APPENDIX C
NOISE AND VIBRATION

CONTENTS

Noise and Vibration Methodology

Preferred Alternative Noise and Vibration Contour Maps

Route B Alternative Noise and Vibration Contour Maps

Preferred Alternative and Route B Alternative Joint Segment Noise and Vibration Contour Maps

This Page Intentionally Left Blank

NOISE AND VIBRATION METHODOLOGY

Noise and Vibration

This section discusses the methodology and potential impacts related to the operational airborne noise and vibrations from the proposed Chicago to Iowa City Project. The noise analysis followed Federal Transit Administration (FTA) guidelines published in “Transit Noise and Vibration Impact Assessment” (May 2006). The FRA published virtually identical guidance for assessing noise and vibration from high speed passenger trains in 2005. The Project team performed a Screening Noise Assessment using aspects of the General Noise Assessment and General Vibration Assessment in accordance with FTA guidelines. Both existing and future rail traffic were evaluated in order to assess the incremental, Project-related effects of airborne noise. Analysis results identified a limited number of potential noise impacts throughout the Project corridor. Noise from horns and wheel-rail interaction (wayside noise) contribute to the projected noise impacts. The methodology used to assess Project-related noise is based on guidance provided by the FRA for use in Tier 1 NEPA review.

1.0 Noise Evaluation Criteria

The FTA and FRA established similar procedures and guidelines for assessing train noise. Train noise is expressed in units of A-weighted decibels (dBA) as a function of time. The time descriptor used in this train noise assessment is the day-night noise level (Ldn). The Ldn can be thought of as a 24-hour average noise level that penalizes noise events that happen at night because most people are more annoyed by noise at nighttime than during the daytime.

This Tier 1 Service-level (programmatic) NEPA noise assessment assessed Project-related noise at land uses where overnight sleep occurs (primarily residences); this is consistent with FRA guidance for Tier 1 Service-level NEPA review. Residences were identified by visual inspection of digital aerial photographs; no windshield surveys were performed. The impact assessment, discussed later in this document, uses the term receptors to refer to land uses where overnight sleep occurs; each noise impact identified later in this report represents a single receptor, or land use where overnight sleep occurs.

This EA also performed a cursory review of land use adjacent to the Project corridors to determine where parks abut the rail lines. Visual inspection of digital aerial photographs and a limited search of the Internet identified a small number of parks immediately adjacent to the rail corridors. There may be other small parks that didn’t get picked up at this screening-level of analysis. Analysis results show that the incremental increase in the distance to the noise impact contour (the point at which noise impacts are no longer predicted to occur) in most instances is less than 20 feet. This small incremental change is nominal at this level of analysis, and impacted parks will be identified using the residential noise impact contours. Therefore the actual noise effect upon parks is minimal because the incremental change in noise is so small. Also, the Project will not introduce a noise source that is unfamiliar in the parks, (for the purposes of this analysis, diesel locomotives are assumed to sound the same). Therefore, this incremental increase does not merit a site-specific discussion of Project-related noise impacts at parks. Refer to Section 3.11, Parks and Federally or State-listed Natural Areas for additional information.

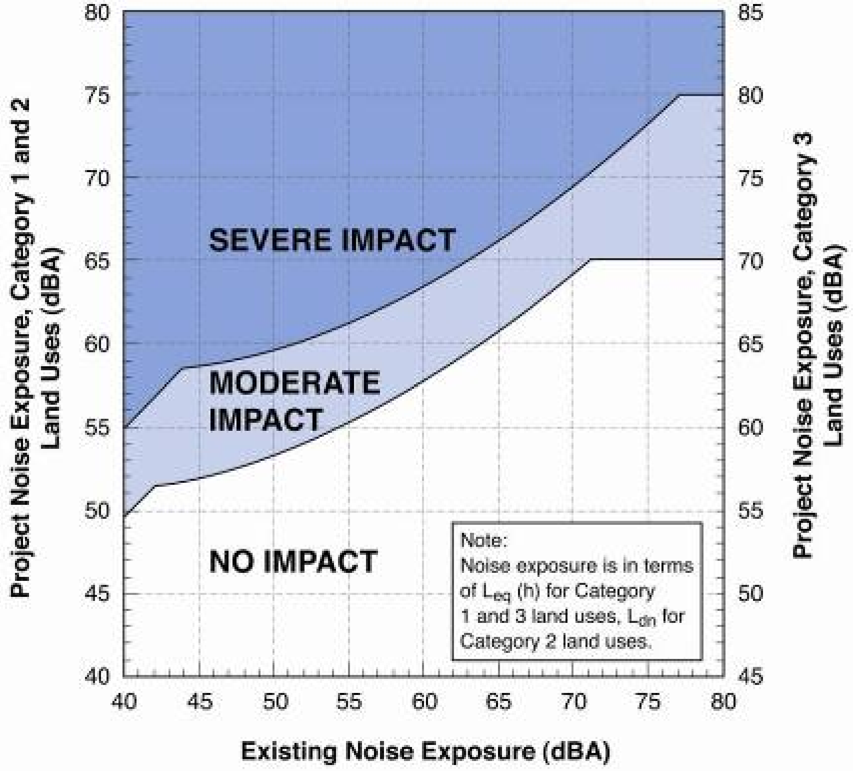
The FTA noise impact criteria (summarized in Figure 1, FTA Noise Impact Criteria) are defined by two curves, representing severe and moderate noise impacts, which are defined below.

Severe Impact. A significant percentage of people are highly annoyed by noise in this range. Noise mitigation would normally be specified for severe impact areas unless it is not feasible or reasonable (unless there is no practical method of mitigating the impact).

Moderate Impact. In this range, other project-specific factors are considered to determine the magnitude of the impact and the need for mitigation. Other factors include the predicted increase over existing noise levels, the types and number of noise-sensitive land uses affected, existing outdoor-indoor sound insulation, and the cost-effectiveness of mitigating noise to more acceptable levels.

The FTA noise impact criteria are summarized in Chart 1 (FTA Noise Impact Criteria) below. The chart illustrates existing noise exposure and project-related noise exposure, and demonstrates that FTA noise impact thresholds vary with existing noise levels. Although the chart below references all three land use categories used by FTA, this analysis focused on Category 2 (land uses where overnight sleep occurs).

Chart 1 FTA Noise Impact Criteria



The first step in the noise assessment is to identify existing noise levels. This assessment used methods published by FTA (2006) to estimate existing noise levels based on factors such as proximity to roadways, highways, and railroads, and also by population density. Per FTA guidance, the highest estimate of existing noise levels produced by these methods was incorporated into this analysis. In accordance with FTA and FRA guidance, this analysis used the existing noise level to identify the noise impact threshold. The noise impact threshold is determined by locating the measured or estimated existing noise level in a table published by FTA and FRA; the table identifies noise impact thresholds corresponding to the existing noise levels. Using the methods described above, this analysis determined an existing noise Ldn of 62 dBA for lands immediately adjacent to the rail line everywhere throughout the Project corridors.

The range of train volume and speeds present in the Project corridors were summarized into a series of eight traffic conditions (A through H), as shown in Table 1. This allowed the corridor to be subdivided into sections with similar train traffic characteristics. A series of “traffic conditions”, or zones, were established throughout the rail line; each traffic condition represents a range of similar rail traffic and surrounding land use (and existing noise levels). Assigning traffic conditions to the Project corridor allowed the corridor to be logically subdivided into sub-sections, simplifying the noise analysis.

