



REDLANDS PASSENGER RAIL PROJECT
Noise Technical Addendum
Cities of San Bernardino, Loma Linda, Redlands
San Bernardino County, California



DRAFT

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Table of Contents

Executive Summary	ES-1
1.0 Introduction	1
1.1 Project Description	1
2.0 Methodology	2
2.1 Operational Noise	2
2.2 Operational Vibration	2
3.0 Impact Assessment	3
3.1 Operational Noise	3
3.2 Operational Vibration	12
3.3 Construction Impacts	12
4.0 Mitigation	13
4.1 Noise Barriers without Quiet Zone Implementation	13
4.2 Noise Barriers with Quiet Zone Implementation	15
4.3 Cumulative Impacts	21
5.0 References	22

Appendix A: Rail Noise Input and Output for the DMU Option

List of Tables

	Page
1 Rail Noise Assessment Inventory—DMU Option.....	4
2 Sound Barrier Locations—without Implementation of Quiet Zones.....	13
3 Rail Noise Impacts following Quiet Zone Implementation.....	15
4 Sound Barrier Locations—with Implementation of Quiet Zones.....	20

List of Figures

	Follows Page
1 Evaluated Sound Barrier Locations Under DMU Option: Scenario without Implementation of Quiet Zones	14
2 Evaluated Sound Barrier Locations Under DMU Option: Scenario with Implementation of Quiet Zones.....	20

Acronyms

ATSF	Atchison, Topeka, and Santa Fe Railroad
dB	decibel
dBA	A-weighted decibel
DMU	Diesel Multiple Unit
FTA	Federal Transit Administration
L_{dn}	day-night average sound level
L_{eq}	equivalent sound level
ROW	right-of-way
RPRP or Preferred Project	Redlands Passenger Rail Project
SANBAG	San Bernardino Associated Governments
SEL	sound exposure level
VdB	vibration decibels

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EXECUTIVE SUMMARY

The San Bernardino Associated Governments (SANBAG) proposes the introduction of passenger rail service along the existing railroad right-of-way (ROW) owned by SANBAG from the City of San Bernardino on the west to the City of Redlands on the east, in southwestern San Bernardino County, California. The Build Alternatives and Design Options would include replacement of rail infrastructure along the easterly most 9-mile section of railroad owned by SANBAG and part of the former Atchison, Topeka, and Santa Fe (ATSF) Railroad's Redlands Subdivision—commonly referred to as the “Redlands Spur.”

SANBAG is evaluating the operation of a Diesel Multiple Unit (DMU) vehicle-type in addition to the use of diesel-powered locomotive as considered in the Noise Technical Memorandum (ICF 2013). The DMU operations would be identical to the current operational scenario of the Preferred Project. This Addendum for the Noise Technical Memorandum (ICF 2013) specifically evaluates the operation of a DMU vehicle option in association with the Preferred Project.

Under the Preferred Project, local rail service would be provided by up to two trainsets composed of up to two cars and one locomotive (or a DMU) shuttling between the University of Redlands and San Bernardino. All construction and operational conditions and projected roadway traffic conditions would remain unchanged under a DMU Vehicle Option. The only operational change associated with a DMU would be noise produced by the local service trains. The reference sound exposure level (SEL) for the DMU vehicle is 7 decibels (dB) less than the locomotive driven trainset. However, for most receivers the overall noise level under the DMU Option is the same as the locomotive driven trainset or 1 dB less. Although the reference SEL value for the DMU vehicle is 7 dB less than the reference SEL value for the locomotive driven trainset, the overall noise level is typically governed by crossing horn noise. The Metrolink train, which would not change under the DMU Option and would remain a locomotive-driven trainset, also influences the overall noise level. Accordingly, the large reduction in the train reference SEL value typically does not result in a comparable reduction in overall noise level. Larger reductions in noise in the range of 3 to 4 dB occur at Receivers 9, 34, 35, 42, and 43 which are far from crossings and are therefore less influenced by horn noise.

Under the DMU Option, there are two receivers (9 and 62) where the Federal Transit Administration (FTA) level of noise impact would change from moderate impact to no impact. Receiver 9 represents one noise sensitive site and Receiver 62 represents 7 noise sensitive sites. Accordingly, implementation of the DMU option would reduce the number of noise sensitive sites exposed to moderate impact by 8 units. The number of severe impacts would not change.

No adverse vibration impacts were identified for the locomotive driven trainset under the Preferred Project. The reference vibration level for the DMU vehicle is about 5 dB less than the locomotive driven trainset. Accordingly, no adverse vibration impacts were identified for the DMU Option.

With the exception of Mitigation Measure NV-2: Construct Sound Barriers, the mitigation measures identified in the Noise Technical Memorandum would not change with implementation of the DMU option. The length of barriers 3NQZ and 18NQZ would be reduced as a result of impacts being reduced at Receivers 9 and 62.

The noise reducing effect of the DMU Option with Quiet Zones implemented is more pronounced when compared to the use a locomotive driven trainset with the Preferred Project. Severe impacts would be reduced to moderate impacts at Receivers 3, 14, 22, and 41 which represent a total of 11 noise-sensitive sites. Moderate impacts would be reduced to no impacts at Receivers 9, 15, 19, 23, 24, 31, and 39 which represent a total of 23 noise sensitive sites.

Under the DMU Option with Quiet Zones barriers 2WQZ and 4WQZ would be reduced in length relative to the locomotive driven trainset and barriers 6WQZ and 7WQZ would be eliminated.

1.0 INTRODUCTION

The San Bernardino Associated Governments (SANBAG) is proposing the Redlands Passenger Rail Project (Preferred Project), which involves the introduction of passenger rail service along an existing railroad right-of-way (ROW) owned by SANBAG. Passenger train service would be provided from the City of San Bernardino on the west to the City of Redlands on the east, in southwestern San Bernardino County, California. The Build Alternatives and Design Options would include replacement of rail infrastructure along the easterly most 9-mile section of railroad owned by SANBAG and part of the former Atchison, Topeka, and Santa Fe (ATSF) Railroad’s Redlands Subdivision—commonly referred to as the “Redlands Spur.”

1.1 PROJECT DESCRIPTION

Under the Preferred Project, local rail service would be provided by up to two trainsets composed of up to two cars and one locomotive or a diesel multiple unit (DMU) shuttling between the University of Redlands and San Bernardino. ICF prepared a Noise Technical Memorandum (ICF 2013) that addresses noise and vibration effects associated with build alternatives and design options, which involve the operation of a locomotive driven trainset. This technical addendum addresses noise- and vibration-related impacts associated with the operation of a DMU vehicle-type option for the Preferred Project.

Under the DMU Vehicle Option, all train operations would be identical to the current operational scenario with local rail service operating on 30-minute headways during the peak morning and evening periods and on 1-hour headways during off-peak hours and weekends. Up to two Metrolink express trains would also run westbound in the AM peak period and eastbound in the PM peak period, originating/terminating at the Downtown Redlands Station. These trains will be composed of a typical Metrolink trainset.

All construction and operational conditions and projected roadway traffic conditions would remain unchanged under the DMU Vehicle Option. Refer to the Noise Technical Memorandum for details related to the proposed construction and operational conditions, applicable noise and vibration impact criteria, and existing noise and vibration conditions. The regulatory and environmental setting for DMU option is the same as discussed in the Noise Technical Memorandum, and is thus not addressed herein.

2.0 METHODOLOGY

2.1 OPERATIONAL NOISE

Methods used to evaluate operational rail noise are discussed in the Noise Technical Memorandum (ICF 2013). Noise associated with roadway traffic, rail station parking lots, layover facilities, and wheel/rail interaction is unchanged under the DMU option. Accordingly, no additional analysis of noise from these sources is necessary.

To assess noise associated with operation of the DMU vehicle the reference sound exposure level (SEL) value of 92 A-weighted decibels (dBA) used for the locomotive trainset has been replaced with a reference SEL value of 85 dBA in the noise calculations. This value is from Table 5-1 in the Federal Transit Administration (FTA) guidance manual “Transit Noise and Vibration Impact Assessment” (FTA 2006). The reference SEL value used for the Metrolink trains is unchanged under the DMU option.

Appendix A of this addendum provides a revised version of the original Appendix D from the Noise Technical Memorandum with revised technical assumptions and rail noise modeling inputs and outputs included for the DMU Option. All other appendices are unchanged.

2.2 OPERATIONAL VIBRATION

Methods used to evaluate operational rail vibration are discussed in the Noise Technical Memorandum. The vibration analysis in the Noise Technical Memorandum uses the reference vibration velocity level for “Locomotive Powered Passenger or Freight” reported in Figure 10-1 of the FTA guidance manual. Figure 10-1 in the manual does not provide a vibration reference level specific to DMU vehicles. However, the manual states that “self-powered diesel multiple units (DMUs) create vibration levels somewhere between rapid transit vehicles and locomotive-powered passenger trains.” Accordingly for this analysis a vibration reference level equal to the average of the locomotive and rapid transit reference levels was used. The net effect is that vibration source levels for the DMU vehicle are at least 5 dB less than the source levels used for the locomotive driven trainset.

3.0 IMPACT ASSESSMENT

3.1 OPERATIONAL NOISE

Table 1 summarizes predicted rail operation noise levels under the DMU Option. For comparison purposes the table also shows the predicted noise level from the Noise Technical Memorandum for the locomotive driven trainset. The reference SEL for the DMU vehicle is 7 dB less than the locomotive driven trainset. However, for most receivers the overall noise level under a DMU Vehicle Option is the same as the locomotive driven trainset or 1 dB less.

Although the reference SEL value for the DMU vehicle is 7 dB less than the reference SEL value for the locomotive driven trainset, the overall noise level is typically governed by crossing horn noise. The Metrolink train, which would not change under a DMU Vehicle Option, would remain a locomotive driven trainset thereby also influencing the overall noise level. Accordingly, the large reduction in the train reference SEL value typically does not result in a comparable reduction in overall noise level. Larger reductions in noise in the range of 3 to 4 dB occur at Receivers 9, 34, 35, 42, and 43 which are far from crossings and are therefore less influenced by horn noise.

Where the DMU Option will result in a reduced noise level, the reported noise level in Table 1 is underlined. There are two receivers (9 and 62) where the FTA level of noise impact would change from moderate impact to no impact. Where there is a change in the level of impact, the text is underlined. Receiver 9 represents one noise sensitive residential use and Receiver 62 represents 7 noise sensitive residential uses. Accordingly, implementation of the DMU vehicle option would reduce the number of residential units exposed to moderate impact by 8 units. The number of severe impacts would not change.

Table 1. Rail Noise Assessment Inventory—DMU Option

Receiver #	Receiver Location Description	Land Use Category	Number of Noise-Sensitive Sites Represented	Existing Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers)	Closest Distance to Project (Feet) ¹	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers – Preferred Project)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers - DMU)	FTA Level of Noise Impact ²
MP 1 to MP 2: E St. to southeast of Sierra Way								
1	Commercial/Transient Residential use east of N. E St. and north of alignment (includes horn noise)	Transient Residential / Commercial (Motel) / 2	1	69	200	57	57	No Impact
2	200' to 400' south of alignment, west of Pershing Ave.	Residential / 2	2	55	200	62	62	Severe Impact
3	50' to 100' east of alignment, east of Dorothy St.	Residential / 2	3	55	75	68	68	Severe Impact
4	100 to 200' east of alignment, east of Dorothy St.	Residential / 2	3	55	150	64	<u>63</u>	Severe Impact
5	200 to 400' east of alignment, east of Dorothy St.	Residential / 2	32	55	220	61	61	Moderate Impact
6	400 to 800' east of alignment, east of Dorothy St.	Residential / 2	8	55	400	51	51	No Impact
7	200 to 400' east of alignment, east of Dorothy St.	Residential / 2	3	55	250	55	55	No Impact
8	50' to 100' east of alignment, east of Dorothy St.	Residential / 2	5	55	75	68	68	Severe Impact

Receiver #	Receiver Location Description	Land Use Category	Number of Noise-Sensitive Sites Represented	Existing Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers)	Closest Distance to Project (Feet)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers – Preferred Project)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers - DMU)	FTA Level of Noise Impact ²
9	100 to 200' east of alignment, east of Dorothy St.	Residential / 2	1	55	150	56	<u>52</u>	No Impact ³
10	200 to 400' east of alignment, east of Dorothy St.	Residential / 2	1	55	300	54	54	No Impact
MP 2 to MP 3.5: Southeast of Sierra Way to southeast of S. Waterman Ave.								
11	200 to 400' east of alignment, east of Lincoln Ave.	Residential / 2	3	52	275	55	55	Moderate Impact
12	200' to 400' west of alignment, east of S. Washington Ave.	Residential / 2	1	52	350	58	58	Moderate Impact
13	100 to 200' east of alignment, east of Lincoln Ave.	Residential / 2	6	52	100	66	66	Severe Impact
14	50' to 100' west of alignment, east of S. Washington Ave.	Residential / 2	1	52	75	68	68	Severe Impact
15	100' to 200' west of alignment, east of S. Washington Ave.	Residential / 2	2	52	125	65	<u>64</u>	Severe Impact
16	200' to 400' west of alignment, east of S. Washington Ave.	Residential / 2	3	52	250	55	55	Moderate Impact
17	200' to 400' west of alignment, east of S. Washington Ave.	Residential / 2	2	52	200	62	62	Severe Impact
18	100' to 200' east of alignment, south of Ennis St.	Residential / 2	1	52	150	64	64	Severe Impact

Receiver #	Receiver Location Description	Land Use Category	Number of Noise-Sensitive Sites Represented	Existing Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers)	Closest Distance to Project (Feet)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers – Preferred Project)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers - DMU)	FTA Level of Noise Impact ²
19	200' to 400' east of alignment, east of Lincoln Ave.	Residential / 2	2	52	200	62	62	Severe Impact
20	200' to 400' east of alignment, east of Lincoln Ave.	Residential / 2	2	52	350	58	58	Moderate Impact
21	400' to 800' west of alignment, south of Orange Show Rd	Residential / 2	1	52	325	59	59	Moderate Impact
22	50' to 100' southwest of alignment, north of Dumas St.	Residential / 2	1	52	50	71	<u>70</u>	Severe Impact
23	100' to 200' southwest of alignment, north of Dumas St.	Residential / 2	2	52	140	64	64	Severe Impact
24	200' to 400' southwest of alignment, north of Dumas St.	Residential / 2	4	52	220	61	61	Severe Impact
MP 3.5 to MP 6: Southeast of S. Waterman Ave. to Bryn Mawr Ave.								
25	100' to 200' south of alignment, east of Tippecanoe Ave.	Residential / 2	3	64	140	64	64	Moderate Impact
26	200' to 400' south of alignment, east of Tippecanoe Ave.	Residential / 2	8	64	380	58	<u>57</u>	No Impact
27	100' to 200' south of alignment, east of Tippecanoe Ave.	Residential / 2	8	64	175	63	<u>62</u>	Moderate Impact
28	100' to 200' south of alignment, west of S. Richardson St.	Residential / 2	18	64	175	63	<u>62</u>	Moderate Impact

