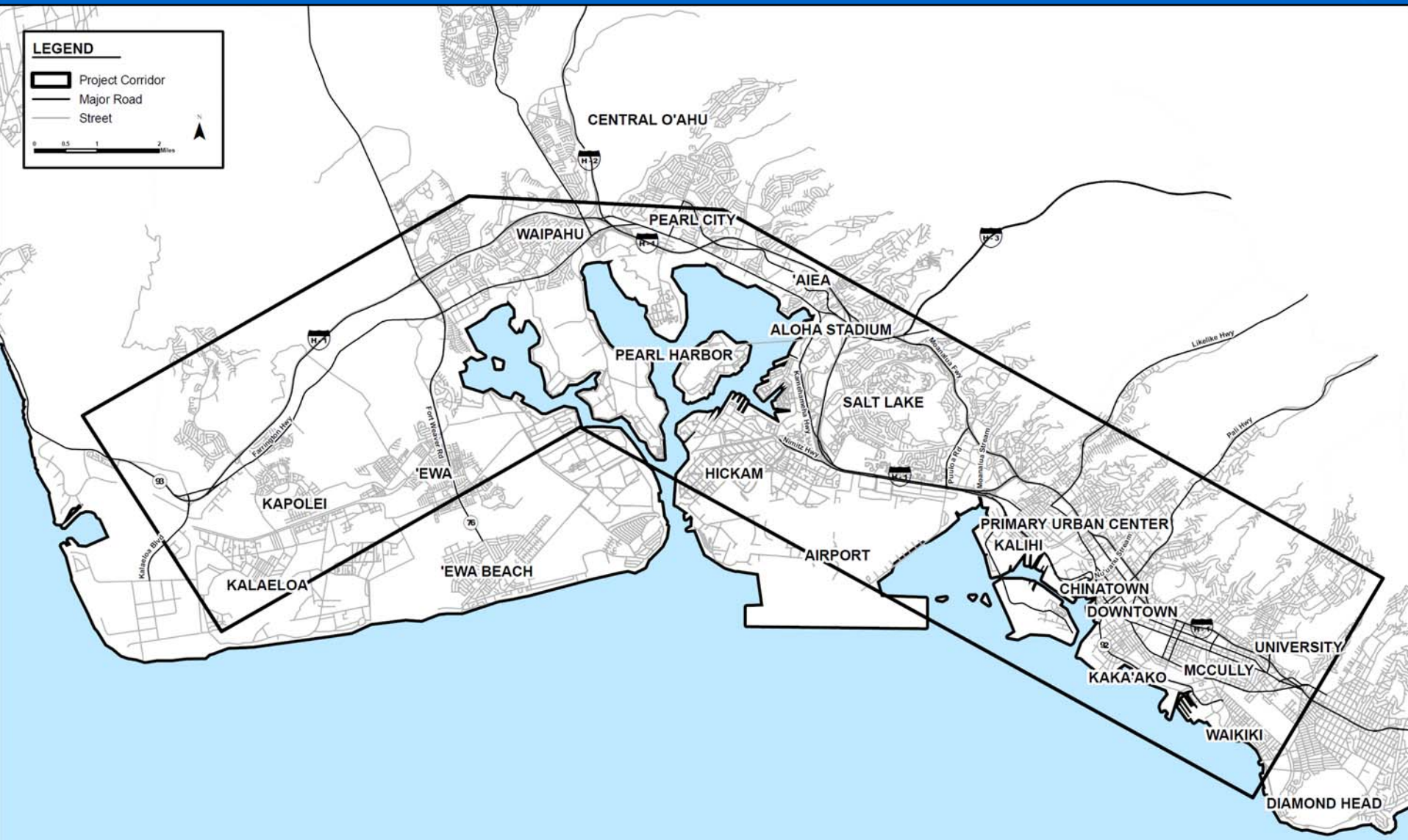
# Elevated Transit Noise Assessment in an Urban Environment - Case Study Honolulu High Capacity Transit