Table 1
Summary of Traffic Conditions

Traffic Condition	Trains per Day	No. of Locomotives	No. of Cars	Speed
	Freight Trains			
A	10.0	2.9	125.3	40
B	10.0	2.9	125.3	15
C	18.5	2.6	90.7	60
D	0.0	0.0	0.0	0
E	0.0	0.0	0.0	0
F	36.0	2.6	74.8	37
G	36.0	2.6	74.8	60
H	36.0	2.6	74.8	60
	Passenger Trains			
A	0.0	0.0	0.0	0
B	0.0	0.0	0.0	0
C	7.8	1.5	9.8	60
D	53.7	1.0	12.7	60
E	53.7	1.0	12.7	60
F	89.1	1.0	11.4	37
G	89.1	1.0	11.4	60
H	89.1	1.0	11.4	60
	Future Passenger Trains			
A	4.0	1.0	8.0	79
B	4.0	1.0	8.0	15
C	4.0	1.0	8.0	79
D	4.0	1.0	8.0	60
E	4.0	1.0	8.0	60
F	4.0	1.0	8.0	37
G	4.0	1.0	8.0	70
H	4.0	1.0	8.0	55

In general, Traffic Condition A was defined for the rail sections along Route A from Iowa City to Wyanet (except the vicinity of Moline which was assigned Traffic Condition B), and from Wyanet to Joliet along Route B. Traffic Condition C includes the rail sections from Wyanet to Aurora along Route A. Traffic Condition D was assigned to the sections between Joliet and Englewood along Route B. Traffic Condition E was assigned from Aurora to Chicago along Route A, and from Englewood to Chicago along Route B. Conditions F through H were assigned from Aurora to Chicago along Route A.

The range of development density present throughout the Project corridor was simplified into the three land use categories used in the FRA horn noise model (rural, suburban, and urban). The shielding assumptions used in that model, for each respective land use, were also incorporated into this analysis. A series of “noise conditions” were then created by combining traffic conditions and the three categories of development density. Table 2, below, summarizes the Noise Condition definitions. Figures C-1 through C-3 show the assigned Noise Conditions.

Table 2
Noise Condition Definitions

Noise Condition	Traffic Condition	Development Density
1	A	Rural
2	A	Suburban
3	B	Suburban
4	A	Urban
5	C	Rural
6	C	Suburban
7	D	Urban
8	D	Suburban
9	E	Urban
10	F	Urban
11	G	Urban
12	H	Urban

Assigning noise conditions to the Project corridor allowed the corridor to be logically subdivided into sub-sections with similar rail traffic, building-induced shielding characteristics, existing noise levels, and therefore noise impact thresholds (thus simplifying the noise analysis). The moderate noise impact threshold was 59 dBA and the severe noise impact threshold was 64 dBA, both on an Ldn basis.

The FRA grade crossing database was incorporated in this assessment. It was used to identify the locations of public at-grade rail crossings where locomotive horns are used, and also to identify where quiet zones exist. Based on the FRA database, this analysis assumes that a quiet zone exists between Chicago and Aurora on Alternative A (the northern route). In addition, according to the FRA grade crossing database all crossings appear to be grade-separated between Chicago and Englewood on Alternative B (the southern route). These portions of the Project area comprise much of Noise Condition 9. Therefore, horns are apparently not used on any Noise Condition 9 rail sections, and locomotive horn analyses were not performed for Noise Condition 9.

The FRA locomotive horn noise model does not allow a modeler to model several different trains at the same time, and was therefore not used on this analysis. The horn noise contours were created using methods in the FTA and FRA guidance documents, and incorporating some of the features of the FRA horn noise model (the 1/4-mile horn noise zone distance, and the shielding equations).

1.1 No-Build Alternative

This analysis assumes that train-induced noise does not change anywhere throughout the Project area under the No-Build Alternative.

1.2 Two Round Trip Trains per Day

Both the existing and proposed (two round trip passenger TPD) rail traffic was assessed; this allowed the analysis to identify the incremental increase in train noise effects on residential land uses in the Project area – which is reported in the sections below. This portion of the analysis is based on the proposed addition of two round-trip passenger TPD at 79 mph from Chicago to Iowa City. Existing noise impacts were determined by modeling existing train traffic and plotting the resulting noise impact contour.

1.2.1 Preferred Alternative (Route A – Amtrak-BNSF-IAIS)

Table 3 presents the incremental increase in noise impacts at residential land uses adjacent to the Preferred Alternative. The table presents noise impacts predicted to occur in each municipality along the Preferred Alternative, according to moderate and severe grade crossing and wayside (wheel/rail) noise impacts. The portion of the route unique to Route A is distinguished from the portion of the route that would be the same for Routes A and B. The entire corridor was evaluated; rural areas are listed as unincorporated in the table below.

Table 3
Incremental Increase in Noise Impacts Associated with the Preferred Alternative

Municipality	Moderate		Severe		Total
	Grade Crossing	Wayside	Grade Crossing	Wayside	
Alignment A					
Arlington	1		2		3
Aurora		1			1
Berwyn		3		2	5
Brookfield		3		5	8
Chicago		8		5	13
Clarendon Hills		2		4	6
Downers Grove		6		1	7
Earlville	8		2		10
Hinsdale		2			2
Leland	2		6		8
Lisle		1			1
Malden	1		3		4
Mendota	3	1		1	5

Municipality	Moderate		Severe		Total
	Grade Crossing	Wayside	Grade Crossing	Wayside	
Montgomery	4				4
Naperville		1		1	2
Plano	10		5		15
Princeton	1			1	2
Riverside		13		10	23
Sandwich	10		4	1	15
Somonauk	3	1	1		5
Western Springs		3		3	6
Westmont		4			4
Wyanet	6		1		7
Unincorporated	5	9	5	12	31
Common Section					
Annawan, IL	3		1		4
Atalissa, IA	3		6		9
Atkinson, IL	4				4
Carbon Cliff, IL	1	1			2
Colona, IL	9	2	3	1	15
Davenport, IA	17	15	1	2	35
Durant, IA	9				9
East Moline, IL	39		8	4	51
Geneseo, IL	12		1		13
Green River, IL	1				1
Iowa City, IA	1	6	1	9	17
Mineral, IL	1		3		4
Moline, IL	37	4	6	3	50
Rock Island, IL	2	1	6		9
Sheffield, IL	2				2
Silvis, IL	2				2
Stockton, IA	1	2	3		6
Walcott, IA	7				7
West Liberty, IA	4				4
Wilton, IA	5		1		6
Unincorporated	10	4	6	2	22
Alternative A Totals	**224**	**93**	**75**	**67**	**459**
	317		**142**		

Analysis results show a low incremental increase in noise impacts per mile associated with the Preferred Alternative. The Preferred Alternative is projected to result in: 1.5 new moderate noise impacts per mile; 0.7 new severe noise impacts per mile, and a combined average total of 2.1

noise impacts per mile. On this basis, the incremental increase in train noise is not considered to be significant for this analysis. The table above shows that the distribution of Project-related noise impacts is scattered throughout the Project corridor. Areas with high existing traffic volumes, and quiet zones are expected to experience a minor incremental increase in train noise associated with the Preferred Alternative. Conversely, areas with low existing traffic volumes, slow trains, and fewer or no quiet zones are expected to experience a larger incremental increase in train noise associated with the Preferred Alternative.