Receiver #	Receiver Location Description	Land Use Category	Number of Noise-Sensitive Sites Represented	Existing Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers)	Closest Distance to Project (Feet)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers – Preferred Project)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers - DMU)	FTA Level of Noise Impact ²
29	200' to 400' south of alignment, west of S. Richardson St.	Residential / 2	4	64	390	53	<u>52</u>	No Impact
30	100' to 200' south of alignment, east of S. Richardson St.	Recreation (School Athletic Fields) and School / 3	1	55	175	60	60	No Impact (Category 3)
31	100' to 200' north of alignment, east of S. Richardson St.	Residential / 2	6	58	100	66	66	Severe Impact
32	200' to 400' north of alignment, east of S. Richardson St.	Residential / 2	5	58	320	54	<u>53</u>	No Impact
33	100' to 200' north of alignment, south of Victoria Ave.	Residential / 2	8	58	150	64	<u>63</u>	Severe Impact
34	100' to 200' north of alignment, south of Victoria Ave.	Residential / 2	4	58	150	56	<u>52</u>	No Impact
35	100' to 200' south of alignment, north of E. Gould St.	Residential / 2	8	58	175	55	<u>51</u>	No Impact
36	100' to 200' south of alignment, north of E. Gould St.	Residential / 2	10	58	150	64	<u>63</u>	Severe Impact
37	200' to 400' south of alignment, west of Mountain View Ave.	Residential / 2	7	58	350	53	53	No Impact
38	200' to 400' south of alignment, west of Mountain View Ave.	Day Care Facility / 3	1	55	340	56	56	No Impact (Category 3)

Receiver #	Receiver Location Description	Land Use Category	Number of Noise-Sensitive Sites Represented	Existing Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers)	Closest Distance to Project (Feet)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers – Preferred Project)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers - DMU)	FTA Level of Noise Impact ²
39	100' to 200' north of alignment, south of Victoria Ave.	Residential / 2	3	58	125	65	65	Severe Impact
40	200' to 400' north of alignment, south of Victoria Ave.	Residential / 2	3	58	350	58	58	Moderate Impact
41	50' to 100' north of alignment, east of Mountain View Ave.	Residential / 2	6	58	50	71	<u>70</u>	Severe Impact
MP 6 to MP 8.5: Bryn Mawr Ave. to east of Texas St.								
42	100' to 200' south of alignment, east of Bryn Mawr Ave.	Residential / 2	8	71	150	56	<u>52</u>	No Impact
43	50' to 100' north of alignment, east of Nevada St.	Transient Residential / Commercial (Motel)	1	67	75	60	<u>57</u>	No Impact
44	100' to 200' south of alignment, south of Redlands Blvd.	Residential / 2	6	67	150	64	<u>63</u>	Moderate Impact
45	200' to 400' south of alignment, south of Redlands Blvd.	Residential / 2	22	67	225	55	<u>54</u>	No Impact
46	0' to 100' north of alignment, west of Tennessee St.	Transient Residential / Commercial (Motel) / 2	1	67	75	68	68	Severe Impact
47	100' to 200' north of alignment, west of New York St.	Residential / 2	1	62	175	63	63	Moderate Impact

Receiver #	Receiver Location Description	Land Use Category	Number of Noise-Sensitive Sites Represented	Existing Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers)	Closest Distance to Project (Feet)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers – Preferred Project)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers - DMU)	FTA Level of Noise Impact ²
48	200' to 400' south of alignment, south of Redlands Blvd.	Recreation (Park) / 3	1	60	200	60	<u>59</u>	No Impact (Category 3)
49	200' to 400' north of alignment, west of Texas St.	Recreation (School Athletic Fields) and School / 3	1	57	250	58	58	No Impact (Category 3)
50	200' to 400' north of alignment, east of Texas St.	Residential / 2	6	62	240	56	56	No Impact
51	200' to 400' north of alignment, east of Texas St.	Residential / 2	1	62	350	51	<u>50</u>	No Impact
MP 8.5 to MP 10: East of Texas St. to east of N. University St. (Project End)								
52	200' to 400' north of alignment, east of Eureka St.	Residential / 2	3	62	375	58	58	No Impact
53	200' to 400' north of alignment, east of Texas St.	Residential / 2	1	62	300	55	54	No Impact
54	50' to 100' north of alignment, west of 9th St.	Residential / 2	3	67	75	68	68	Severe Impact
55	50' to 100' north of alignment, west of 9th St.	Church / 3	1	61	80	66	65	Moderate Impact (Category 3)
56	200' to 400' south of alignment, west of Church St.	Residential / 2	4	67	475	52	<u>51</u>	No Impact

Receiver #	Receiver Location Description	Land Use Category	Number of Noise-Sensitive Sites Represented	Existing Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers)	Closest Distance to Project (Feet)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers – Preferred Project)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers - DMU)	FTA Level of Noise Impact ²
57	200' to 400' south of alignment, west of Church St.	Residential / 2	4	67	250	56	<u>55</u>	No Impact
58	200' to 400' north of alignment, east of 9th St.	Residential / 2	10	67	225	56	56	No Impact
59	200' to 400' north of alignment, east of 9th St.	Residential / 2	10	67	225	56	56	No Impact
60	200' to 400' south of alignment, east of Church St.	Residential / 2	3	67	475	52	<u>51</u>	No Impact
61	50' to 100' north of alignment, east of Church St.	Residential / 2	6	67	50	71	71	Severe Impact
62	200' to 400' north of alignment, north of Sylvan Blvd.	Residential / 2	7	64	250	61	<u>60</u>	No Impact ³
63	50' to 100' north of alignment, north of Park Ave.	Recreation (Park) / 3	1	61	75	68	68	Moderate Impact (Category 3)
64	100' to 200' south of alignment, west of University St.	Residential / 2	1	64	100	62	<u>61</u>	Moderate Impact
65	100' to 200' south of alignment, west of University St.	Residential / 2	8	64	100	62	<u>61</u>	Moderate Impact
66	100' to 200' south of alignment, west of University St.	Residential / 2	10	64	175	56	56	No Impact
67	200' to 400' south of alignment, west of University St.	Residential / 2	4	64	300	52	<u>51</u>	No Impact

Receiver #	Receiver Location Description	Land Use Category	Number of Noise-Sensitive Sites Represented	Existing Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers)	Closest Distance to Project (Feet) ¹	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers – Preferred Project)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers - DMU)	FTA Level of Noise Impact ²
68	50' to 100' south of alignment, east of University St.	Residential / 2	6	61	75	69	<u>68</u>	Severe Impact
69	100' to 200' south of alignment, east of University St.	Residential / 2	7	61	150	59	59	Moderate Impact
70	200' to 400' south of alignment, east of University St.	Residential / 2	4	61	250	54	54	No Impact
71	100' to 200' north of alignment, east of University St.	School (University of Redlands) / 3	1	54	150	63	63	Moderate Impact (Category 3)
72	100' to 200' south of alignment, east of Cook St.	Residential / 2	6	61	125	60	60	Moderate Impact

L_{dn} = day-night average sound levels

L_{eq} = equivalent sound level

Notes:

¹ As measured from the ROW centerline.

² Represents FTA impact criteria.

³ Effect changes from Moderate Impact to No Impact with DMU option.

3.2 OPERATIONAL VIBRATION

Based on guidance in the FTA manual ground vibration levels generated by the DMU vehicle are predicted to be at least 5 less than vibration levels generated by the locomotive driven trainsets. As indicated in Table 6-4 in the Noise Technical Memorandum operation of the locomotive driven trainset is predicted to result in no effect. Because vibration generated by the DMU vehicle would be less, there would also be no effect with the DMU vehicles.

As indicated Table 6-5 of the Noise Technical Memorandum, the predicted vibration level from rail pass-bys at the Redlands Depot would be approximately 74 vibration decibels (VdB), which would be lower than the corresponding damage criteria level of 90 VdB. Vibration from the DMU vehicles would be even less. Therefore, operational vibration levels from the DMU vehicles are not predicted to exceed the criteria threshold for fragile structures. There would be no effect.

3.3 CONSTRUCTION IMPACTS

The DMU option would result in similar construction-related effects as analyzed in the Noise Technical Memorandum prepared for the Preferred Project (for the locomotive driven trainset). No new construction analysis is required. Consequently, the impact of construction-related impacts from the Preferred Project is considered moderate and less than significant with mitigation incorporated, as specified in the Noise Technical Memorandum.

4.0 MITIGATION

With the exception Mitigation Measure NV-2: Construct Sound Barriers, the mitigation measures identified in the Noise Technical Memorandum would not change with implementation of the DMU option.

4.1 NOISE BARRIERS WITHOUT QUIET ZONE IMPLEMENTATION

Noise barriers were identified to reduce moderate impacts and severe impacts to the no impact level. As indicated in Table 1 implementation of the DMU option would change noise effects from moderate impact to no impact at Receivers 9 and 62. Accordingly, barriers would no longer be needed to reduce moderate impacts to No Effects at Receivers 9 and 62. Slight reductions in sound levels associated with the DMU option would change the noise reduction requirement for several other barriers.

Table 2 and Figure 1 indicate the changes in the barriers 3NQZ and 18NQZ associated with Receivers 9 and 62 respectively that would occur with implementation of the DMU option. Changes are also indicated for barriers 11NQZ, 13NQZ, 20NQZ, 21NQZ, and 22NQZ. Where the DMU option will result in a change relative to the Preferred Project, the text is underlined.

Table 2. Sound Barrier Locations—without Implementation of Quiet Zones

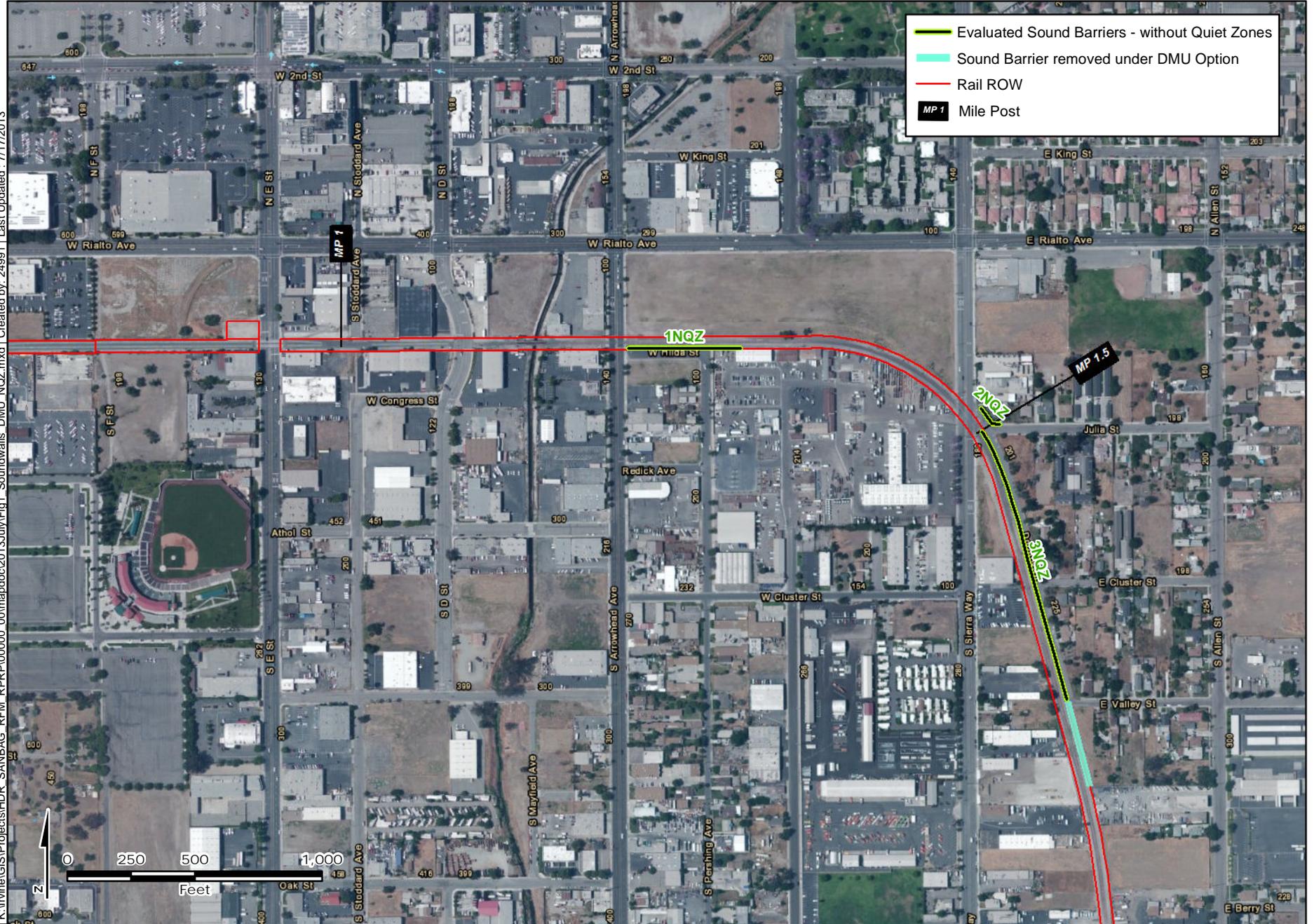
Sound Barrier #	Receiver #s	Sound Barrier Location/Description	Mile Post Location (Approx.)	Max. Threshold Exceeded, dB	Barrier Length (feet)	Barrier Height (feet)	Estimated Barrier Performance ¹ (dB)
1NQZ	2	South side of rail alignment east of S. Arrowhead Ave.	1.3	7	440	12	8
2NQZ	3	Northeast side of rail alignment north of E. Julia St., east of S. Sierra Way	1.5	13	105	16	13
3NQZ	4, 5, 8 <u>(9 removed)</u>	East side of rail alignment adjacent to S. Dorothy St.	1.6	13	<u>1,100</u>	18	13
4NQZ	12, 14, 15, 16, 17	West side of rail alignment, north of E. Orange Show Rd.	2.6	14	2,570	10 to 22	14
5NQZ	11, 13, 18, 19, 20	East side of rail alignment, north of E. Orange Show Rd., south of E. Central Ave.	2.6	12	2,200	18	12
6NQZ	21, 22, 23	Southwest side of rail alignment, south of E. Orange Show Rd., west of Waterman Ave.	2.9	17	1,120	18	17
7NQZ	24	Southwest side of rail alignment, south of W. Dumas St., west of Waterman Ave.	3.0	7	410	10	8
8NQZ	25, 27, 28	South side of rail alignment, east of S. Tippecanoe Ave.	4.4	4	2,190	12	4

Sound Barrier #	Receiver #s	Sound Barrier Location/Description	Mile Post Location (Approx.)	Max. Threshold Exceeded, dB	Barrier Length (feet)	Barrier Height (feet)	Estimated Barrier Performance ¹ (dB)
9NQZ	31, 33	North side of rail alignment, east of S. Richardson St.	4.8	10	1,320	14	10
10NQZ	30	South side of rail alignment, east of S. Richardson St.	4.7	7	1,120	12	8
11NQZ	36	South side of rail alignment, west of Mountain View Ave.	5.2	8	990	<u>10</u>	<u>8</u>
12NQZ	39, 40	Northeast side of rail alignment, west of Mountain View Ave.	5.2	9	650	16	10
13NQZ	41	Northeast side of rail alignment, east of Mountain View Ave., south of W. Lugonia Ave.	5.3	<u>14</u>	610	<u>24</u>	15
14NQZ	44	South side of rail alignment, at Kansas St.	7.6	<u>1</u>	1,370	10	6
15NQZ	46	North side of rail alignment, west of Tennessee St.	7.7	6	860	8	6
16NQZ	47	North side of rail alignment, west of New York St.	8.1	5	1,040	10	8
17NQZ	54, 55	North side of rail alignment, west of 9th St.	9.1	6	340	10	7
18NQZ	61 (62 removed)	North side of rail alignment, east of Church St.	9.4	9	<u>500</u>	14	10
19NQZ	63	North side of rail alignment, east of Division St.	9.6	8	560	12	9
20NQZ	64	North side of rail alignment, west of N. University St.	9.7	<u>1</u>	690	10	4
21NQZ	65	South side of rail alignment, west of N. University St.	9.7	<u>1</u>	780	10	7
22NQZ	68, 69, 72	South side of rail alignment, east of N. University St.	9.8	<u>10</u>	1,260	10 to 16	11
23NQZ	71	North side of rail alignment, east of N. University St.	9.8	6	760	10	8

Note:

¹Assuming a solid barrier with absorptive surface facing the rail alignment.

