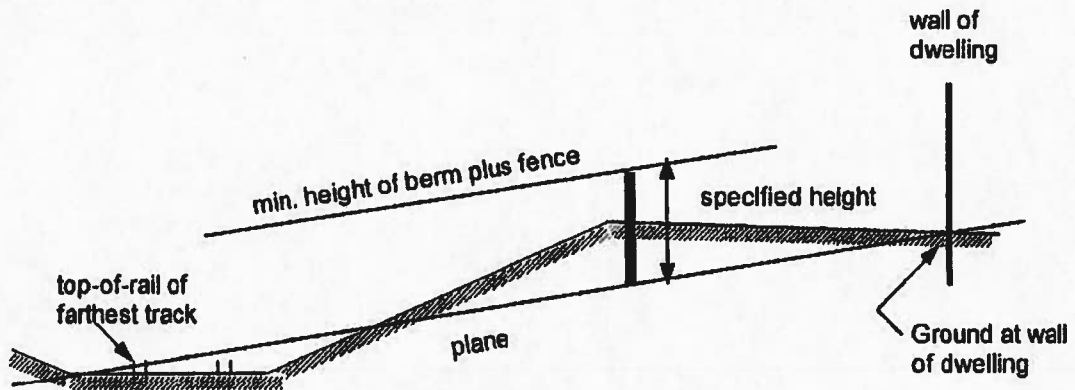
## Sketches Illustrating "Variations for specific Site Conditions"

### A. Height of the Berm and Fence

- i. Minimum overall height of the berm and fence where tracks are at a different elevation from houses.
  - a. Where tracks are above dwellings:

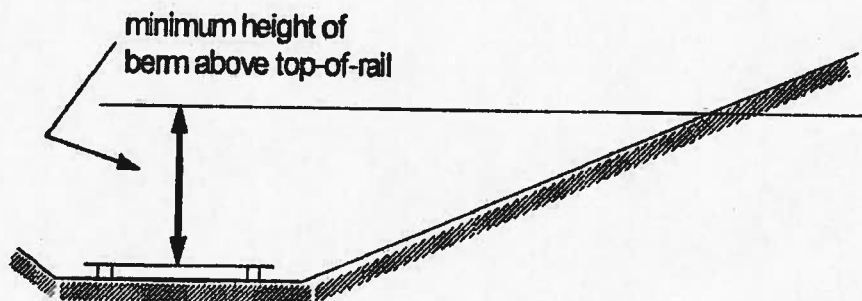


- b. Where tracks are below dwellings:

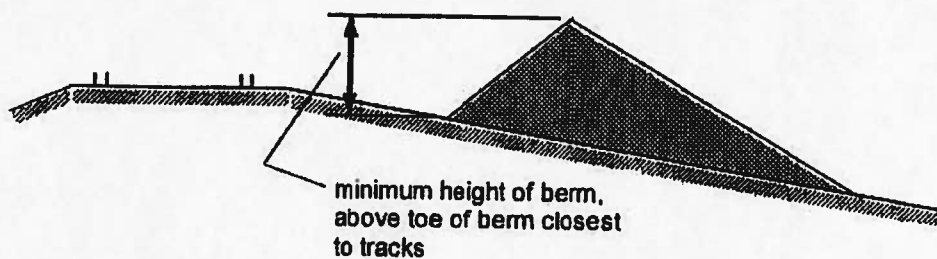


ii. Minimum height of the berm where tracks are at a different elevation from dwellings.

a. Where tracks are depressed:

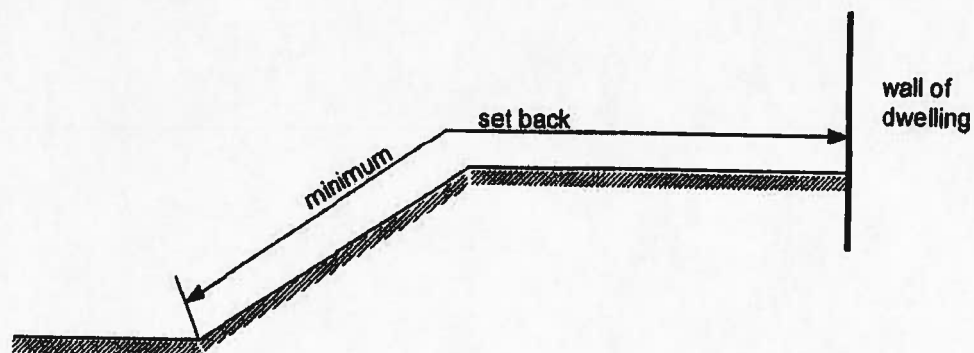


b. Where tracks are elevated:



## B. Setback of Dwellings.

Where tracks are in a cut:



**Note:** In all cases, allowance must be made for potential changes in track configuration.