Table 3 reflects the trend of a low incremental increase in noise impacts in Chicago where train volumes are already higher than elsewhere in the corridor but much of the area along the Preferred Alternative consists of a quiet zone. Analysis results show that municipalities in the Quad Cities, where train speeds and volumes are low, and quiet zones do not exist, are likely to experience a larger incremental increase in train noise levels and corresponding impacts associated with the Preferred Alternative. The influence of quiet zones on the magnitude of the incremental increase in train noise impacts suggests they represent an opportunity to mitigate many of the predicted train noise impacts.

1.2.1.1 Route B Alternative (AMTRAK-CN-METRA/ROCK ISLAND DISTRICT-CSXT-IAIS)

Table 4 presents the incremental increase in noise impacts at residential land uses adjacent to the Route B Alternative. The table presents noise impacts predicted to occur in each municipality along the Route B Alternative, and sorts the impacts in to moderate and severe grade crossing and wayside (wheel/rail) noise impacts. The portion of the route unique to Route B is distinguished from the portion of the route that would be the same for Routes A and B. The number of moderate and severe noise impacts in unincorporated, rural areas is also quite low due to the low density of development in these areas.

Table 4

Incremental Increase in Noise Impacts Associated with the Route B Alternative

Municipality	Moderate		Severe		Total
	Grade Crossing	Wayside	Grade Crossing	Wayside	
Alignment B					
Blue Island	5	4	1	1	11
Bureau Junction	5		5		10
Chicago	12	12	13	11	48
De Pue	4				4
Joliet	2	2	2		6
La Salle	2	2			4
Marseilles	18	4	4	4	30
Midlothian	2	1			3
Minooka	12				12
Mokena	5		1	1	7
Morris	10				10
New Lenox	1		1		2
North Utica	5		2		7
Oak Forest		5		1	6

Municipality	Moderate		Severe		Total
	Grade Crossing	Wayside	Grade Crossing	Wayside	
Ottawa	6		2		8
Peru	2				2
Rockdale	1				1
Seneca	2				2
Spring Valley				1	1
Tinley Park	1		1		2
Tiskilwa	2	1			3
Unincorporated	1	3	5		9
Common Section					
Annawan, IL	3		1		4
Atalissa, IA	3		6		9
Atkinson, IL	4				4
Carbon Cliff, IL	1	1			2
Colona, IL	9	2	3	1	15
Davenport, IA	17	15	1	2	35
Durant, IA	9				9
East Moline, IL	39		8	4	51
Geneseo, IL	12		1		13
Green River, IL	1				1
Iowa City, IA	1	6	1	9	17
Mineral, IL	1		3		4
Moline, IL	37	4	6	3	50
Rock Island, IL	2	1	6		9
Sheffield, IL	2				2
Silvis, IL	2				2
Stockton, IA	1	2	3		6
Walcott, IA	7				7
West Liberty, IA	4				4
Wilton, IA	5		1		6
Unincorporated	10	4	6	2	22
Alternative B Totals	**268**	**69**	**83**	**40**	**460**
	337		**123**		

The Route B Alternative is projected to result in: 1.4 new moderate noise impacts per mile; 0.5 new severe noise impacts per mile, and a combined total of 2.0 noise impacts per mile. On this basis, the incremental increase in train noise is not considered to be significant for this analysis. The table above shows that the distribution of Project-related noise impacts is also scattered throughout the Project corridor. Unlike the Preferred Alternative, the Route B alternative does not contain a quiet zone in the Chicago metro area. As a result, train noise impacts are predicted to be higher along this alternative. Consistent with the Preferred Alternative, areas with low existing traffic volumes, slow trains, and no quiet zones are also expected to experience a larger incremental increase in train noise associated with the Route B Alternative.

Table 4 also reflects the trend of high incremental increase in noise impacts in Chicago and in the Quad Cities. The number of noise impacts in unincorporated, rural areas is comparable to the Preferred Alternative. The absence of quiet zones on the Route B Alternative and its influence on the magnitude of the incremental increase in train noise impacts also suggests that they represent an opportunity to mitigate many of the predicted train noise impacts.

1.2.2 Five Round-Trip Trains Per Day

The MWRRI envisions five round-trip trains per day (TPD) – at 90 mph, from Chicago to Wyanet, Illinois; and 79 mph from Wyanet to Iowa City, Iowa. This level of increased train activity was assessed in this Tier 1 Service-level (programmatic) NEPA review to help inform the reader of the likely potential impacts from the complete implementation of the MWRRI vision. (A separate NEPA analysis would be required prior to increasing the train numbers and speeds.)

Five round-trip TPD were evaluate using the same methods and modeling approach as described in the previous section, but with increased future passenger train traffic. Table 5 presents a simple comparison of noise contour distances under each of the ranges of rail traffic.

Table 5
Impact Threshold Contour Distances

Noise Condition	Existing Moderate Impact	4-TPD Moderate Impact	10-TPD Moderate Impact	Existing Severe Impact	4-TPD Severe Impact	10-TPD Severe Impact
Wayside Contour Distances (ft)						
1	*274*	*295*	324	*126*	*136*	*149*
2	200	212	229	*126*	*136*	*149*
3	264	296	336	*179*	207	245
4	183	194	210	126	136	149
5	391	408	*432*	*180*	*188*	*199*
6	266	275	287	*180*	*188*	*199*
7	203	210	203	*104*	*108*	*104*
8	222	229	222	143	149	143
9	203	210	203	104	108	104
10	281	286	281	149	152	149
11	256	261	256	134	137	134
12	256	261	256	134	137	134
Grade Crossing Contour Distances (ft)						
1	*377*	*404*	441	*258*	*285*	*323*
2	349	375	410	*200*	*206*	*229*
3	504	570	647	*291*	336	391

Noise Condition	Existing Moderate Impact	4-TPD Moderate Impact	10-TPD Moderate Impact	Existing Severe Impact	4-TPD Severe Impact	10-TPD Severe Impact
4	323	348	381	174	189	210
5	436	458	*483*	*318*	*342*	*371*
6	405	426	450	*225*	*239*	*255*
7	505	520	505	*291*	*301*	*291*
8	541	556	541	316	326	316
9	505	520	505	291	301	291
10	720	731	720	444	452	444
11	613	621	613	366	372	366
12	613	624	613	366	374	366

Note: Italicized contour distances do not include a shielding correction because the corrected distance is less than the FRA-assumed threshold distance for applying shielding in areas with the specified density of development. TPD means trains per day.

The table above shows that the incremental increase in noise impact contour distances associated with the five round trip TPD scenario is greatest in noise condition 3 areas where train speeds are slow and development density and shielding is classified as suburban. The incremental increase in noise impact contours is least in noise condition 9 areas where development density is high and train volumes are high.

1.2.3 Noise Mitigation Opportunities

As shown above, the presence or absence of quiet zones has a large effect on the predicted number of train noise impacts. Locomotive horn use at public-at grade crossings causes the majority of the predicted noise impacts. Therefore, minimizing locomotive horn use in the Project area represents the greatest opportunity to mitigate potential Project-related noise impacts. The Project would upgrade some electronic circuitry due to installation of constant time circuitry (warning lights) at public at-grade roadway-rail crossings. In effect, the Project would install the electronic infrastructure for quiet zones. Municipalities predicted to experience an increase in train noise impacts can chose to initiate the process of developing quiet zones, and to take advantage of the infrastructure provided by the proposed Project. The largest concentration of anticipated noise impacts would be in the Quad Cities region. The following additional receptors would be impacted under either alternative route: 56 in East Moline, 58 in Moline, 10 in Rock Island, and 36 in Davenport. The increase in receptors would be primarily due to the slow speed of the existing track configuration through the Quad Cities area. Colona, IL would also see an additional 20 receptors impacted primarily due to the slow current track speed at the crossing of the IAIS and the BNSF rail lines.