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Evaluated Sound Barrier Locations Under DMU Option - Scenario without Implementation of Quiet Zones

Figure 1A

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Sources

Evaluated Sound Barrier Locations Under DMU Option - Scenario without Implementation of Quiet Zones
Figure 1B

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Sources

Evaluated Sound Barrier Locations Under DMU Option - Scenario without Implementation of Quiet Zones
Figure 1C

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Evaluated Sound Barrier Locations Under DMU Option - Scenario without Implementation of Quiet Zones

Figure 1D

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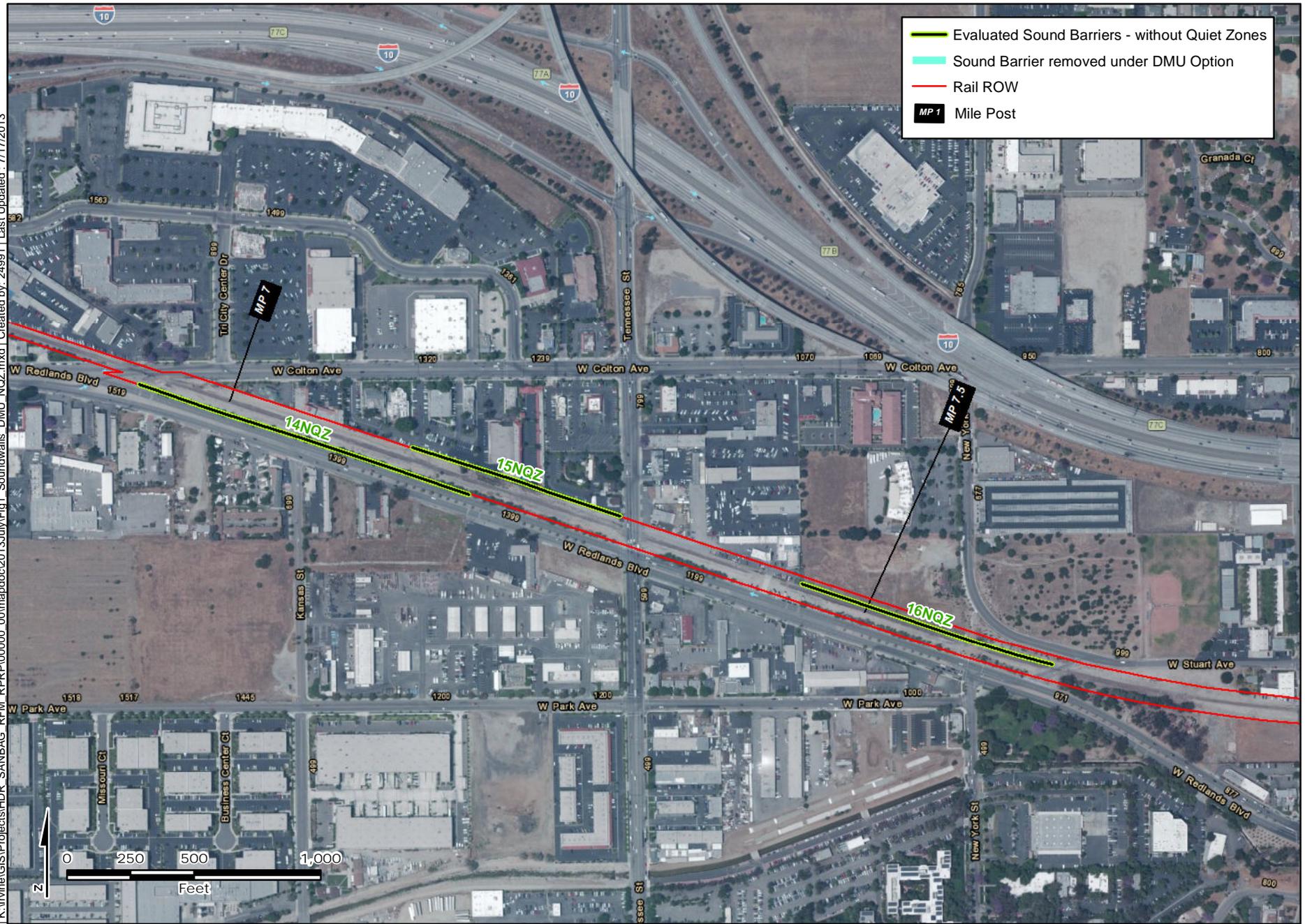


Sources

Evaluated Sound Barrier Locations Under DMU Option - Scenario without Implementation of Quiet Zones

Figure 1E

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Sources

Evaluated Sound Barrier Locations Under DMU Option - Scenario without Implementation of Quiet Zones

Figure 1F

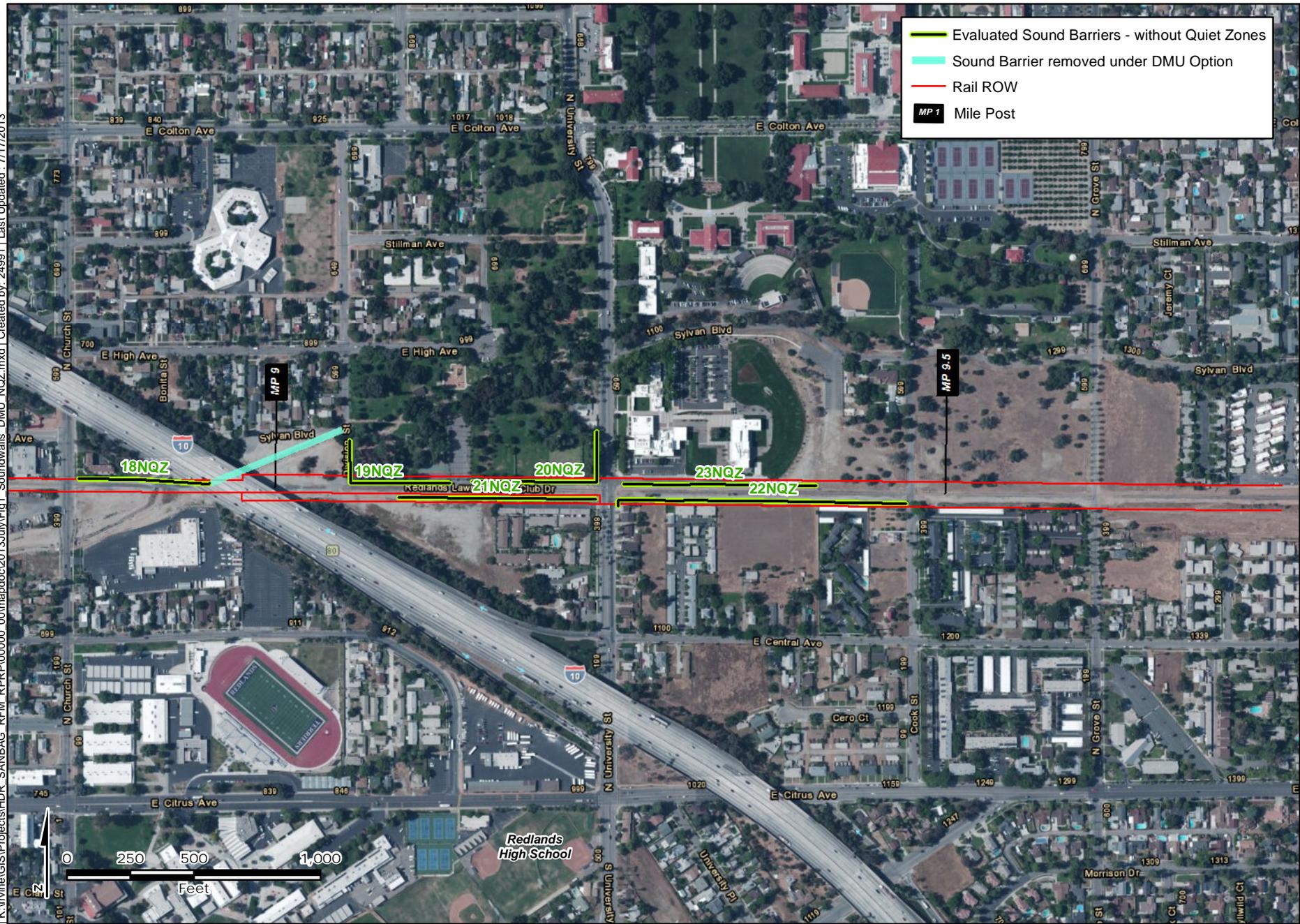
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Evaluated Sound Barrier Locations Under DMU Option - Scenario without Implementation of Quiet Zones

Figure 1G

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Evaluated Sound Barrier Locations Under DMU Option - Scenario without Implementation of Quiet Zones

Figure 1H



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4.2 NOISE BARRIERS WITH QUIET ZONE IMPLEMENTATION

Table 3 summarizes predicted rail operation noise levels under the DMU option with Quiet Zone implementation. For comparison purposes the table also shows the predicted noise level from the Noise Technical Memorandum for the Preferred Project (trainset with locomotive). With crossing horns removed from the overall train noise level, the effect of implementing the DMU option is more pronounced compared to the condition with horns included. With Quiet Zone implementation overall noise levels under the DMU option are in the range of 2 to 6 dB less than the locomotive driven trainset. Severe impacts would be reduced to moderate impacts at Receivers 3, 14, 22, and 41 which represent a total of 11 noise-sensitive sites. Moderate impacts would be reduced to no impacts at Receivers 4, 9, 15, 19, 23, 24, 31, and 39 which represent a total of 23 noise sensitive sites. Where the DMU option will result in a change in the sound level or impact level relative to a locomotive driven trainset, the sound level or impact level in Table 3 is underlined.

Table 3. Rail Noise Impacts following Quiet Zone Implementation

Receiver #	Receiver Location Description	Land Use Category	Number of Noise-Sensitive Sites Represented	Existing Noise Exposure (dBA L_{dn} or L_{eq} for Cat 3 Receivers)	Project Noise Exposure (dBA L_{dn} or L_{eq} for Cat 3 Receivers) with Quiet Zone-Preferred Project	Project Noise Exposure (dBA L_{dn} or L_{eq} for Cat 3 Receivers) with Quiet Zone-DMU	FTA Level of Noise Impact Remaining ¹
MP 1 to MP 2: E St. to southeast of Sierra Way							
1	Commercial/ Transient Residential use east of N. E. St. and north of alignment (includes horn noise)	Transient Residential / Commercial (Motel) / 2	1	69	51	<u>48</u>	No Impact
2	200' to 400' south of alignment, west of Pershing Ave.	Residential / 2	2	55	55	<u>52</u>	No Impact
3	50' to 100' east of alignment, east of Dorothy St.	Residential / 2	3	55	62	<u>60</u>	Moderate Impact ²
4	100 to 200' east of alignment, east of Dorothy St.	Residential / 2	3	55	56	<u>53</u>	<u>No Impact</u> ³
5	200 to 400' east of alignment, east of Dorothy St.	Residential / 2	32	55	54	<u>51</u>	No Impact
6	400 to 800' east of alignment, east of Dorothy St.	Residential / 2	8	55	44	<u>41</u>	No Impact
7	200 to 400' east of alignment, east of Dorothy St.	Residential / 2	3	55	48	<u>45</u>	No Impact
8	50' to 100' east of alignment, east of Dorothy St.	Residential / 2	5	55	60	<u>57</u>	Moderate Impact
9	100 to 200' east of alignment, east of Dorothy St.	Residential / 2	1	55	56	<u>52</u>	<u>No Impact</u> ³
10	200 to 400' east of alignment, east of Dorothy St.	Residential / 2	1	55	47	<u>44</u>	No Impact

Receiver #	Receiver Location Description	Land Use Category	Number of Noise-Sensitive Sites Represented	Existing Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers) with Quiet Zone-Preferred Project	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers) with Quiet Zone-DMU	FTA Level of Noise Impact Remaining ¹
MP 2 to MP 3.5: Southeast of Sierra Way to southeast of S. Waterman Ave.							
11	200 to 400' east of alignment, east of Lincoln Ave.	Residential / 2	3	52	50	<u>48</u>	No Impact
12	200' to 400' west of alignment, east of S. Washington Ave.	Residential / 2	1	52	51	<u>48</u>	No Impact
13	100 to 200' east of alignment, east of Lincoln Ave.	Residential / 2	6	52	59	<u>55</u>	Moderate Impact
14	50' to 100' west of alignment, east of S. Washington Ave.	Residential / 2	1	52	61	<u>57</u>	Moderate Impact ²
15	100' to 200' west of alignment, east of S. Washington Ave.	Residential / 2	2	52	57	<u>54</u>	<u>No Impact</u> ³
16	200' to 400' west of alignment, east of S. Washington Ave.	Residential / 2	3	52	48	<u>45</u>	No Impact
17	200' to 400' west of alignment, east of S. Washington Ave.	Residential / 2	2	52	55	<u>52</u>	<u>No Impact</u> ³
18	100' to 200' east of alignment, south of Ennis St.	Residential / 2	1	52	58	<u>56</u>	Moderate Impact
19	200' to 400' east of alignment, east of Lincoln Ave.	Residential / 2	2	52	55	<u>52</u>	<u>No Impact</u> ³
20	200' to 400' east of alignment, east of Lincoln Ave.	Residential / 2	2	52	52	<u>50</u>	No Impact
21	400' to 800' west of alignment, south of Orange Show Rd	Residential / 2	1	52	52	<u>50</u>	No Impact
22	50' to 100' southwest of alignment, north of Dumas St.	Residential / 2	1	52	63	<u>60</u>	Moderate Impact ²
23	100' to 200' southwest of alignment, north of Dumas St.	Residential / 2	2	52	57	<u>54</u>	<u>No Impact</u> ³
24	200' to 400' southwest of alignment, north of Dumas St.	Residential / 2	4	52	55	<u>52</u>	<u>No Impact</u> ³
MP 3.5 to MP 6: Southeast of S. Waterman Ave. to Bryn Mawr Ave.							
25	100' to 200' south of alignment, east of Tippecanoe Ave.	Residential / 2	3	64	58	<u>55</u>	No Impact