However, track improvements would be made in both the Quad Cities and in Colona to improve the fluidity of the passenger trains and to increase the passenger rail speed through the communities. In the Quad Cities, track signals would be improved through East Moline, Moline, Rock Island and Davenport to allow for an increase in passenger train speeds from the current 10 to 15 mph constraint to 40 mph. In addition, a passenger train by-pass of the Rock Island yard would be constructed to reduce the delays to the passenger trains through the yard. In Colona, the crossing of the BNSF and IAIS rail lines would be reconstructed to increase the track speed on the IAIS from the current 10 mph to 40 mph. These improvements in the Quad

Cities and Colona would also improve the speed for the current freight trains. The speed increases would reduce the number of noise receptors that would be impacted because the duration of a locomotive horn use (pass-by) event would be shorter.

2.0 Ground-borne Vibration

This section summarizes potential ground-borne vibration (GBV) impacts associated with the proposed Project. The General Vibration Assessment described here was prepared in accordance with Federal Transit Administration (FTA) guidelines ("Transit Noise and Vibration Impact Assessment," May 2006); FRA has very similar vibration assessment methods. The purpose of this assessment is to determine the number of potential ground-borne vibration (GBV) impacts associated with the proposed Project at vibration-sensitive land uses (receptors) throughout the Project corridor.

Existing and future rail traffic scenarios were analyzed, and the incremental increase in ground-borne vibration associated with the proposed Project was identified.

2.6 Human Response and Perception of Vibration Levels

GBV can be a serious concern for residents or at facilities that are vibration-sensitive, such as laboratories or recording studios. The effects of GBV include perceptible movement of building floors, interference with vibration sensitive instruments, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds.

Vibration consists of rapidly fluctuating motions. However, human response to vibration is a function of the average motion over a longer (but still short) time period, such as one second. The root mean square (RMS) amplitude of a motion over a one second period is commonly used to predict human response to vibration. For convenience, decibel notation is used to describe vibration relative to a reference level. In this section, vibration decibels (VdB) relative to a reference of 10^{-6} inches per second (1 μin/sec) are used.

In contrast to airborne noise, GBV is not a phenomenon that most people experience every day. The background vibration level in residential areas is usually 50 VdB or lower—well below the threshold of perception for humans, which is around 65 VdB. Levels at which vibration interferes with sensitive instrumentation such as nuclear magnetic resonance (NMR) equipment and other optical instrumentation can be much lower than the threshold of human perception. Most perceptible indoor vibration is caused by sources within a building such as the operation of mechanical equipment, movement of people, or slamming of doors. Typical outdoor sources of perceptible GBV are construction equipment, steel-wheeled trains, and traffic on rough roads.

Vibration as it relates to railway movements is generally caused by uneven interactions between the wheels of the train and the railway surfaces. Examples of this include wheels rolling over rail joints and flat spots on wheels that are not true. These uneven interactions result in vibration that travels through the adjacent ground. This vibration can range from barely perceptible to very disruptive. Consistent with other FRA Tier 1 Service-level NEPA vibration assessments, ground-borne noise was not evaluated in this analysis.

2.6.1 FTA Vibration Criteria

The FTA recognizes three land use categories for assessing general vibration impacts.

Land Use Category 1 – High Vibration Sensitivity: This category includes buildings where low ambient vibration is essential for operations within the building that may be well below levels associated with human annoyance. Typical Category 1 land uses include vibration-sensitive research and manufacturing facilities, hospitals, and university research operations. Category 1 also includes special land uses, such as concert halls, television and recording studios, and theaters, which can be very sensitive to vibration and ground-borne noise. The FTA has developed special vibration levels for these land uses.

Land Use Category 2 – Residential: This category includes all residential land uses and any building where people sleep, such as hotels and hospitals.

Land Use Category 3 – Institutional: This category includes schools, churches, other institutions, and quiet offices that do not have vibration-sensitive equipment, but still have the potential for activity interference.

The criteria for GBV used in this assessment are shown in Table 6.

Table 6
Ground-Borne Vibration Impact Criteria

Land Use Category	Ground-Borne Vibration Impact Levels (VdB re 1 micro inch/sec)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB

Source: FTA, "Transit Noise and Vibration Impact Assessment" (May 2006) (FTA-VA-90-1103-06), page 8-3.
Notes:

[1] *"Frequent Events" is defined as more than 70 vibration events per day. Most rapid transit projects fall into this category.*

[2] *"Occasional Events" is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.*

[3] *"Infrequent Events" is defined as fewer than 30 vibration events per day. This category includes most commuter rail branch lines.*

[4] *This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research would require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors.*

Table 6 includes impact criteria for all three event frequencies defined by FTA. Based on the daily train counts for the current and anticipated rail usage, and the number of locomotives per train, the number of vibration events may range from less than 30 (infrequent) to over 70 (frequent) events per day depending on location. FTA recommends, however, that the frequent-event criterion be applied for line-haul freight trains because of the lengthy vibration event caused by the rail cars. Since both Routes A and B contain qualifying line-haul freight traffic, the frequent-event criterion is applied in this assessment. The frequent-event criterion represents the most conservative case.

2.6.2 Methodology

A General Vibration Assessment was performed in accordance with the FTA guidance document (2006). Only GBV was evaluated. For purposes of this assessment ground-borne noise, (which is different than both air-borne noise and ground-borne vibration, and can be estimated using FTA/FRA methods),was not addressed; this is consistent with vibration analyses performed for FRA on other Tier 1 service-level HSIPR projects. Both existing and proposed (future) operations were evaluated to assess the potential vibration impact along Routes A and B. The future use scenario includes passenger trains moving at 79 miles per hour (mph), along with existing freight train traffic, on welded track. A potential 90 mph passenger train scenario on Route A was partially analyzed for a future 5 train/day scenario, and potential impact distances are provided for comparison purposes

The assessment began with a data gathering task and construction of a geographic information system (GIS) for the Project. The railroad alignments, surface geology, aerial photography, and train traffic data (number of locomotives and rail cars per train) were among the critical information gathered. Geology sources included GIS data and maps available at the Iowa Geological Survey and Illinois State Geological Survey websites. Train traffic data were compiled during the noise assessment. The traffic conditions developed for use in the noise assessment documented in the first part of this section were also applied in the vibration analysis. The traffic conditions, described in Table 7, refer to sections of rail which have specific combinations of train speed and frequency (although for the vibration assessment the frequent-event criterion is assumed). The frequent event vibration impact threshold is lower than the infrequent event vibration impact threshold. This adds an element of conservatism to the analysis.

Table 7
Traffic Conditions

Traffic Condition	Location	Speed (mph)	
		Existing	Future
A	Aurora; Wyanet to Moline; Moline to Iowa City	40	79
B	Moline	15	15
C	Aurora to Wyanet	60	79
D	Englewood to Joliet	60	60
E	Chicago to Englewood	60	60
F	Chicago to West Side	37	37
G	West Side to Eola	60	70
H	Eola to Aurora	60	55

Once the necessary datasets had been gathered, the vibration impacts for existing and future scenarios were analyzed. The generalized ground surface vibration curves (Figure 10-1 in the FTA guidance document) provide the distance from track centerline within which potential receptors (impacts) should be counted at various vibration decibel (VdB) levels. In order to determine the distance to potential impacts at Category 2 thresholds, the generalized (reference) ground surface vibration curve needs to be adjusted to more accurately fit the actual conditions.

The ground-borne vibration reference curve most applicable to this Project assumes a locomotive-powered passenger or freight train traveling at 50 mph on CWR, over soil that is inefficient at transmitting vibration. Given the actual geologic conditions and the current and future train speeds, adjustments for geology and train speed were needed. (Note: it is assumed that all existing jointed track would be replaced with CWR.) The surface geology of the area generally consists of a mixture of silt, sand, gravel, and floodplain sediments, all of which are assumed to be non-efficient at transmitting vibration for this assessment, and glacial till, which is assumed to be a stiff clay and efficient at transmitting vibration. The approximate linear extent of efficient and non-efficient soil that each traffic condition section transects was calculated and a weighted average vibration decibel (VdB) adjustment applied to the section. The reference vibration curve adjustment factors for existing use, future 79 mph, and future 90 mph scenarios are provided in Tables 8 through 10, respectively. The 90 mph scenario applies only to the five round trip TPD option.

The information contained in Tables 8 through 10, on the following pages, was used to adjust the ground surface vibration reference curve and determine an appropriate estimate of vibration levels for this Project. The new ground-borne vibration curves, based on the adjustment factors, are shown in Charts 2 through 4, which follow. The distance to the ground-borne vibration impact contour was established using Charts 2 through 4.

Table 8
Reference Vibration Curve Adjustment Factors (Existing Use)

Reference Curve Assumptions:			
Vehicle Type:	Locomotive Powered Passenger or Freight		
Speed (mph):	50		
Track:	Continuously Welded Rail (CWR)		
Geology:	Normal soil, inefficient at transmitting vibration		
Traffic Condition A (Aurora; Wyanet to East Moline; Moline to Iowa City):			
Train Type:	Locomotive Powered Freight		
Speed (mph):	40		
Track:	CWR (same as reference case)		
Geology:	Till	303,853	Linear Ft
	Sand/Gravel/Sed	659,853	Linear Ft
	Total	963,706	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**-1.9**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		3.2	**dB, weighted average over section**
Total Adjustments:		**1.2**	**dB**
Traffic Condition B (East Moline to Moline):			
Train Type:	Locomotive Powered Freight		
Speed (mph):	15		
Track:	CWR (same as reference case)		
Geology:	Till	38,554	Linear Ft
	Sand/Gravel/Sed	28,805	Linear Ft
	Total	67,359	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**-10.5**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		5.7	**dB, weighted average over section**
Total Adjustments:		**-4.7**	**dB**
Traffic Condition C (Aurora to Wyanet):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	60		
Track:	CWR (same as reference case)		
Geology:	Till	89,277	Linear Ft
	Sand/Gravel/Sed	246,281	Linear Ft
	Total	335,558	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**1.6**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		2.7	**dB, weighted average over section**
Total Adjustments:		**4.2**	**dB**

Traffic Condition D (Englewood to Joliet):			
Train Type:	Locomotive Powered Passenger		
Speed (mph):	60		
Track:	CWR (same as reference case)		
Geology:	Till	146,328	Linear Ft
	Sand/Gravel/Sed	21,454	Linear Ft
	Total	167,782	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**1.6**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		8.7	**dB, weighted average over section**
Total Adjustments:		**10.3**	**dB**
Traffic Condition E (Chicago to Englewood):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	60		
Track:	CWR (same as reference case)		
Geology:	Till	24,628	Linear Ft
	Sand/Gravel/Sed	2,883	Linear Ft
	Total	27,511	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**1.6**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		9.0	**dB, weighted average over section**
Total Adjustments:		**10.5**	**dB**
Traffic Condition F (Chicago to West Side):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	37		
Track:	CWR (same as reference case)		
Geology:	Till	21,120	Linear Ft
	Sand/Gravel/Sed	0	Linear Ft
	Total	21,120	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**-2.6**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		10.0	**dB, weighted average over section**
Total Adjustments:		**7.4**	**dB**

Traffic Condition G (West Side to Eola):

Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	60		
Track:	CWR (same as reference case)		
Geology:	Till	125,101	Linear Ft
	Sand/Gravel/Sed	38,579	Linear Ft
	Total	163,680	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**1.6**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		7.6	**dB, weighted average over section**
Total Adjustments:		**9.2**	**dB**

Traffic Condition H (Eola to Aurora):

Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	60		
Track:	CWR (same as reference case)		
Geology:	Till	16,368	Linear Ft
	Sand/Gravel/Sed	0	Linear Ft
	Total	16,368	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**1.6**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		10.0	**dB, weighted average over section**
Total Adjustments:		**11.6**	**dB**

Table 9
Reference Vibration Curve Adjustment Factors (Future 79 mph Use)

Reference Curve Assumptions:			
Vehicle Type:	Locomotive Powered Passenger or Freight		
Speed (mph):	50		
Track:	Continuously Welded Rail (CWR)		
Geology:	Normal soil, inefficient at transmitting vibration		
Traffic Condition A (Aurora; Wyanet to East Moline; Moline to Iowa City):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	79		
Track:	CWR (same as reference case)		
Geology:	Till	303,853	Linear Ft
	Sand/Gravel/Sed	659,853	Linear Ft
	Total	963,706	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**4.0**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		3.2	**dB, weighted average over section**
Total Adjustments:		**7.1**	**dB**
Traffic Condition B (East Moline to Moline):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	15		
Track:	CWR (same as reference case)		
Geology:	Till	38,554	Linear Ft
	Sand/Gravel/Sed	28,805	Linear Ft
	Total	67,359	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**-10.5**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		5.7	**dB, weighted average over section**
Total Adjustments:		**-4.7**	**dB**
Traffic Condition C (Aurora to Wyanet):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	79		
Track:	CWR (same as reference case)		
Geology:	Till	89,277	Linear Ft
	Sand/Gravel/Sed	246,281	Linear Ft
	Total	335,558	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**4.0**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		2.7	**dB, weighted average over section**
Total Adjustments:		**6.6**	**dB**

Traffic Condition D (Englewood to Joliet):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	60		
Track:	CWR (same as reference case)		
Geology:	Till	146,328	Linear Ft
	Sand/Gravel/Sed	21,454	Linear Ft
	Total	167,782	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**1.6**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		8.7	**dB, weighted average over section**
Total Adjustments:		**10.3**	**dB**
Traffic Condition E (Chicago to Englewood):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	60		
Track:	CWR (same as reference case)		
Geology:	Till	24,628	Linear Ft
	Sand/Gravel/Sed	2,883	Linear Ft
	Total	27,511	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**1.6**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		9.0	**dB, weighted average over section**
Total Adjustments:		**10.5**	**dB**
Traffic Condition F (Chicago to West Side):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	37		
Track:	CWR (same as reference case)		
Geology:	Till	21,120	Linear Ft
	Sand/Gravel/Sed	0	Linear Ft
	Total	21,120	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**-2.6**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		10.0	**dB, weighted average over section**
Total Adjustments:		**7.4**	**dB**