Receiver #	Receiver Location Description	Land Use Category	Number of Noise-Sensitive Sites Represented	Existing Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers) with Quiet Zone-Preferred Project	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers) with Quiet Zone-DMU	FTA Level of Noise Impact Remaining ¹
26	200' to 400' south of alignment, east of Tippecanoe Ave.	Residential / 2	8	64	51	<u>49</u>	No Impact
27	100' to 200' south of alignment, east of Tippecanoe Ave.	Residential / 2	8	64	55	<u>52</u>	No Impact
28	100' to 200' south of alignment, west of S. Richardson St.	Residential / 2	18	64	55	<u>52</u>	No Impact
29	200' to 400' south of alignment, west of S. Richardson St.	Residential / 2	4	64	46	<u>43</u>	No Impact
30	100' to 200' south of alignment, east of S. Richardson St.	Recreation (School Athletic Fields) and School / 3	1	55	57	<u>51</u>	No Impact (Category 3)
31	100' to 200' north of alignment, east of S. Richardson St.	Residential / 2	6	58	59	<u>55</u>	No Impact ³
32	200' to 400' north of alignment, east of S. Richardson St.	Residential / 2	5	58	47	<u>44</u>	No Impact
33	100' to 200' north of alignment, south of Victoria Ave.	Residential / 2	8	58	56	<u>52</u>	No Impact
34	100' to 200' north of alignment, south of Victoria Ave.	Residential / 2	4	58	56	<u>52</u>	No Impact
35	100' to 200' south of alignment, north of E. Gould St.	Residential / 2	8	58	55	<u>51</u>	No Impact
36	100' to 200' south of alignment, north of E. Gould St.	Residential / 2	10	58	56	<u>53</u>	No Impact
37	200' to 400' south of alignment, west of Mountain View Ave.	Residential / 2	7	58	46	<u>43</u>	No Impact
38	200' to 400' south of alignment, west of Mountain View Ave.	Day Care Facility / 3	1	55	56	<u>47</u>	No Impact
39	100' to 200' north of alignment, south of Victoria Ave.	Residential / 2	3	58	58	<u>54</u>	No Impact ³

Receiver #	Receiver Location Description	Land Use Category	Number of Noise-Sensitive Sites Represented	Existing Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers) with Quiet Zone-Preferred Project	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers) with Quiet Zone-DMU	FTA Level of Noise Impact Remaining ¹
40	200' to 400' north of alignment, south of Victoria Ave.	Residential / 2	3	58	51	<u>48</u>	No Impact
41	50' to 100' north of alignment, east of Mountain View Ave.	Residential / 2	6	58	63	<u>60</u>	Moderate Impact ²
MP 6 to MP 8.5: Bryn Mawr Ave. to east of Texas St.							
42	100' to 200' south of alignment, east of Bryn Mawr Ave.	Residential / 2	8	71	56	<u>52</u>	No Impact
43	50' to 100' north of alignment, east of Nevada St.	Transient Residential / Commercial (Motel)	1	67	60	<u>57</u>	No Impact
44	100' to 200' south of alignment, south of Redlands Blvd.	Residential / 2	6	67	56	<u>53</u>	No Impact
45	200' to 400' south of alignment, south of Redlands Blvd.	Residential / 2	22	67	47	<u>44</u>	No Impact
46	0' to 100' north of alignment, west of Tennessee St.	Transient Residential / Commercial (Motel) / 2	1	67	61	<u>57</u>	No Impact
47	100' to 200' north of alignment, west of New York St.	Residential / 2	1	62	57	<u>54</u>	No Impact
48	200' to 400' south of alignment, south of Redlands Blvd.	Recreation (Park) / 3	1	60	61	<u>52</u>	No Impact (Category 3)
49	200' to 400' north of alignment, west of Texas St.	Recreation (School Athletic Fields) and School / 2	1	57	58	<u>48</u>	No Impact (Category 3)
50	200' to 400' north of alignment, east of Texas St.	Residential / 2	6	62	51	<u>48</u>	No Impact
51	200' to 400' north of alignment, east of Texas St.	Residential / 2	1	62	45	<u>43</u>	No Impact
MP 8.5 to MP 10: East of Texas St. to east of N. University St. (Project End)							
52	200' to 400' north of alignment, east of Eureka St.	Residential / 2	3	62	53	<u>50</u>	No Impact
53	200' to 400' north of alignment, east of Texas St.	Residential / 2	1	62	49	<u>46</u>	No Impact

Receiver #	Receiver Location Description	Land Use Category	Number of Noise-Sensitive Sites Represented	Existing Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers) with Quiet Zone-Preferred Project	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers) with Quiet Zone-DMU	FTA Level of Noise Impact Remaining ¹
54	50' to 100' north of alignment, west of 9th St.	Residential / 2	3	67	62	<u>59</u>	No Impact
55	50' to 100' north of alignment, west of 9th St.	Church / 3	1	61	60	<u>58</u>	No Impact
56	200' to 400' south of alignment, west of Church St.	Residential / 2	4	67	47	<u>45</u>	No Impact
57	200' to 400' south of alignment, west of Church St.	Residential / 2	4	67	49	<u>46</u>	No Impact
58	200' to 400' north of alignment, east of 9th St.	Residential / 2	10	67	50	<u>46</u>	No Impact
59	200' to 400' north of alignment, east of 9th St.	Residential / 2	10	67	50	<u>46</u>	No Impact
60	200' to 400' south of alignment, east of Church St.	Residential / 2	3	67	45	<u>43</u>	No Impact
61	50' to 100' north of alignment, east of Church St.	Residential / 2	6	67	65	<u>63</u>	Moderate Impact
62	200' to 400' north of alignment, north of Sylvan Blvd.	Residential / 2	7	64	53	<u>50</u>	No Impact
63	50' to 100' north of alignment, north of Park Ave.	Recreation (Park) / 3	1	61	58	<u>53</u>	No Impact (Category 3)
64	100' to 200' south of alignment, west of University St.	Residential / 2	1	64	55	<u>51</u>	No Impact
65	100' to 200' south of alignment, west of University St.	Residential / 2	8	64	55	<u>52</u>	No Impact
66	100' to 200' south of alignment, west of University St.	Residential / 2	10	64	50	<u>47</u>	No Impact
67	200' to 400' south of alignment, west of University St.	Residential / 2	4	64	45	<u>43</u>	No Impact
68	50' to 100' south of alignment, east of University St.	Residential / 2	6	61	62	<u>60</u>	Moderate Impact
69	100' to 200' south of alignment, east of University St.	Residential / 2	7	61	53	<u>50</u>	No Impact

Receiver #	Receiver Location Description	Land Use Category	Number of Noise-Sensitive Sites Represented	Existing Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers)	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers) with Quiet Zone-Preferred Project	Project Noise Exposure (dBA L _{dn} or L _{eq} for Cat 3 Receivers) with Quiet Zone-DMU	FTA Level of Noise Impact Remaining ¹
70	200' to 400' south of alignment, east of University St.	Residential / 2	4	61	48	<u>45</u>	No Impact
71	100' to 200' north of alignment, east of University St.	School (University of Redlands) / 3	1	54	57	50	No Impact
72	100' to 200' south of alignment, east of Cook St.	Residential / 2	6	61	53	49	No Impact

Notes:

¹ Represents FTA Impact criteria

² Effect changes from Severe Impact to Moderate Impact with DMU option.

³ Effect changes from Moderate Impact to No Impact with DMU option.

With Quiet Zones in operation the DMU Option would result in noise levels that are 2 to 6 dB less than the locomotive driven trainset with Quiet Zone and would change the level of impact at a number of receiver locations. This would change the requirements for barriers. Under the DMU Option with Quiet Zones barriers 2WQZ and 4WQZ would be reduced in length relative to the locomotive driven trainset and barrier 6WQZ and 7WQZ would be eliminated. Table 4 summarizes barrier information with Quiet Zones in place. Where the DMU option would result in a change relative to the locomotive driven trainset, the text is underlined. Figure 2 shows how barriers 2WQZ and 4WQZ would change.

Table 4. Sound Barrier Locations—with Implementation of Quiet Zones

Sound Barrier #	Receiver #s	Sound Barrier Location/Description	Mile Post Location (Approx.)	Max. Threshold Exceeded, dB	Barrier Length (feet)	Barrier Height (feet)	Estimated Barrier Performance (dB)
1WQZ	3	Northeast side of rail alignment north of E. Julia St., east of S. Sierra Way	1.5	5	105	<u>8</u>	<u>6</u>
2WQZ	8 (<u>4 and 9 removed</u>)	East side of rail alignment adjacent to S. Dorothy St.	1.6	2	<u>800</u>	10	6
3WQZ	13,18 (<u>19 removed</u>)	East side of rail alignment, north of E. Orange Show Rd., south of E. Central Ave.	2.6	2	2,200	10	5
4WQZ	14 (<u>15 and 17 removed</u>)	West side of rail alignment, north of E. Orange Show Rd.	2.8	3	<u>650</u>	<u>8</u>	5
5WQZ	22 (<u>23 and 24 removed</u>)	Southwest side of rail alignment, south of E. Orange Show Rd., west of Waterman Ave.	3.0	6	700	<u>10</u>	<u>8</u>

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Evaluated Sound Barrier Locations Under DMU Option - Scenario with Implementation of Quiet Zones

Figure 2A

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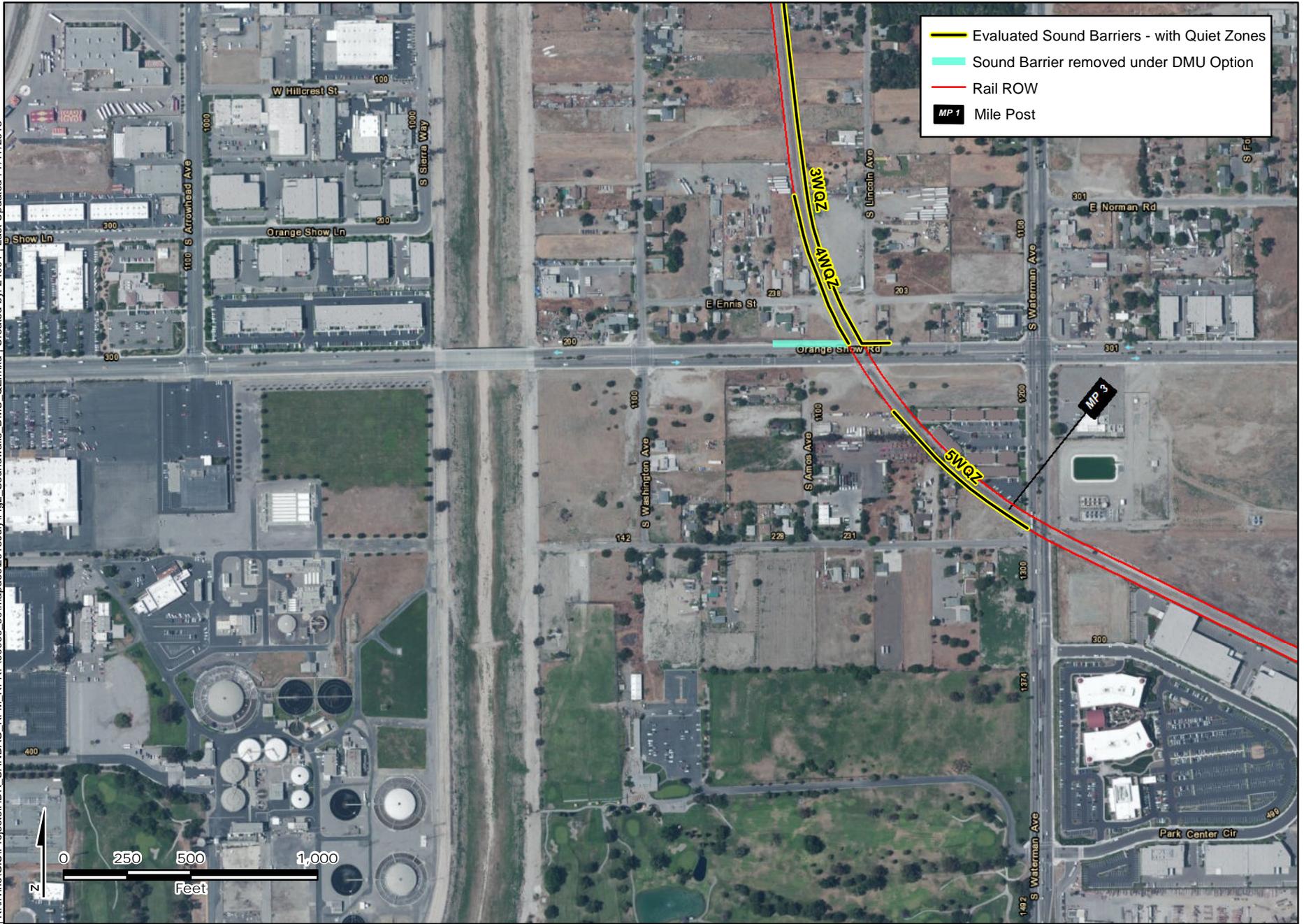


Sources

Evaluated Sound Barrier Locations Under DMU Option - Scenario with Implementation of Quiet Zones

Figure 2B

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Sources

Evaluated Sound Barrier Locations Under DMU Option - Scenario with Implementation of Quiet Zones
Figure 2C

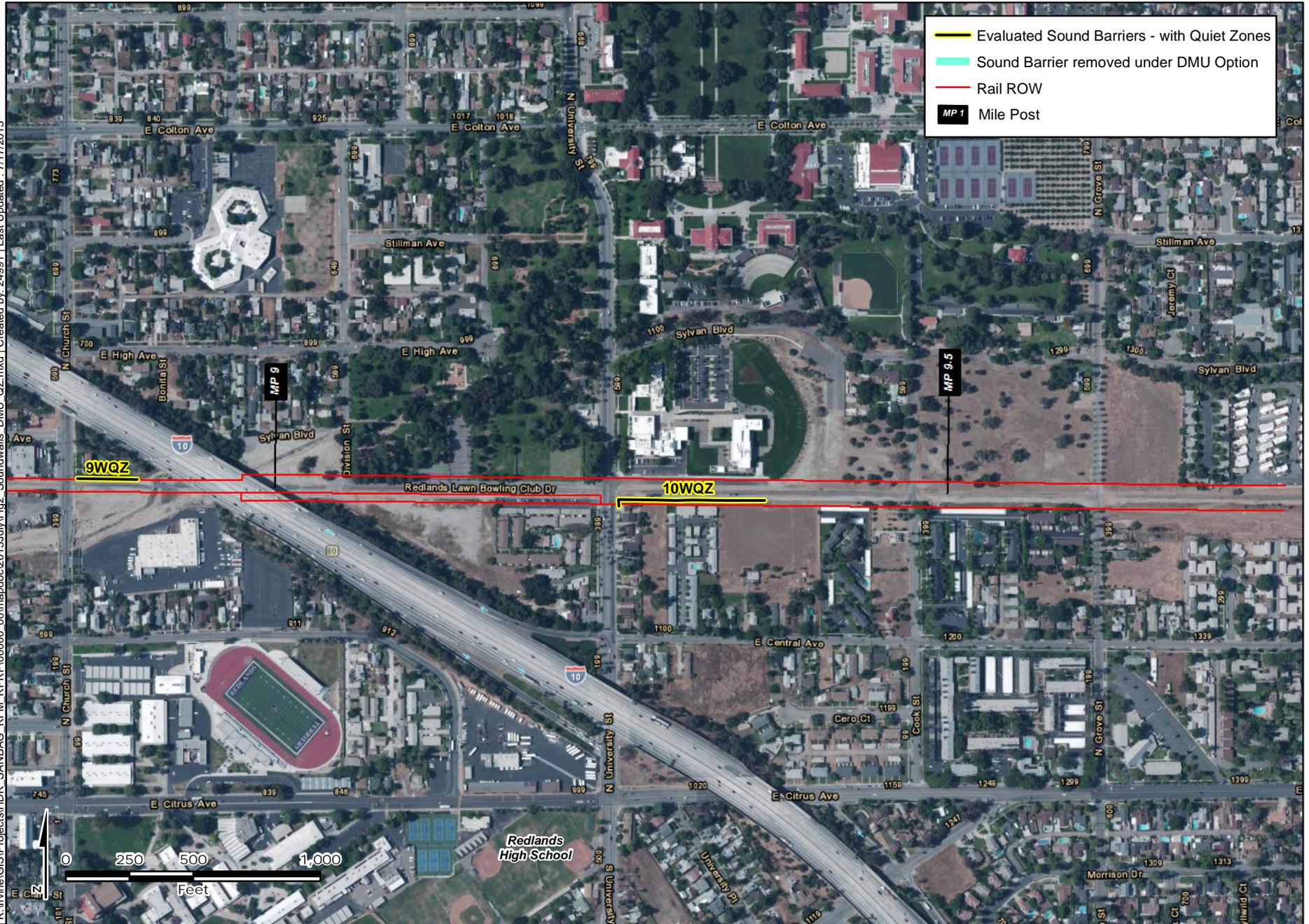
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Sources