Traffic Condition G (West Side to Eola):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	70		
Track:	CWR (same as reference case)		
Geology:	Till	125,101	Linear Ft
	Sand/Gravel/Sed	38,579	Linear Ft
	Total	163,680	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**2.9**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		7.6	**dB, weighted average over section**
Total Adjustments:		**10.6**	**dB**
Traffic Condition H (Eola to Aurora):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	55		
Track:	CWR (same as reference case)		
Geology:	Till	16,368	Linear Ft
	Sand/Gravel/Sed	0	Linear Ft
	Total	16,368	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**0.8**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		10.0	**dB, weighted average over section**
Total Adjustments:		**10.8**	**dB**

Table 10
Reference Vibration Curve Adjustment Factors (Future 90 mph Use)

Reference Curve Assumptions:			
Vehicle Type:	Locomotive Powered Passenger or Freight		
Speed (mph):	50		
Track:	Continuously Welded Rail (CWR)		
Geology:	Normal soil, inefficient at transmitting vibration		
Traffic Condition A (Aurora; Wyanet to East Moline; Moline to Iowa City):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	90		
Track:	CWR (same as reference case)		
Geology:	Till	303,853	Linear Ft
	Sand/Gravel/Sed	659,853	Linear Ft
	Total	963,706	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**5.1**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		3.2	**dB, weighted average over section**
Total Adjustments:		**8.3**	**dB**
Traffic Condition B (East Moline to Moline):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	15		
Track:	CWR (same as reference case)		
Geology:	Till	38,554	Linear Ft
	Sand/Gravel/Sed	28,805	Linear Ft
	Total	67,359	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**-10.5**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		5.7	**dB, weighted average over section**
Total Adjustments:		**-4.7**	**dB**
Traffic Condition C (Aurora to Wyanet):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	90		
Track:	CWR (same as reference case)		
Geology:	Till	89,277	Linear Ft
	Sand/Gravel/Sed	246,281	Linear Ft
	Total	335,558	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**5.1**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		2.7	**dB, weighted average over section**
Total Adjustments:		**7.8**	**dB**

Traffic Condition D (Englewood to Joliet):

Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	90		
Track:	CWR (same as reference case)		
Geology:	Till	146,328	Linear Ft
	Sand/Gravel/Sed	21,454	Linear Ft
	Total	167,782	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**5.1**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		8.7	**dB, weighted average over section**
Total Adjustments:		**13.8**	**dB**

Traffic Condition E (Chicago to Englewood):

Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	90		
Track:	CWR (same as reference case)		
Geology:	Till	24,628	Linear Ft
	Sand/Gravel/Sed	2,883	Linear Ft
	Total	27,511	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**5.1**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		9.0	**dB, weighted average over section**
Total Adjustments:		**14.1**	**dB**

Traffic Condition F (Chicago to West Side):

Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	37		
Track:	CWR (same as reference case)		
Geology:	Till	21,120	Linear Ft
	Sand/Gravel/Sed	0	Linear Ft
	Total	21,120	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**-2.6**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		10.0	**dB, weighted average over section**
Total Adjustments:		**7.4**	**dB**

Traffic Condition G (West Side to Eola):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	90		
Track:	CWR (same as reference case)		
Geology:	Till	125,101	Linear Ft
	Sand/Gravel/Sed	38,579	Linear Ft
	Total	163,680	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**5.1**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		7.6	**dB, weighted average over section**
Total Adjustments:		**12.7**	**dB**
Traffic Condition H (Eola to Aurora):			
Train Type:	Locomotive Powered Freight and Passenger		
Speed (mph):	90		
Track:	CWR (same as reference case)		
Geology:	Till	16,368	Linear Ft
	Sand/Gravel/Sed	0	Linear Ft
	Total	16,368	Linear Ft
Reference Curve Adjustment Factors:			
Increased Speed:		**5.1**	**dB, calc. per FTA guidance**
Track:		**0**	**dB**
Geology:		10	dB, for till (efficient soil)
		0	dB, for sand/gravel/sediment (inefficient soil)
		10.0	**dB, weighted average over section**
Total Adjustments:		**15.1**	**dB**