Evaluated Sound Barrier Locations Under DMU Option - Scenario with Implementation of Quiet Zones
Figure 2E

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Sources

Evaluated Sound Barrier Locations Under DMU Option - Scenario with Implementation of Quiet Zones

Figure 2F

Sound Barrier #	Receiver #s	Sound Barrier Location/Description	Mile Post Location (Approx.)	Max. Threshold Exceeded, dB	Barrier Length (feet)	Barrier Height (feet)	Estimated Barrier Performance (dB)
6WQZ	(31 removed)	NA	NA	NA	NA	NA	NA
7WQZ	(39 removed)	NA	NA	NA	NA	NA	NA
8WQZ	41	Northeast side of rail alignment, east of Mountain View Ave., south of W. Lugonia Ave.	5.3	4	610	8	5
9WQZ	61	North side of rail alignment, east of Church St.	9.3	1	235	12	3
10WQZ	68	South side of rail alignment, east of N. University St.	9.8	2	600	8	3

Note:

¹ Assuming a solid barrier with absorptive surface facing the rail alignment.

4.3 CUMULATIVE IMPACTS

The noise and vibration analysis contained herein represents a cumulative impact analysis, looking at the impacts of the DMU option in connection with the Preferred Project and the growth in traffic and other noise-generating sources that are anticipated in the region. As discussed previously, the DMU option would result in fewer operational rail impacts to noise and vibration than the use of a locomotive driven trainset.

Considerable construction noise impacts would be the same for the DMU option under the Preferred Project. With implementation of mitigation measures, construction-related effects would not result in a severe cumulative impact. Conversely, severe impacts on rail noise during operations would represent a cumulative impact. Mitigation is provided to reduce these severe impacts; however, the Preferred Project using the DMU vehicle option would continue to result in severe noise conditions during operations at certain locations along the rail alignment. Therefore, the Preferred Project would contribute to a severe cumulative impact, although impacts would be reduced compared to the use of a locomotive driven trainset. The same mitigation would be required, except with the reduction in length and location of sound barriers, as described previously in Section 4 and shown in Figure 2.

5.0 REFERENCES

ICF International (ICF). 2013. Redlands Passenger Rail Project Noise Technical Memorandum. May.

U.S. Department of Transportation, Federal Transit Administration (FTA). Office of Planning and Environment. 2006. *Transit Noise and Vibration Impact Assessment*. FTA-VA-90-1003-06 (Prepared under contract by Harris, Miller, Miller and Hanson). Burlington, MA. May.

Appendix A
Rail Noise
Input and Output
For the DMU Option

Detailed Noise Assessment - Chapters 5 and 6 of the FTA Transit Noise and Vibration Assessment manual

Source Reference Levels:

Using 92 dBA SEL for Metrolink diesel-electric locomotive at 50 feet and 50 mph, 82 dBA SEL for Metrolink rail cars, and 85 dBA SEL for DMU vehicle based on Table 5-1

Speed: 20 mph (assumed)

Hourly Leq at 50':

Train without horns (ref : Table 5-2 FTA Manual)

$$Leqh = SEL_{ref} + 10 \cdot \log(N) + K \cdot \log(S/50) + 10 \cdot \log(V) - 35.6$$

Nlocos=1 (for RPRP consist), 2 for Metrolink Express 1 2

Ncars = 2 (for RPRP consist), 6 for Metrolink Express 2 6

K=-10 (passenger diesel)

RPRP Trains

V=21/15 = 1.4 daytime, 3/9 = 0.33 nighttime 1.40 0.33

Metrolink Express Trains

V=1/15 = 0.07 daytime, 1/9 = 0.11 nighttime 0.07 0.11

Locomotives:

Rail cars: NA

RPRP Trains

Daytime Hourly Leq:

Leqh= 54.8

Daytime Hourly Leq:

Leqh= -39.1

Nighttime Hourly Leq

Leqh= 48.6

Nighttime Hourly Leq

Leqh= -45.3

Ldn @50': 56.7 dBA

Ldn @50': -37.3

Combined Ldn 56.7

Metrolink Express Trains

Daytime Hourly Leq:

Leqh= 51.6

Daytime Hourly Leq:

Leqh= 34.5

Nighttime Hourly Leq

Leqh= 53.8

Nighttime Hourly Leq

Leqh= 36.7

Ldn @50': 60.0 dBA

Ldn @50': 42.8

Combined Ldn 60.1

Combined Leq day 56.6

Combined Leq night 55.0

Total Combined Ldn 61.7

Detailed Noise Assessment - Chapters 5 and 6 of the FTA Transit Noise and Vibration Assessment manual (Cont'd)

Speed: 28 mph (assumed)

Hourly Leq at 50':

Train without horns (ref : Table 5-2 FTA Manual)

$$\text{Leqh} = \text{SELref} + 10 * \text{Log}(N) + K * \text{Log}(S/50) + 10 * \text{Log}(V) - 35.6$$

Nlocos=1 (for RPRP consist), 2 for Metrolink Express	1	2
Ncars = 2 (for RPRP consist), 6 for Metrolink Express	2	6
K=-10 (passenger diesel)		

RPRP Trains

V=21/15 = 1.4 daytime, 3/9 = 0.33 nighttime	1.40	0.33
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Metrolink Express Trains

V=1/15 = 0.07 daytime, 1/9 = 0.11 nighttime	0.07	0.11
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Locomotives:

Rail cars: NA

RPRP Trains

Daytime Hourly Leq:

$$\text{Leqh} = 53.4$$

Daytime Hourly Leq:

$$\text{Leqh} = -36.2$$

Nighttime Hourly Leq

$$\text{Leqh} = 47.1$$

Nighttime Hourly Leq

$$\text{Leqh} = -42.4$$

Ldn @50': 55.2 dBA

Ldn @50': -34.4

Combined Ldn 55.2

Metrolink Express Trains

Daytime Hourly Leq:

$$\text{Leqh} = 50.2$$

Daytime Hourly Leq:

$$\text{Leqh} = 37.4$$

Nighttime Hourly Leq

$$\text{Leqh} = 52.4$$

Nighttime Hourly Leq

$$\text{Leqh} = 39.6$$

Ldn @50': 58.5 dBA

Ldn @50': 45.8

Combined Ldn 58.8

Combined Leq day 55.1

Combined Leq night 53.7

Total Combined Ldn 60.3

D-1

Detailed Noise Assessment - Chapters 5 and 6 of the FTA Transit Noise and Vibration Assessment manual (Cont'd)

Speed: 35 mph (assumed)

Hourly Leq at 50':

Train without horns (ref : Table 5-2 FTA Manual)

$$\text{Leqh} = \text{SELref} + 10 * \text{Log}(N) + K * \text{Log}(S/50) + 10 * \text{Log}(V) - 35.6$$

Nlocos=1 (for RPRP consist), 2 for Metrolink Express 1 2

Ncars = 2 (for RPRP consist), 6 for Metrolink Express 2 6

K=-10 (passenger diesel)

RPRP Trains

V=21/15 = 1.4 daytime, 3/9 = 0.33 nighttime 1.40 0.33

Metrolink Express Trains

V=1/15 = 0.07 daytime, 1/9 = 0.11 nighttime 0.07 0.11

Locomotives:

Rail cars: NA

RPRP Trains

Daytime Hourly Leq:

Daytime Hourly Leq:

Leqh= 52.4

Leqh= -34.2

Nighttime Hourly Leq

Nighttime Hourly Leq

Leqh= 46.2

Leqh= -40.5

Ldn @50': 54.2 dBA

Ldn @50': -32.4

Combined Ldn 54.2

Metrolink Express Trains

Daytime Hourly Leq:

Daytime Hourly Leq:

Leqh= 49.2

Leqh= 39.3

Nighttime Hourly Leq

Nighttime Hourly Leq

Leqh= 51.4

Leqh= 41.5

Ldn @50': 57.6 dBA

Ldn @50': 47.7

Combined Ldn 58.0

Combined Leq day 54.2

Combined Leq night 52.9

Total Combined Ldn 59.5

Combined Daytime Leq: 54.2

Detailed Noise Assessment - Chapters 5 and 6 of the FTA Transit Noise and Vibration Assessment manual (Cont'd)

Train Horns (ref: Table 5-2 and Table 6-3, FTA Manual)

$$Leq_h = SEL_{ref} + 10 \cdot \log(V) - 35.6$$

$$V_d = 1.47 \text{ Daytime}$$

$$V_n = 0.44 \text{ Nighttime}$$

Based on information provided by ATS Consulting (e-mail of 6/14/2011), using 97 dBA SEL at 100 feet (adjusted to 50 feet level)

$$SEL_{ref} = 101.5 \text{ dBA SEL}$$

Daytime Hourly Leq:

$$Leq_h = 67.6 \text{ at } 50 \text{ feet}$$

Nighttime Hourly Leq:

$$Leq_h = 62.4 \text{ at } 50 \text{ feet}$$

Ldn @50':	70.0 dBA
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Crossing Signal Noise (applicable to all at-grade crossings)

Per Table 5-6, Chapter 5 of the FTA Manual

$$\text{Reference SEL} = 109 \text{ dBA}$$

$$E, \text{ average duration: assume } 20 \text{ seconds}$$

$$N_d = 1.47$$

$$N_n = 0.44$$

Daytime Hourly Leq:

$$Leq_h = 54.2$$

Nighttime Hourly Leq

$$Leq_h = 43.8$$

Ldn @50':	54.0 dBA
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Layover Tracks

Per Table 5-6, Chapter 5 of the FTA Manual

$$\text{Reference SEL} = 109 \text{ dBA}$$

$$N_T, \text{ number of trains} = 3 \text{ Trains}$$

$$N_d = 0.00$$

$$N_n = 0.33$$

Daytime Hourly Leq:

$$Leq_h = 0.0$$

Nighttime Hourly Leq

$$Leq_h = 68.6$$

Ldn @50':	74.4 dBA
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Detailed Noise Assessment - Chapters 5 and 6 of the FTA Transit Noise and Vibration Assessment manual (Cont'd)

Summary Table		
Speed	Combined Rail Ldn	Combined Rail Leq for Cat 3
20	61.7	56.6
28	60.3	55.1
35	59.5	54.2

Redlands Passenger Rail Project FTA Noise Detailed Analysis Modeling Results Input and Output

Receiver #	Receiver Location Description	Land Use Description	Number of Noise Sensitive Sites Represented	Existing (dBA Ldn or Leq for Cat 3 Rcvrs)	Distance to BNSF Track Centerline (Feet)	Modeled Future with Project Rail Noise Level (dBA Ldn) (Includes horn noise where applicable)	Existing Barrier or Building Row ?	Estimated Reduction from Existing Barriers / Building Rows	Resultant Rail Noise Level (dBA Ldn or Leq for Cat 3 Rcvrs)	Distance to Crossing Signal (Feet)	Modeled Future Crossing Signal (Bell) Noise Level (dBA Ldn or Leq for Cat 3 Rcvrs)	Existing Barrier or Building Row ?	Estimated Reduction from Existing Barriers / Building Rows	Resultant Crossing Bell Noise Level (dBA Ldn or Leq for Cat 3 Rcvrs)	Combined Modeled Future with Project Rail Plus Crossing Signal Noise (dBA Ldn)	FTA Impact Level
1	Commercial/ Transient Residential use e of N. E St. and n of alignment (includes horn noise)	Transient Residential / Commercial (Motel)	1	69	200	61	1 Row	5	56	210	50	1 Row	5	45	57	No Impact
2	200' to 400' s of alignment, w of Pershing Ave	Residential	2	55	200	61	0 Rows	0	61	300	47	0 Rows	0	47	62	Severe Impact
3	50' to 100' e of alignment, e of Dorothy St	Residential	3	55	75	68	0 Rows	0	68	100	57	0 Rows	0	57	68	Severe Impact
4	100 to 200' e of alignment, e of Dorothy St	Residential	3	55	150	63	0 Rows	0	63	320	47	0 Rows	0	47	63	Severe Impact
5	200 to 400' e of alignment, e of Dorothy St	Residential	32	55	220	61	0 Rows	0	61	440	44	0 Rows	0	44	61	Moderate Impact
6	400 to 800' e of alignment, e of Dorothy St	Residential	8	55	400	57	2 Rows	6.5	50	540	42	2 Rows	6.5	36	51	No Impact
7	200 to 400' e of alignment, e of Dorothy St	Residential	3	55	250	60	1 Row	5	55	700	40	1 Row	5	35	55	No Impact
8	50' to 100' e of alignment, e of Dorothy St	Residential	5	55	75	68	0 Rows	0	68	900	38	0 Rows	0	38	68	Severe Impact
9	100 to 200' e of alignment, e of Dorothy St	Residential	1	55	150	52	0 Rows	0	52	1200	35	1 Row	5	30	52	No Impact
10	200 to 400' e of alignment, e of Dorothy St	Residential	1	55	300	59	1 Row	5	54	600	41	1 Row	5	36	54	No Impact
11	200 to 400' e of alignment, e of Lincoln Ave	Residential	3	52	275	59	1 Row	5	54	320	47	0 Rows	0	47	55	Moderate Impact
12	200' to 400' w of alignment, e of S Washington Ave	Residential	1	52	350	58	0 Rows	0	58	520	42	0 Rows	0	42	58	Moderate Impact

13	100' to 200' e of alignment, e of Lincoln Ave	Residential	6	52	100	66	0 Rows	0	66	740	39	1 Row	5	34	66	Severe Impact
14	50' to 100' w of alignment, e of S Washington Ave	Residential	1	52	75	68	0 Rows	0	68	430	44	1 Row	5	39	68	Severe Impact
15	100' to 200' w of alignment, e of S Washington Ave	Residential	2	52	125	64	0 Rows	0	64	490	43	1 Row	5	38	64	Severe Impact
16	200' to 400' w of alignment, e of S Washington Ave	Residential	3	52	250	60	1 Row	5	55	530	42	2 Rows	6.5	36	55	Moderate Impact
17	200' to 400' w of alignment, e of S Washington Ave	Residential	2	52	200	61	0 Rows	0	61	320	47	0 Rows	0	47	62	Severe Impact
18	100' to 200' e of alignment, s of Ennis St	Residential	1	52	150	63	0 Rows	0	63	140	54	0 Rows	0	54	64	Severe Impact
19	200' to 400' e of alignment, s of Lincoln Ave	Residential	2	52	200	61	0 Rows	0	61	300	47	0 Rows	0	47	62	Severe Impact
20	200' to 400' e of alignment, e of Lincoln Ave	Residential	2	52	350	58	0 Rows	0	58	330	46	0 Rows	0	46	58	Moderate Impact
21	400' to 800' w of alignment, s of Orange Show Rd	Residential	1	52	325	58	0 Rows	0	58	300	47	0 Rows	0	47	59	Moderate Impact
22	50' to 100' sw of alignment, n of Dumas St	Residential	1	52	50	70	0 Rows	0	70	390	45	0 Rows	0	45	70	Severe Impact
23	100' to 200' sw of alignment, n of Dumas St	Residential	2	52	140	64	0 Rows	0	64	350	46	0 Rows	0	46	64	Severe Impact
24	200' to 400' sw of alignment, n of Dumas St	Residential	4	52	220	61	0 Rows	0	61	240	49	0 Rows	0	49	61	Severe Impact
25	100' to 200' s of alignment, e of Tippecanoe Ave	Residential	3	64	140	64	0 Rows	0	64	180	52	0 Rows	0	52	64	Moderate Impact
26	200' to 400' s of alignment, e of Tippecanoe Ave	Residential	8	64	380	57	0 Rows	0	57	380	45	0 Rows	0	45	57	No Impact
27	100' to 200' s of alignment, e of Tippecanoe Ave	Residential	8	64	175	62	0 Rows	0	62	490	43	0 Rows	0	43	62	Moderate Impact
28	100' to 200' s of alignment, w of S Richardson St	Residential	18	64	175	62	0 Rows	0	62	420	44	0 Rows	0	44	62	Moderate Impact

29	200' to 400' s of alignment, w of S Richardson St	Residential	4	64	390	57	1 Row	5	52	450	44	1 Row	5	39	52	No Impact
30	100' to 200' s of alignment, e of S Richardson St	Recreation (School Athletic Fields) and School	1	55	175	60	0 Rows	0	60	240	49	0 Rows	0	49	60	No Impact (Category 3)
31	100' to 200' n of alignment, e of S Richardson St	Residential	6	58	100	66	0 Rows	0	66	430	44	0 Rows	0	44	66	Severe Impact
32	200' to 400' n of alignment, e of S Richardson St	Residential	5	58	320	58	1 Row	5	53	530	42	1 Row	5	37	53	No Impact
33	100' to 200' n of alignment, s of Victoria Ave	Residential	8	58	150	63	0 Rows	0	63	980	37	1 Row	5	32	63	Severe Impact
34	100' to 200' n of alignment, s of Victoria Ave	Residential	4	58	150	52	0 Rows	0	52	1350	34	0 Rows	0	34	52	No Impact
35	100' to 200' s of alignment, n of E Gould St	Residential	8	58	175	51	0 Rows	0	51	1100	36	0 Rows	0	36	51	No Impact
36	100' to 200' s of alignment, n of E Gould St	Residential	10	58	150	63	0 Rows	0	63	470	43	0 Rows	0	43	63	Severe Impact
37	200' to 400' s of alignment, w of Mountain View Ave	Residential	7	58	350	58	1 Row	5	53	530	42	1 Row	5	37	53	No Impact
38	200' to 400' s of alignment, w of Mountain View Ave	Day Care Facility	1	55	340	55	0 Rows	0	55	340	46	0 Rows	0	46	56	No Impact (Category 3)
39	100' to 200' n of alignment, s of Victoria Ave	Residential	3	58	125	64	0 Rows	0	64	315	47	0 Rows	0	47	65	Severe Impact
40	200' to 400' n of alignment, s of Victoria Ave	Residential	3	58	350	58	0 Rows	0	58	625	41	0 Rows	0	41	58	Moderate Impact
41	50' to 100' n of alignment, e of Mountain View Ave	Residential	6	58	50	70	0 Rows	0	70	650	40	0 Rows	0	40	70	Severe Impact
42	100' to 200' s of alignment, e of Bryn Mawr Ave	Residential	8	71	150	52	0 Rows	0	52	1000	37	0 Rows	0	37	52	No Impact
43	50' to 100' n of alignment, e of Nevada St	Transient Residential / Commercial (Motel)	1	67	75	57	0 Rows	0	57	1450	33	1 Row	5	28	57	No Impact
44	100' to 200' s of alignment, s of Redlands Blvd	Residential	6	67	150	63	0 Rows	0	63	600	41	0 Rows	0	41	63	Moderate Impact
45	200' to 400' s of alignment, s of Redlands Blvd	Residential	22	67	225	61	2 Rows	6.5	54	640	41	1 Row	5	36	54	No Impact

46	0' to 100' n of alignment, w of Tennessee St	Transient Residential / Commercial (Motel)	1	67	75	68	0 Rows	0	68	430	44	1 Row	5	39	68	Severe Impact
47	100' to 200' n of alignment, w of New York St	Residential	1	62	175	62	0 Rows	0	62	500	43	0 Rows	0	43	63	Moderate Impact
48	200' to 400' s of alignment, s of Redlands Blvd	Recreation (Park)	1	60	200	59	0 Rows	0	59	200	51	0 Rows	0	51	59	No Impact (Category 3)
49	200' to 400' n of alignment, w of Texas St	Recreation (School Athletic Fields) and School	1	57	250	57	0 Rows	0	57	525	42	0 Rows	0	42	58	No Impact (Category 3)
50	200' to 400' n of alignment, e of Texas St	Residential	6	62	240	60	1 Row	5	55	250	49	1 Row	5	44	56	No Impact
51	200' to 400' n of alignment, e of Texas St	Residential	1	62	350	58	3 Rows	8	50	420	44	2 Rows	6.5	38	50	No Impact
52	200' to 400' n of alignment, e of Eureka St	Residential	3	62	375	58	0 Rows	0	58	420	44	0 Rows	0	44	58	No Impact
53	200' to 400' n of alignment, e of Texas St	Residential	1	62	300	59	1 Row	5	54	590	41	1 Row	5	36	54	No Impact
54	50' to 100' n of alignment, w of 9th St	Residential	3	67	75	68	0 Rows	0	68	140	54	0 Rows	0	54	68	Severe Impact
55	50' to 100' n of alignment, w of 9th St	Church	1	61	80	65	0 Rows	0	65	100	57	0 Rows	0	57	65	Moderate Impact (Category 3)
56	200' to 400' s of alignment, w of Church St	Residential	4	67	475	56	1 Row	5	51	275	48	1 Row	5	43	51	No Impact
57	200' to 400' s of alignment, w of Church St	Residential	4	67	250	60	1 Row	5	55	400	45	1 Row	5	40	55	No Impact
58	200' to 400' n of alignment, e of 9th St	Residential	10	67	225	61	1 Row	5	56	410	44	1 Row	5	39	56	No Impact
59	200' to 400' n of alignment, e of 9th St	Residential	10	67	225	61	1 Row	5	56	410	44	1 Row	5	39	56	No Impact
60	200' to 400' s of alignment, e of Church St	Residential	3	67	475	56	1 Row	5	51	480	43	1 Row	5	38	51	No Impact
61	50' to 100' n of alignment, e of Church St	Residential	6	67	50	70	0 Rows	0	70	80	59	0 Rows	0	59	71	Severe Impact
62	200' to 400' n of alignment, n of Sylvan Blvd	Residential	7	64	250	60	0 Rows	0	60	820	38	1 Row	5	33	60	No Impact
63	50' to 100' n of alignment, n of Park Ave	Recreation (Park)	1	61	75	68	0 Rows	0	68	700	40	0 Rows	0	40	68	Moderate Impact (Category 3)
64	100' to 200' s of alignment, w of University St	Residential	1	64	100	66	1 Row	5	61	390	45	1 Row	5	40	61	Moderate Impact
65	100' to 200' s of alignment, w of University St	Residential	8	64	100	66	1 Row	5	61	190	51	1 Row	5	46	61	Moderate Impact

66	100' to 200' s of alignment, w of University St	Residential	10	64	175	62	2 Rows	6.5	56	270	48	2 Rows	6.5	42	56	No Impact
67	200' to 400' s of alignment, w of University St	Residential	4	64	300	59	3 Rows	8	51	320	47	3 Rows	8	39	51	No Impact
68	50' to 100' s of alignment, e of University St	Residential	6	61	75	68	0 Rows	0	68	120	55	0 Rows	0	55	68	Severe Impact
69	100' to 200' s of alignment, e of University St	Residential	7	61	150	63	1 Row	5	58	185	51	1 Row	5	46	59	Moderate Impact
70	200' to 400' s of alignment, e of University St	Residential	4	61	250	60	2 Rows	6.5	53	275	48	2 Rows	6.5	41	54	No Impact
71	100' to 200' n of alignment, e of University St	School (University of Redlands)	1	54	150	63	0 Rows	0	63	380	45	0 Rows	0	45	63	Moderate Impact (Category 3)
72	100' to 200' s of alignment, e of Cook St	Residential	6	61	125	65	1 Row	5	60	870	38	1 Row	5	33	60	Moderate Impact

Rec 63 and 71 corrected to ref Leq horn per Mike Greene 7-10-13

Redlands Passenger Rail Project FTA Noise Detailed Analysis Modeling Results Input and Output - with Quiet Zones ¹

Receiver #	Receiver Location Description	Land Use Description	Number of Noise-Sensitive Sites Represented	Existing (dBA Ldn or Leq for Cat 3 Rcvrs)	Distance to BNSF Track Centerline (Feet)	Modeled Future with Project Rail Noise Level (dBA Ldn or Leq for Cat 3 Rcvrs)	Existing Barrier or Building Row ?	Estimated Reduction from Existing Barriers / Building Rows	Resultant Rail Noise Level (dBA Ldn or Leq for Cat 3 Rcvrs)	Distance to Crossing Signal (Feet)	Modeled Future Crossing Signal (Bell) Noise Level (dBA Ldn or Leq for Cat 3 Rcvrs)	Existing Barrier or Building Row ?	Estimated Reduction from Existing Barriers / Building Rows	Resultant Crossing Bell Noise Level (dBA Ldn)	Receiver #	Combined Modeled Future with Project Rail Plus Crossing Signal Noise (dBA Ldn or Leq for Cat 3 Rcvrs)	Combined Existing plus Future Rail Noise (dBA Ldn or Leq for Cat 3 Rcvrs) (for Cumulative Analysis)	Rail Noise minus Existing Noise Level (dB)	FTA Impact Level
1	Commercial/ Transient Residential use e of N. E. St. and n of alignment (includes horn noise)	Transient Residential / Commercial (Motel)	1	69	200	50.5	1 Row	5	45	210	50	1 Row	5	45	1	48	69	-21	No Impact
2	200' to 400' s of alignment, w of Pershing Ave	Residential	2	55	200	50.5	0 Rows	0	50	300	47	0 Rows	0	47	2	52	57	-3	No Impact
3	50' to 100' e of alignment, e of Dorothy St	Residential	3	55	75	56.9	0 Rows	0	57	100	57	0 Rows	0	57	3	60	61	5	Moderate Impact
4	100 to 200' e of alignment, e of Dorothy St	Residential	3	55	150	52.4	0 Rows	0	52	320	47	0 Rows	0	47	4	53	57	-2	No Impact
5	200 to 400' e of alignment, e of Dorothy St	Residential	32	55	220	49.9	0 Rows	0	50	440	44	0 Rows	0	44	5	51	56	-4	No Impact
6	400 to 800' e of alignment, e of Dorothy St	Residential	8	55	400	46.0	2 Rows	6.5	39	540	42	2 Rows	6.5	36	6	41	55	-14	No Impact
7	200 to 400' e of alignment, e of Dorothy St	Residential	3	55	250	49.0	1 Row	5	44	700	40	1 Row	5	35	7	45	55	-10	No Impact
8	50' to 100' e of alignment, e of Dorothy St	Residential	5	55	75	56.9	0 Rows	0	57	900	38	0 Rows	0	38	8	57	59	2	Moderate Impact
9	100 to 200' e of alignment, e of Dorothy St	Residential	1	55	150	52.4	0 Rows	0	52	1200	35	1 Row	5	30	9	52	57	-3	No Impact
10	200 to 400' e of alignment, e of Dorothy St	Residential	1	55	300	47.8	1 Row	5	43	600	41	1 Row	5	36	10	44	55	-11	No Impact
11	200 to 400' e of alignment, e of Lincoln Ave	Residential	3	52	275	48.4	1 Row	5	43	320	47	0 Rows	0	47	11	48	54	-4	No Impact
12	200' to 400' w of alignment, e of S Washington Ave	Residential	1	52	350	46.8	0 Rows	0	47	520	42	0 Rows	0	42	12	48	54	-4	No Impact
13	100 to 200' e of alignment, e of Lincoln Ave	Residential	6	52	100	55.0	0 Rows	0	55	740	39	1 Row	5	34	13	55	57	3	Moderate Impact
14	50' to 100' w of alignment, e of S Washington Ave	Residential	1	52	75	56.9	0 Rows	0	57	430	44	1 Row	5	39	14	57	58	5	Moderate Impact
15	100' to 200' w of alignment, e of S Washington Ave	Residential	2	52	125	53.6	0 Rows	0	54	490	43	1 Row	5	38	15	54	56	2	No Impact
16	200' to 400' w of alignment, e of S Washington Ave	Residential	3	52	250	49.0	1 Row	5	44	530	42	2 Rows	6.5	36	16	45	53	-7	No Impact