Chart 2
Ground Surface Vibration Curves - Existing Use

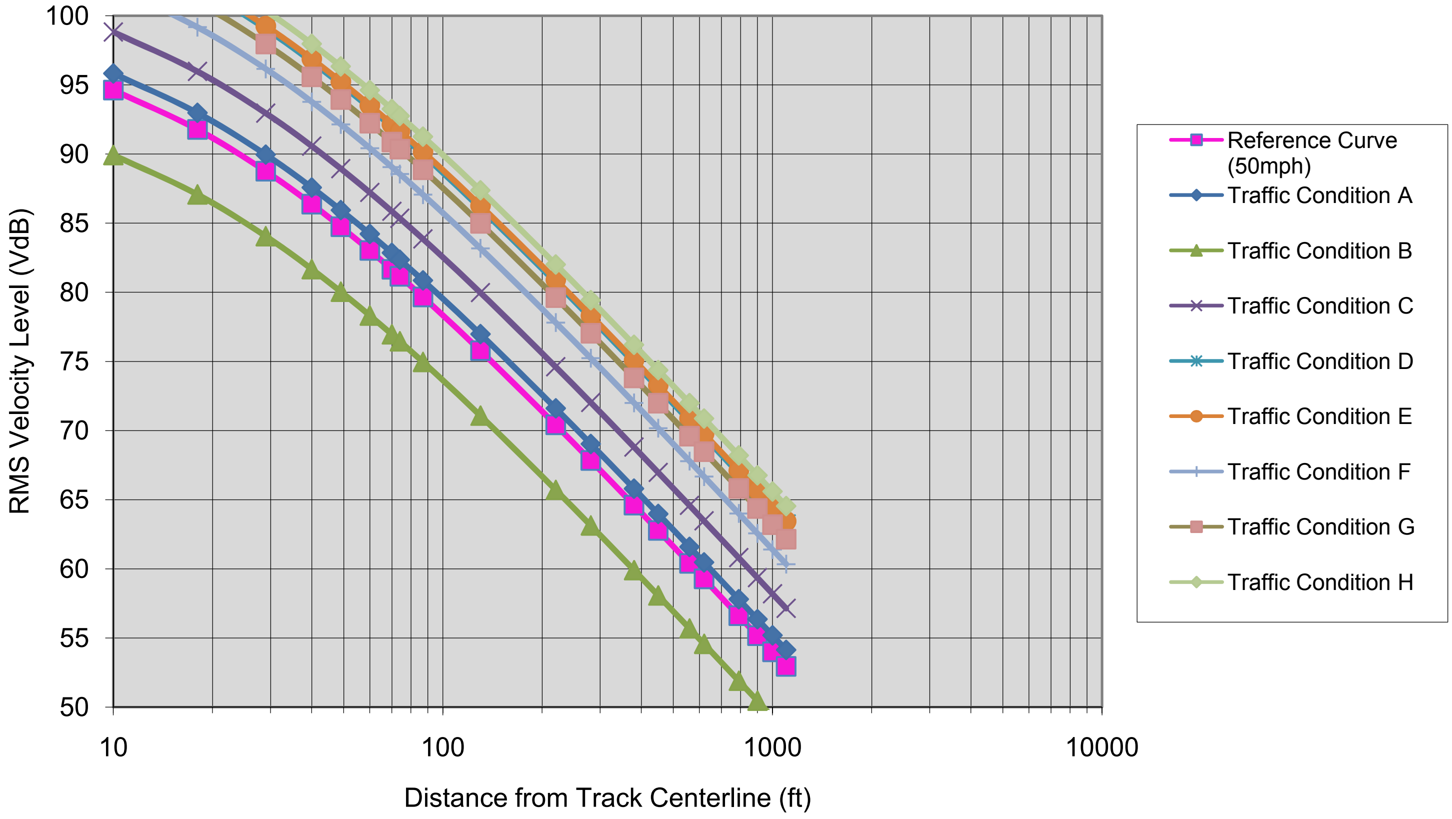


Chart 3
Ground Surface Vibration Curves - Future 79mph Use

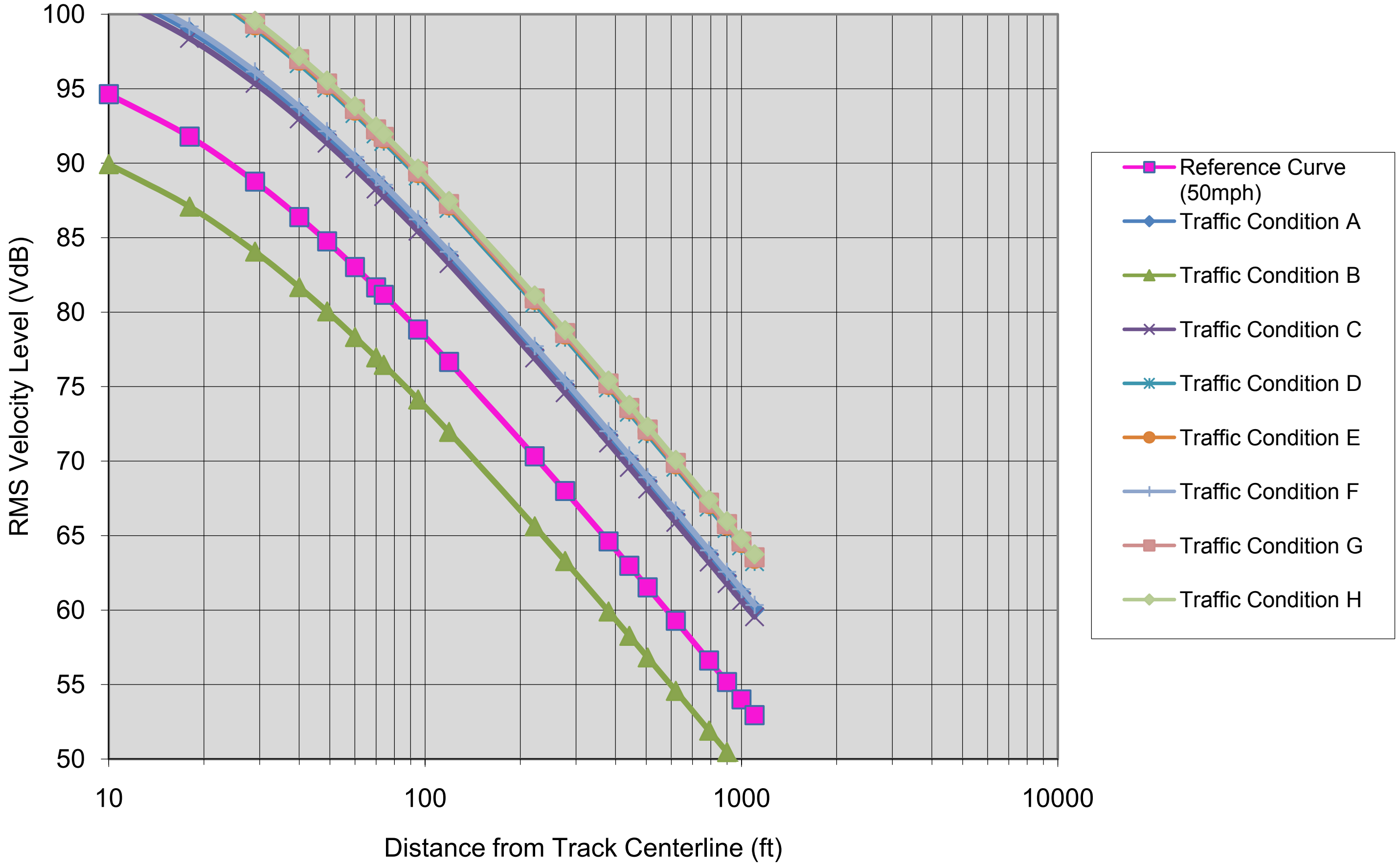
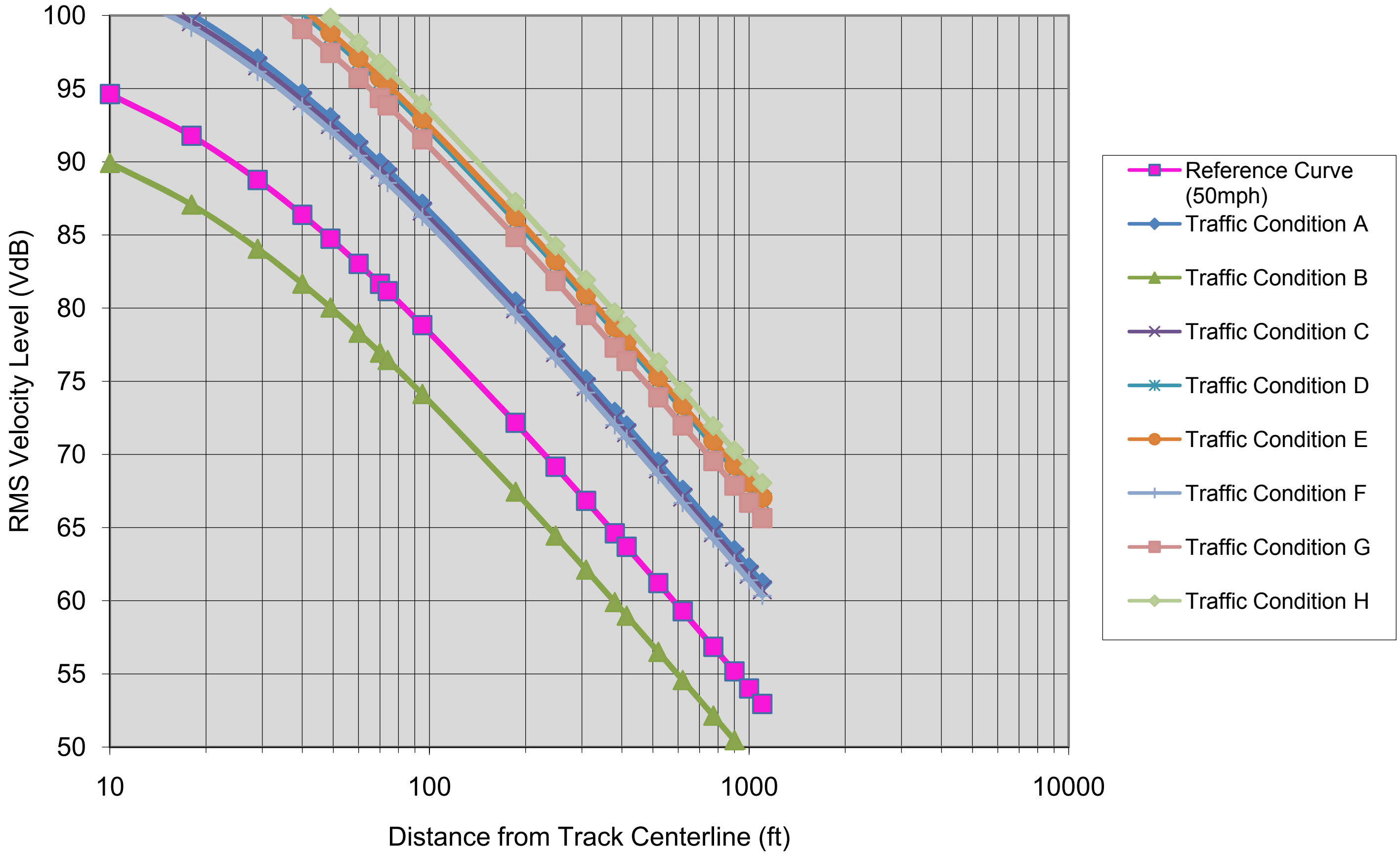