17	200' to 400' w of alignment, e of S Washington Ave	Residential	2	52	200	50.5	0 Rows	0	50	320	47	0 Rows	0	47	17	52	55	0	No Impact
18	100' to 200' e of alignment, s of Ennis St	Residential	1	52	150	52.4	0 Rows	0	52	140	54	0 Rows	0	54	18	56	58	4	Moderate Impact
19	200' to 400' e of alignment, e of Lincoln Ave	Residential	2	52	200	50.5	0 Rows	0	50	300	47	0 Rows	0	47	19	52	55	0	No Impact
20	200' to 400' e of alignment, e of Lincoln Ave	Residential	2	52	350	46.8	0 Rows	0	47	330	46	0 Rows	0	46	20	50	54	-2	No Impact
21	400' to 800' w of alignment, s of Orange Show Rd	Residential	1	52	325	47.3	0 Rows	0	47	300	47	0 Rows	0	47	21	50	54	-2	No Impact
22	50' to 100' sw of alignment, n of Dumas St	Residential	1	52	50	59.5	0 Rows	0	60	390	45	0 Rows	0	45	22	60	60	8	Moderate Impact
23	100' to 200' sw of alignment, n of Dumas St	Residential	2	52	140	52.8	0 Rows	0	53	350	46	0 Rows	0	46	23	54	56	2	No Impact
24	200' to 400' sw of alignment, n of Dumas St	Residential	4	52	220	49.9	0 Rows	0	50	240	49	0 Rows	0	49	24	52	55	0	No Impact
25	100' to 200' s of alignment, e of Tippecanoe Ave	Residential	3	64	140	52.8	0 Rows	0	53	180	52	0 Rows	0	52	25	55	65	-9	No Impact
26	200' to 400' s of alignment, e of Tippecanoe Ave	Residential	8	64	380	46.3	0 Rows	0	46	380	45	0 Rows	0	45	26	49	64	-15	No Impact
27	100' to 200' s of alignment, e of Tippecanoe Ave	Residential	8	64	175	51.4	0 Rows	0	51	490	43	0 Rows	0	43	27	52	64	-12	No Impact
28	100' to 200' s of alignment, w of S Richardson St	Residential	18	64	175	51.4	0 Rows	0	51	420	44	0 Rows	0	44	28	52	64	-12	No Impact
29	200' to 400' s of alignment, w of S Richardson St	Residential	4	64	390	46.1	1 Row	5	41	450	44	1 Row	5	39	29	43	64	-21	No Impact
30	100' to 200' s of alignment, e of S Richardson St	Recreation (School Athletic Fields) and School	1	55	175	46.1	0 Rows	0	46	240	49	0 Rows	0	49	30	51	56	-4	No Impact
31	100' to 200' n of alignment, e of S Richardson St	Residential	6	58	100	55.0	0 Rows	0	55	430	44	0 Rows	0	44	31	55	60	-3	No Impact
32	200' to 400' n of alignment, e of S Richardson St	Residential	5	58	320	47.4	1 Row	5	42	530	42	1 Row	5	37	32	44	58	-14	No Impact
33	100' to 200' n of alignment, s of Victoria Ave	Residential	8	58	150	52.4	0 Rows	0	52	980	37	1 Row	5	32	33	52	59	-6	No Impact
34	100' to 200' n of alignment, s of Victoria Ave	Residential	4	58	150	52.4	0 Rows	0	52	1350	34	0 Rows	0	34	34	52	59	-6	No Impact
35	100' to 200' s of alignment, n of E Gould St	Residential	8	58	175	51.4	0 Rows	0	51	1100	36	0 Rows	0	36	35	51	59	-7	No Impact
36	100' to 200' s of alignment, n of E Gould St	Residential	10	58	150	52.4	0 Rows	0	52	470	43	0 Rows	0	43	36	53	59	-5	No Impact
37	200' to 400' s of alignment, w of Mountain View Ave	Residential	7	58	350	46.8	1 Row	5	42	530	42	1 Row	5	37	37	43	58	-15	No Impact

38	200' to 400' s of alignment, w of Mountain View Ave	Day Care Facility	1	55	340	41.8	0 Rows	0	42	340	46	0 Rows	0	46	38	47	56	-8	No Impact
39	100' to 200' n of alignment, s of Victoria Ave	Residential	3	58	125	53.6	0 Rows	0	54	315	47	0 Rows	0	47	39	54	60	-4	No Impact
40	200' to 400' n of alignment, s of Victoria Ave	Residential	3	58	350	46.8	0 Rows	0	47	625	41	0 Rows	0	41	40	48	58	-10	No Impact
41	50' to 100' n of alignment, e of Mountain View Ave	Residential	6	58	50	59.5	0 Rows	0	60	650	40	0 Rows	0	40	41	60	62	2	Moderate Impact
42	100' to 200' s of alignment, e of Bryn Mawr Ave	Residential	8	71	150	52.4	0 Rows	0	52	1000	37	0 Rows	0	37	42	52	71	-19	No Impact
43	50' to 100' n of alignment, e of Nevada St	Transient Residential / Commercial (Motel)	1	67	75	56.9	0 Rows	0	57	1450	33	1 Row	5	28	43	57	67	-10	No Impact
44	100' to 200' s of alignment, s of Redlands Blvd	Residential	6	67	150	52.4	0 Rows	0	52	600	41	0 Rows	0	41	44	53	67	-14	No Impact
45	200' to 400' s of alignment, s of Redlands Blvd	Residential	22	67	225	49.7	2 Rows	6.5	43	640	41	1 Row	5	36	45	44	67	-23	No Impact
46	0' to 100' n of alignment, w of Tennessee St	Transient Residential / Commercial (Motel)	1	67	75	56.9	0 Rows	0	57	430	44	1 Row	5	39	46	57	67	-10	No Impact
47	100' to 200' n of alignment, w of New York St	Residential	1	62	175	53.6	0 Rows	0	54	500	43	0 Rows	0	43	47	54	63	-8	No Impact
48	200' to 400' s of alignment, s of Redlands Blvd	Recreation (Park)	1	60	200	47.5	0 Rows	0	48	200	51	0 Rows	0	51	48	52	61	-8	No Impact
49	200' to 400' n of alignment, w of Texas St	Recreation (School Athletic Fields) and School	1	57	250	46.1	0 Rows	0	46	525	42	0 Rows	0	42	49	48	57	-9	No Impact
50	200' to 400' n of alignment, e of Texas St	Residential	6	62	240	51.5	1 Row	5	46	250	49	1 Row	5	44	50	48	62	-14	No Impact
51	200' to 400' n of alignment, e of Texas St	Residential	1	62	350	49.0	3 Rows	8	41	420	44	2 Rows	6.5	38	51	43	62	-19	No Impact
52	200' to 400' n of alignment, e of Eureka St	Residential	3	62	375	48.6	0 Rows	0	49	420	44	0 Rows	0	44	52	50	62	-12	No Impact
53	200' to 400' n of alignment, e of Texas St	Residential	1	62	300	50.0	1 Row	5	45	590	41	1 Row	5	36	53	46	62	-16	No Impact
54	50' to 100' n of alignment, w of 9th St	Residential	3	67	75	57.7	0 Rows	0	58	140	54	0 Rows	0	54	54	59	68	-8	No Impact
55	50' to 100' n of alignment, w of 9th St	Church	1	61	80	52.1	0 Rows	0	52	100	57	0 Rows	0	57	55	58	63	-3	No Impact
56	200' to 400' s of alignment, w of Church St	Residential	4	67	475	45.7	1 Row	5	41	275	48	1 Row	5	43	56	45	67	-22	No Impact
57	200' to 400' s of alignment, w of Church St	Residential	4	67	250	49.9	1 Row	5	45	400	45	1 Row	5	40	57	46	67	-21	No Impact
58	200' to 400' n of alignment, e of 9th St	Residential	10	67	225	50.5	1 Row	5	46	410	44	1 Row	5	39	58	46	67	-21	No Impact
59	200' to 400' n of alignment, e of 9th St	Residential	10	67	225	50.5	1 Row	5	46	410	44	1 Row	5	39	59	46	67	-21	No Impact

60	200' to 400' s of alignment, e of Church St	Residential	3	67	475	45.7	1 Row	5	41	480	43	1 Row	5	38	60	43	67	-24	No Impact
61	50' to 100' n of alignment, e of Church St	Residential	6	67	50	60.3	0 Rows	0	60	80	59	0 Rows	0	59	61	63	68	-4	Moderate Impact
62	200' to 400' n of alignment, n of Sylvan Blvd	Residential	7	64	250	49.9	0 Rows	0	50	820	38	1 Row	5	33	62	50	64	-14	No Impact
63	50' to 100' n of alignment, n of Park Ave	Recreation (Park)	1	61	75	52.5	0 Rows	0	53	700	40	0 Rows	0	40	63	53	62	-8	No Impact
64	100' to 200' s of alignment, w of University St	Residential	1	64	100	55.8	1 Row	5	51	390	45	1 Row	5	40	64	51	64	-13	No Impact
65	100' to 200' s of alignment, w of University St	Residential	8	64	100	55.8	1 Row	5	51	190	51	1 Row	5	46	65	52	64	-12	No Impact
66	100' to 200' s of alignment, w of University St	Residential	10	64	175	52.2	2 Rows	6.5	46	270	48	2 Rows	6.5	42	66	47	64	-17	No Impact
67	200' to 400' s of alignment, w of University St	Residential	4	64	300	48.7	3 Rows	8	41	320	47	3 Rows	8	39	67	43	64	-21	No Impact
68	50' to 100' s of alignment, e of University St	Residential	6	61	75	57.7	0 Rows	0	58	120	55	0 Rows	0	55	68	60	63	-1	Moderate Impact
69	100' to 200' s of alignment, e of University St	Residential	7	61	150	53.2	1 Row	5	48	185	51	1 Row	5	46	69	50	61	-11	No Impact
70	200' to 400' s of alignment, e of University St	Residential	4	61	250	49.9	2 Rows	6.5	43	275	48	2 Rows	6.5	41	70	45	61	-16	No Impact
71	100' to 200' n of alignment, e of University St	School (University of Redlands)	1	54	150	48.0	0 Rows	0	48	380	45	0 Rows	0	45	71	50	55	-4	No Impact
72	100' to 200' s of alignment, e of Cook St	Residential	6	61	125	54.4	1 Row	5	49	870	38	1 Row	5	33	72	49	61	-12	No Impact

1 - Assumes that Quiet Zones would be implemented at the following at-grade crossings: S. Arrowhead Avenue, S/ Sierra Way, W. Central Avenue, E. Orange Show Road, S. Waterman Avenue, S. Tippecanoe Avenue, S. Richardson Street, Mountain View Avenue, W. Colton Avenue, Tennessee Street, Church Street, N. University Street.

Calculation of Barrier / Bldg Row Insertion Loss (Ref. FTA Noise and Vibration Manual)

Barrier Shielding from Building Rows - Ref Table 6-10, page 6-26

Gaps in rows of bldgs typically pretty tight so use 35percent or less

A buildings = min(10 or 1.5(R-1) + 5)

Number of Rows	Barrier Shielding (dB)
0 Rows	0
1 Row	5
2 Rows	6.5
3 Rows	8
4 Rows	9.5
5 Rows	10
6 Rows	10
7 Rows	10
8 Rows	10
9 Rows	10
10 Rows	10

Barrier Insertion Loss

Ref Table 6-9, Page 6-25 (FTA Manual)

Condition	Equation
For non-absorptive transit barriers within 5 feet of the track	$A_{\text{barrier}} = \min\{12 \text{ or } [5.3 \cdot \log(P) + 6.7]\}$
For absorptive transit barriers within 5 feet of the track	$A_{\text{barrier}} = \min\{15 \text{ or } [5.3 \cdot \log(P) + 9.7]\}$
For all other barriers, and for protrusion of terrain above the line of sight:	$A_{\text{barrier}} = \min\{15 \text{ or } [20 \cdot \log((2.51 \cdot \sqrt{P}) / \tanh^* [4.46 \cdot \sqrt{P}]) + 5]\}$
Barrier Insertion Loss	$I_{\text{barrier}} = \max\{0 \text{ or } [A_{\text{barrier}} - 10 \cdot (\text{Gnb} - \text{Gb}) \cdot \log(D/50)]\}$
D= closest distance btwn rcvr and source, in feet	
P = path length difference, in feet (see figure 6-7) : P=A+B-C	
GNB = Ground factor G computed without barrier (see Figure 6-5)	
GB = Ground factor G computed with barrier (see Figure 6-5)	

Hs = 8 feet for trains with diesel-electric locomotives and DMU
Hr =5 feet

Barrier Insertion Loss Calculations - with Quiet Zones

												A _{barrier} = IL because assume hard-ground (Red = negative i.e., no IL)		
Source-Receiver Distance (ft. or m)	Source Base Elev. (ft. or m)	Source Height above Ground (ft. or m)	Receiver Base Elev. (ft. or m)	Receiver Height above Ground (ft. or m)	Horizontal Barrier Dist. (in ref. to source) (ft. or m)	Barrier Base Elev. (ft. or m)	Barrier Height (ft. or m)	Source-Rev. Straight-Line Dist. (ft. or m) - C	Source-Top-of-Barrier Dist. (ft. or m) - A	Receiver-Top-of-Barrier Dist. (ft. or m) - B	P=A+B-C	If Non-absorptive	If Absorptive:	If "Other":
Case: Rcvr 3														
75.0	1018.0	8.0	1018.0	5.0	60.0	1018.0	6.0	75.1	60.0	15.0	0.0	-4.8	-1.8	-34.6
75.0	1018.0	8.0	1018.0	5.0	60.0	1018.0	8.0	75.1	60.0	15.3	0.2	3.4	6.4	6.8
75.0	1018.0	8.0	1018.0	5.0	60.0	1018.0	10.0	75.1	60.0	15.8	0.8	6.1	9.1	11.9
75.0	1018.0	8.0	1018.0	5.0	60.0	1018.0	12.0	75.1	60.1	16.6	1.6	7.8	10.8	12.0
75.0	1018.0	8.0	1018.0	5.0	60.0	1018.0	14.0	75.1	60.3	17.5	2.7	9.0	12.0	12.0
75.0	1018.0	8.0	1018.0	5.0	60.0	1018.0	16.0	75.1	60.5	18.6	4.1	9.9	12.9	12.0
75.0	1018.0	8.0	1018.0	5.0	60.0	1058.0	18.0	75.1	78.1	55.1	58.1	12.0	15.0	12.0
Case: Rcvr 4														
150.0	1017.0	8.0	1017.0	5.0	14.0	1017.0	6.0	150.0	14.1	136.0	0.1	1.7	4.7	3.5
150.0	1017.0	8.0	1017.0	5.0	14.0	1017.0	8.0	150.0	14.0	136.0	0.0	-6.6	-3.6	-65.5
150.0	1017.0	8.0	1017.0	5.0	14.0	1017.0	10.0	150.0	14.1	136.1	0.2	3.0	6.0	6.1
150.0	1017.0	8.0	1017.0	5.0	14.0	1017.0	12.0	150.0	14.6	136.2	0.7	5.9	8.9	11.5
150.0	1017.0	8.0	1017.0	5.0	14.0	1017.0	14.0	150.0	15.2	136.3	1.5	7.6	10.6	12.0
150.0	1017.0	8.0	1017.0	5.0	14.0	1017.0	16.0	150.0	16.1	136.4	2.5	8.8	11.8	12.0
150.0	1017.0	8.0	1017.0	5.0	14.0	1017.0	18.0	150.0	17.2	136.6	3.8	9.8	12.8	12.0
Case: Rcvr 8														
75.0	1016.0	8.0	1016.0	5.0	20.0	1016.0	6.0	75.1	20.1	55.0	0.0	-0.2	2.8	-1.8
75.0	1016.0	8.0	1016.0	5.0	20.0	1016.0	8.0	75.1	20.0	55.1	0.0	-2.1	0.9	-9.9
75.0	1016.0	8.0	1016.0	5.0	20.0	1016.0	10.0	75.1	20.1	55.2	0.3	3.7	6.7	7.3
75.0	1016.0	8.0	1016.0	5.0	20.0	1016.0	12.0	75.1	20.4	55.4	0.8	6.1	9.1	11.9
75.0	1016.0	8.0	1016.0	5.0	20.0	1016.0	14.0	75.1	20.9	55.7	1.6	7.7	10.7	12.0
75.0	1016.0	8.0	1016.0	5.0	20.0	1016.0	16.0	75.1	21.5	56.1	2.6	8.9	11.9	12.0
75.0	1016.0	8.0	1016.0	5.0	20.0	1016.0	18.0	75.1	22.4	56.5	3.8	9.8	12.8	12.0
Case: Rcvr 9														
150.0	1015.0	8.0	1016.0	5.0	20.0	1016.0	6.0	150.0	20.0	130.0	0.0	-2.9	0.1	-15.0
150.0	1015.0	8.0	1016.0	5.0	20.0	1016.0	8.0	150.0	20.0	130.0	0.0	-0.4	2.6	-2.2
150.0	1015.0	8.0	1016.0	5.0	20.0	1016.0	10.0	150.0	20.2	130.1	0.3	4.0	7.0	7.9
150.0	1015.0	8.0	1016.0	5.0	20.0	1016.0	12.0	150.0	20.6	130.2	0.8	6.2	9.2	12.0
150.0	1015.0	8.0	1016.0	5.0	20.0	1016.0	14.0	150.0	21.2	130.3	1.5	7.6	10.6	12.0
150.0	1015.0	8.0	1016.0	5.0	20.0	1016.0	16.0	150.0	21.9	130.5	2.4	8.7	11.7	12.0
150.0	1015.0	8.0	1016.0	5.0	20.0	1016.0	18.0	150.0	22.8	130.6	3.5	9.6	12.6	12.0
Case: Rcvr 13														
100.0	1005.0	8.0	1006.0	5.0	25.0	1005.0	6.0	100.0	25.1	75.0	0.1	0.2	3.2	-0.3
100.0	1005.0	8.0	1006.0	5.0	25.0	1005.0	8.0	100.0	25.0	75.0	0.0	-4.8	-1.8	-34.5
100.0	1005.0	8.0	1006.0	5.0	25.0	1005.0	10.0	100.0	25.1	75.1	0.2	2.6	5.6	5.2
100.0	1005.0	8.0	1006.0	5.0	25.0	1005.0	12.0	100.0	25.3	75.2	0.5	5.3	8.3	10.3
100.0	1005.0	8.0	1006.0	5.0	25.0	1005.0	14.0	100.0	25.7	75.4	1.1	7.0	10.0	12.0
100.0	1005.0	8.0	1006.0	5.0	25.0	1005.0	16.0	100.0	26.2	75.7	1.9	8.2	11.2	12.0
100.0	1005.0	8.0	1006.0	5.0	25.0	1005.0	18.0	100.0	26.9	76.0	2.9	9.1	12.1	12.0
Case: Rcvr 14														
75.0	1009.0	8.0	1008.0	5.0	25.0	1009.0	6.0	75.1	25.1	50.0	0.0	-3.2	-0.2	-17.8
75.0	1009.0	8.0	1008.0	5.0	25.0	1009.0	8.0	75.1	25.0	50.2	0.1	-0.1	2.9	-1.1
75.0	1009.0	8.0	1008.0	5.0	25.0	1009.0	10.0	75.1	25.1	50.4	0.3	4.2	7.2	8.2
75.0	1009.0	8.0	1008.0	5.0	25.0	1009.0	12.0	75.1	25.3	50.6	0.8	6.3	9.3	12.0

Noise Reduction Required for No Impact (DMU)

5

0

2

0

1

3

75.0	1009.0	8.0	1008.0	5.0	25.0	1009.0	14.0	75.1	25.7	51.0	1.6	7.8	10.8	12.0
75.0	1009.0	8.0	1008.0	5.0	25.0	1009.0	16.0	75.1	26.2	51.4	2.6	8.9	11.9	12.0
75.0	1009.0	8.0	1008.0	5.0	25.0	1009.0	18.0	75.1	26.9	51.9	3.7	9.7	12.7	12.0
Case: Rcvr 15														
125.0	1009.0	8.0	1007.0	5.0	25.0	1009.0	6.0	125.1	25.1	100.0	0.0	-1.8	1.2	-8.3
125.0	1009.0	8.0	1007.0	5.0	25.0	1009.0	8.0	125.1	25.0	100.1	0.0	-1.8	1.2	-8.2
125.0	1009.0	8.0	1007.0	5.0	25.0	1009.0	10.0	125.1	25.1	100.2	0.2	3.3	6.3	6.6
125.0	1009.0	8.0	1007.0	5.0	25.0	1009.0	12.0	125.1	25.3	100.4	0.6	5.6	8.6	10.9
125.0	1009.0	8.0	1007.0	5.0	25.0	1009.0	14.0	125.1	25.7	100.6	1.2	7.1	10.1	12.0
125.0	1009.0	8.0	1007.0	5.0	25.0	1009.0	16.0	125.1	26.2	100.8	2.0	8.3	11.3	12.0
125.0	1009.0	8.0	1007.0	5.0	25.0	1009.0	18.0	125.1	26.9	101.1	2.9	9.2	12.2	12.0
Case: Rcvr 17														
200.0	1009.0	8.0	1009.0	5.0	25.0	1009.0	6.0	200.0	25.1	175.0	0.1	0.2	3.2	-0.3
200.0	1009.0	8.0	1009.0	5.0	25.0	1009.0	8.0	200.0	25.0	175.0	0.0	-6.5	-3.5	-63.4
200.0	1009.0	8.0	1009.0	5.0	25.0	1009.0	10.0	200.0	25.1	175.1	0.1	2.0	5.0	4.0
200.0	1009.0	8.0	1009.0	5.0	25.0	1009.0	12.0	200.0	25.3	175.1	0.4	4.8	7.8	9.4
200.0	1009.0	8.0	1009.0	5.0	25.0	1009.0	14.0	200.0	25.7	175.2	0.9	6.5	9.5	12.0
200.0	1009.0	8.0	1009.0	5.0	25.0	1009.0	16.0	200.0	26.2	175.3	1.6	7.7	10.7	12.0
200.0	1009.0	8.0	1009.0	5.0	25.0	1009.0	18.0	200.0	26.9	175.5	2.4	8.7	11.7	12.0
Case: Rcvr 18														
150.0	1009.0	8.0	1010.0	5.0	25.0	1010.0	6.0	150.0	25.0	125.0	0.0	-3.8	-0.8	-22.2
150.0	1009.0	8.0	1010.0	5.0	25.0	1010.0	8.0	150.0	25.0	125.0	0.0	-0.6	2.4	-2.9
150.0	1009.0	8.0	1010.0	5.0	25.0	1010.0	9.0	150.0	25.1	125.1	0.1	2.0	5.0	4.1
150.0	1009.0	8.0	1010.0	5.0	25.0	1010.0	12.0	150.0	25.5	125.2	0.7	5.8	8.8	11.3
150.0	1009.0	8.0	1010.0	5.0	25.0	1010.0	14.0	150.0	26.0	125.3	1.3	7.3	10.3	12.0
150.0	1009.0	8.0	1010.0	5.0	25.0	1010.0	16.0	150.0	26.6	125.5	2.0	8.3	11.3	12.0
150.0	1009.0	8.0	1010.0	5.0	25.0	1010.0	18.0	150.0	27.3	125.7	3.0	9.2	12.2	12.0
Case: Rcvr 19														
200.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	6.0	200.0	25.1	175.0	0.1	0.2	3.2	-0.3
200.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	8.0	200.0	25.0	175.0	0.0	-6.5	-3.5	-63.4
200.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	10.0	200.0	25.1	175.1	0.1	2.0	5.0	4.0
200.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	12.0	200.0	25.3	175.1	0.4	4.8	7.8	9.4
200.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	14.0	200.0	25.7	175.2	0.9	6.5	9.5	12.0
200.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	16.0	200.0	26.2	175.3	1.6	7.7	10.7	12.0
200.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	18.0	200.0	26.9	175.5	2.4	8.7	11.7	12.0
Case: Rcvr 22														
50.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	6.0	50.1	25.1	25.0	0.0	-3.9	-0.9	-23.8
50.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	8.0	50.1	25.0	25.2	0.1	1.1	4.1	2.1
50.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	10.0	50.1	25.1	25.5	0.5	5.0	8.0	9.9
50.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	12.0	50.1	25.3	26.0	1.2	7.1	10.1	12.0
50.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	14.0	50.1	25.7	26.6	2.2	8.5	11.5	12.0
50.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	16.0	50.1	26.2	27.3	3.5	9.6	12.6	12.0
50.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	18.0	50.1	26.9	28.2	5.0	10.4	13.4	12.0
Case: Rcvr 23														
140.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	6.0	140.0	25.1	115.0	0.1	-0.1	2.9	-1.3
140.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	8.0	140.0	25.0	115.0	0.0	-4.7	-1.7	-33.1
140.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	10.0	140.0	25.1	115.1	0.2	2.4	5.4	4.9
140.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	12.0	140.0	25.3	115.2	0.5	5.1	8.1	10.0
140.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	14.0	140.0	25.7	115.4	1.0	6.8	9.8	12.0
140.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	16.0	140.0	26.2	115.5	1.7	8.0	11.0	12.0
140.0	1010.0	8.0	1010.0	5.0	25.0	1010.0	18.0	140.0	26.9	115.7	2.6	8.9	11.9	12.0

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Case: Rcvr 24														
220.0	1012.0	8.0	1010.0	5.0	25.0	1011.0	6.0	220.1	25.2	195.0	0.1	2.1	5.1	4.2
220.0	1012.0	8.0	1010.0	5.0	25.0	1011.0	8.0	220.1	25.0	195.0	0.0	-5.9	-2.9	-51.1
220.0	1012.0	8.0	1010.0	5.0	25.0	1011.0	10.0	220.1	25.0	195.1	0.1	0.0	3.0	-0.8
220.0	1012.0	8.0	1010.0	5.0	25.0	1011.0	12.0	220.1	25.2	195.2	0.3	3.8	6.8	7.6
220.0	1012.0	8.0	1010.0	5.0	25.0	1011.0	14.0	220.1	25.5	195.3	0.7	5.9	8.9	11.4
220.0	1012.0	8.0	1010.0	5.0	25.0	1011.0	16.0	220.1	26.0	195.4	1.3	7.3	10.3	12.0
220.0	1012.0	8.0	1010.0	5.0	25.0	1011.0	18.0	220.1	26.6	195.5	2.0	8.3	11.3	12.0
Case: Rcvr 31														
100.0	1079.0	8.0	1081.0	5.0	50.0	1080.0	6.0	100.0	50.0	50.0	0.0	-5.5	-2.5	-44.2
100.0	1079.0	8.0	1081.0	5.0	50.0	1080.0	8.0	100.0	50.0	50.0	0.0	-0.4	2.6	-2.4
100.0	1079.0	8.0	1081.0	5.0	50.0	1080.0	10.0	100.0	50.1	50.2	0.2	3.5	6.5	6.9
100.0	1079.0	8.0	1081.0	5.0	50.0	1080.0	12.0	100.0	50.2	50.4	0.6	5.5	8.5	10.8
100.0	1079.0	8.0	1081.0	5.0	50.0	1080.0	14.0	100.0	50.5	50.6	1.1	7.0	10.0	12.0
100.0	1079.0	8.0	1081.0	5.0	50.0	1080.0	16.0	100.0	50.8	51.0	1.8	8.0	11.0	12.0
100.0	1079.0	8.0	1081.0	5.0	50.0	1080.0	18.0	100.0	51.2	51.4	2.6	8.9	11.9	12.0
Case: Rcvr 39														
125.0	1096.0	8.0	1100.0	5.0	50.0	1098.0	6.0	125.0	50.0	75.0	0.0	-6.9	-3.9	-73.4
125.0	1096.0	8.0	1100.0	5.0	50.0	1098.0	8.0	125.0	50.0	75.0	0.0	-0.6	2.4	-2.9
125.0	1096.0	8.0	1100.0	5.0	50.0	1098.0	10.0	125.0	50.2	75.1	0.2	3.2	6.2	6.4
125.0	1096.0	8.0	1100.0	5.0	50.0	1098.0	12.0	125.0	50.4	75.2	0.5	5.2	8.2	10.2
125.0	1096.0	8.0	1100.0	5.0	50.0	1098.0	14.0	125.0	50.6	75.3	1.0	6.6	9.6	12.0
125.0	1096.0	8.0	1100.0	5.0	50.0	1098.0	16.0	125.0	51.0	75.5	1.5	7.7	10.7	12.0
125.0	1096.0	8.0	1100.0	5.0	50.0	1098.0	18.0	125.0	51.4	75.8	2.2	8.5	11.5	12.0
Case: Rcvr 41														
50.0	1109.0	8.0	1110.0	5.0	20.0	1110.0	6.0	50.0	20.0	30.0	0.0	-8.0	-5.0	-105.1
50.0	1109.0	8.0	1110.0	5.0	20.0	1110.0	8.0	50.0	20.0	30.1	0.1	2.1	5.1	4.2
50.0	1109.0	8.0	1110.0	5.0	20.0	1110.0	10.0	50.0	20.2	30.4	0.6	5.5	8.5	10.8
50.0	1109.0	8.0	1110.0	5.0	20.0	1110.0	12.0	50.0	20.6	30.8	1.4	7.4	10.4	12.0
50.0	1109.0	8.0	1110.0	5.0	20.0	1110.0	14.0	50.0	21.2	31.3	2.5	8.8	11.8	12.0
50.0	1109.0	8.0	1110.0	5.0	20.0	1110.0	16.0	50.0	21.9	32.0	3.8	9.8	12.8	12.0
50.0	1109.0	8.0	1110.0	5.0	20.0	1110.0	18.0	50.0	22.8	32.7	5.5	10.6	13.6	12.0
Case: Rcvr 61														
50.0	1409.0	8.0	1410.0	15.0	24.0	1410.0	6.0	50.6	24.0	27.5	0.9	6.5	9.5	12.0
50.0	1409.0	8.0	1410.0	15.0	24.0	1410.0	8.0	50.6	24.0	26.9	0.3	4.0	7.0	8.0
50.0	1409.0	8.0	1410.0	15.0	24.0	1410.0	10.0	50.6	24.2	26.5	0.0	-1.6	1.4	-7.2
50.0	1409.0	8.0	1410.0	15.0	24.0	1410.0	12.0	50.6	24.5	26.2	0.1	-0.1	2.9	-1.3
50.0	1409.0	8.0	1410.0	15.0	24.0	1410.0	14.0	50.6	25.0	26.0	0.4	4.5	7.5	8.9
50.0	1409.0	8.0	1410.0	15.0	24.0	1410.0	16.0	50.6	25.6	26.0	1.0	6.7	9.7	12.0
50.0	1409.0	8.0	1410.0	15.0	24.0	1410.0	18.0	50.6	26.4	26.2	1.9	8.2	11.2	12.0
Case: Rcvr 68														
75.0	1446.0	8.0	1446.0	5.0	35.0	1446.0	6.0	75.1	35.1	40.0	0.0	-4.0	-1.0	-24.6
75.0	1446.0	8.0	1446.0	5.0	35.0	1446.0	8.0	75.1	35.0	40.1	0.1	-0.1	2.9	-1.3
75.0	1446.0	8.0	1446.0	5.0	35.0	1446.0	10.0	75.1	35.1	40.3	0.3	4.0	7.0	7.9
75.0	1446.0	8.0	1446.0	5.0	35.0	1446.0	12.0	75.1	35.2	40.6	0.8	6.1	9.1	11.9
75.0	1446.0	8.0	1446.0	5.0	35.0	1446.0	14.0	75.1	35.5	41.0	1.5	7.6	10.6	12.0
75.0	1446.0	8.0	1446.0	5.0	35.0	1446.0	16.0	75.1	35.9	41.5	2.3	8.6	11.6	12.0
75.0	1446.0	8.0	1446.0	5.0	35.0	1446.0	18.0	75.1	36.4	42.1	3.4	9.5	12.5	12.0

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