Chart 4
Ground Surface Vibration Curves - Future 90mph Use



This Tier 1 Service-level NEPA vibration assessment only assessed Project-related ground-borne vibration at land uses where overnight sleep occurs (primarily residences) for the same reasons as noted in the introduction to Section 3.7.

2.6.2.1 No-Build Alternative

This analysis assumes that train-induced ground-borne vibration does not change anywhere throughout the Project area under the No-Build Alternative. Consequently, no new vibration impacts are projected to occur beyond those that could occur due to other projects.

2.6.2.2 Two Round Trip Trains per Day

Both the existing and proposed (two round trip TPD) rail traffic was assessed; this allowed the analysis to identify the incremental increase in ground-borne vibration effects on residential land uses in the Project area for Routes A and B.

2.6.2.3 Preferred Alternative (Route A – Amtrak-BNSF-IAIS)

Table 11 presents the incremental increase in vibration impacts, as defined by FTA, at residential land uses adjacent to the entire Preferred Alternative, including rural areas. The table presents vibration impacts predicted to occur in each municipality along the Preferred Alternative.

Table 11
Incremental Increase in Ground-borne Vibration Impacts
Associated with the Preferred Alternative

Municipality	No. of Impacts	Municipality	No. of Impacts
Alignment A		Common Section	
Arlington, IL	8	Atalissa, IA	20
Aurora, IL	23	Davenport, IA	304
Berwyn, IL	51	Durant, IA	53
Brookfield, IL	55	Iowa City, IA	174
Chicago, IL	110	Stockton, IA	27
Cicero, IL	24	Walcott, IA	56
Clarendon Hills, IL	35	West Liberty, IA	40
Downers Grove, IL	81	Wilton, IA	35
Earlville, IL	19	Annawan, IL	27
Hinsdale, IL	41	Atkinson, IL	25
La Grange, IL	38	Geneseo, IL	61
Leland, IL	23	Mineral, IL	20
Lisle, IL	44	Sheffield, IL	21
Malden, IL	10	Unincorporated	58
Mendota, IL	32		
Montgomery, IL	28		
Naperville, IL	68		
Oswego, IL	16		
Plano, IL	13		
Princeton, IL	5		
Riverside, IL	39		
Sandwich, IL	33		
Somonauk, IL	34		
Western Springs, IL	33		
Westmont, IL	31		
Wyanet, IL	20		
Unincorporated	93		
Vibration Impacts Associated with Alternative A			**1,928**

Analysis results identified approximately 9 additional vibration impacts per mile associated with the Preferred Alternative. This increase is not considered to be significant for this analysis. Analysis results also show that the number of vibration impacts in each municipality is related to the density of residential development in areas immediately adjacent to the rail line.

2.6.2.4 Route B Alternative (AMTRAK-CN-METRA/ROCK ISLAND DISTRICT-CSXT-IAIS)

Table 12 presents the incremental increase in ground-borne vibration impacts, as defined by FTA, at residential land uses adjacent to the Route B Alternative. The table presents vibration impacts predicted to occur in each municipality along the Route B Alternative. The number of vibration impacts in unincorporated, rural areas is also quite low due to the low density of development in these areas.

Table 12
Incremental Increase in Ground-borne Vibration Impacts
Associated with the Route B Alternative

Municipality	No. of Impacts	Municipality	No. of Impacts
Alignment B		Common Section	
Bureau Junction, IL	24	Atalissa, IA	20
De Pue, IL	74	Davenport, IA	304
Joliet, IL	28	Durant, IA	53
La Salle, IL	55	Iowa City, IA	174
Marseilles, IL	195	Stockton, IA	27
Minooka, IL	54	Walcott, IA	56
Morris, IL	119	West Liberty, IA	40
North Utica, IL	44	Wilton, IA	35
Ottawa, IL	102	Annawan, IL	27
Peru, IL	41	Atkinson, IL	25
Rockdale, IL	19	Geneseo, IL	61
Seneca, IL	28	Mineral, IL	20
Spring Valley, IL	18	Sheffield, IL	21
Tiskilwa, IL	27	Unincorporated	58
Unincorporated	52		
Vibration Impacts Associated with Alternative B			**1,801**

Analysis results identified approximately 8 additional vibration impacts per mile associated with the Route B Alternative. This increase in the number of vibration impacts is slightly less than the number of vibration impacts calculated for Route A, and is also not considered to be significant for this analysis. Analysis results show that the number of vibration impacts is related to the density of residential development in areas immediately adjacent to the rail line.

2.6.3 Five Round-Trip Trains per Day

The MWRRI envisions five round-trip TPD – at 90 mph, from Chicago to Wyanet, Illinois; and 79 mph from Wyanet to Iowa City, Iowa. This level of increased train activity was assessed in this Tier 1 Service-level (programmatic) NEPA review to help inform the reader of the likely potential impacts from the complete implementation of the MWRRI vision. (A separate NEPA analysis would be required prior to increasing the train numbers.)

Five round-trip TPD scenario was evaluated using the same methods and modeling approach as described in the previous section, but with increased future passenger train traffic. Table 13 presents a simple comparison of vibration impact contour distances for existing conditions, 79 mph train service, and 90 mph train service.

Table 13
Distances to Category 2 Ground-Borne Vibration Impacts

Scenario	GBV Impact Level (VdB)	Distance to Impact Level (ft)							
		Traffic Cond. A	Traffic Cond. B	Traffic Cond. C	Traffic Cond. D	Traffic Cond. E	Traffic Cond. F	Traffic Cond. G	Traffic Cond. H
Existing Use	72	212	119	281	499	504	380	450	560
Future Use: 79 mph	72	370	119	352	499	504	380	509	520
Future Use: 90 mph	72	414	119	394	685	700	380	620	773

The table above shows that as the train speed increases, the distance to the ground-borne vibration impact contour also increase. Note that the distance to the vibration impact threshold remains the same under traffic conditions B and F. Traffic condition B represents the portion of the Quad Cities area that imposes a 15 mph speed limit on trains, therefore the distance to the vibration impact contour does not change. Traffic condition F represents a portion of the Preferred Alternative near downtown Chicago where the average speed of future traffic is 37 mph. For purposes of this assessment, the same average speed was applied to existing traffic.