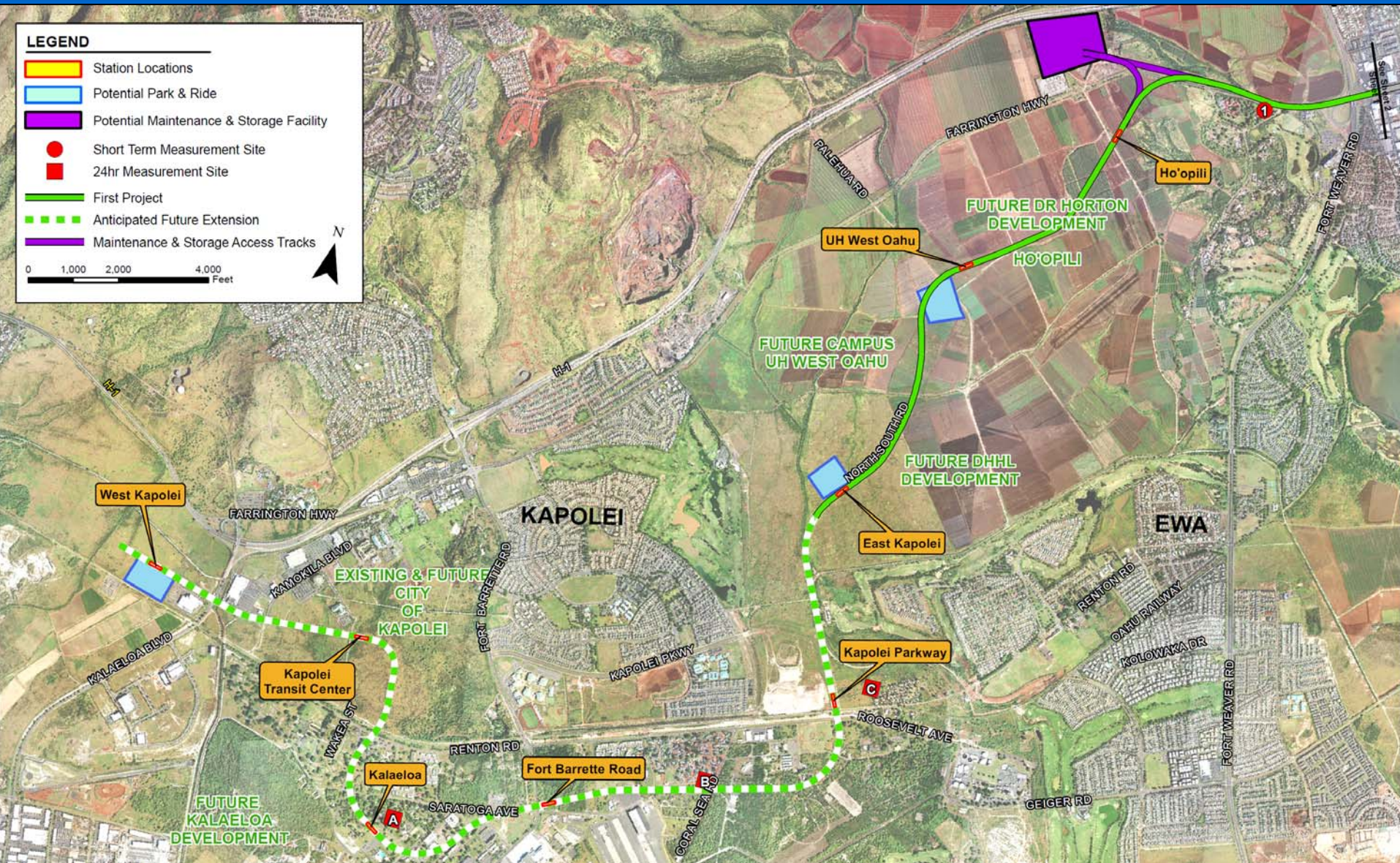
**TRB ADC 40 Summer Meeting**
**July 20 - 23 2008**
**Key West, Florida**

Kevin Keller, PB Americas

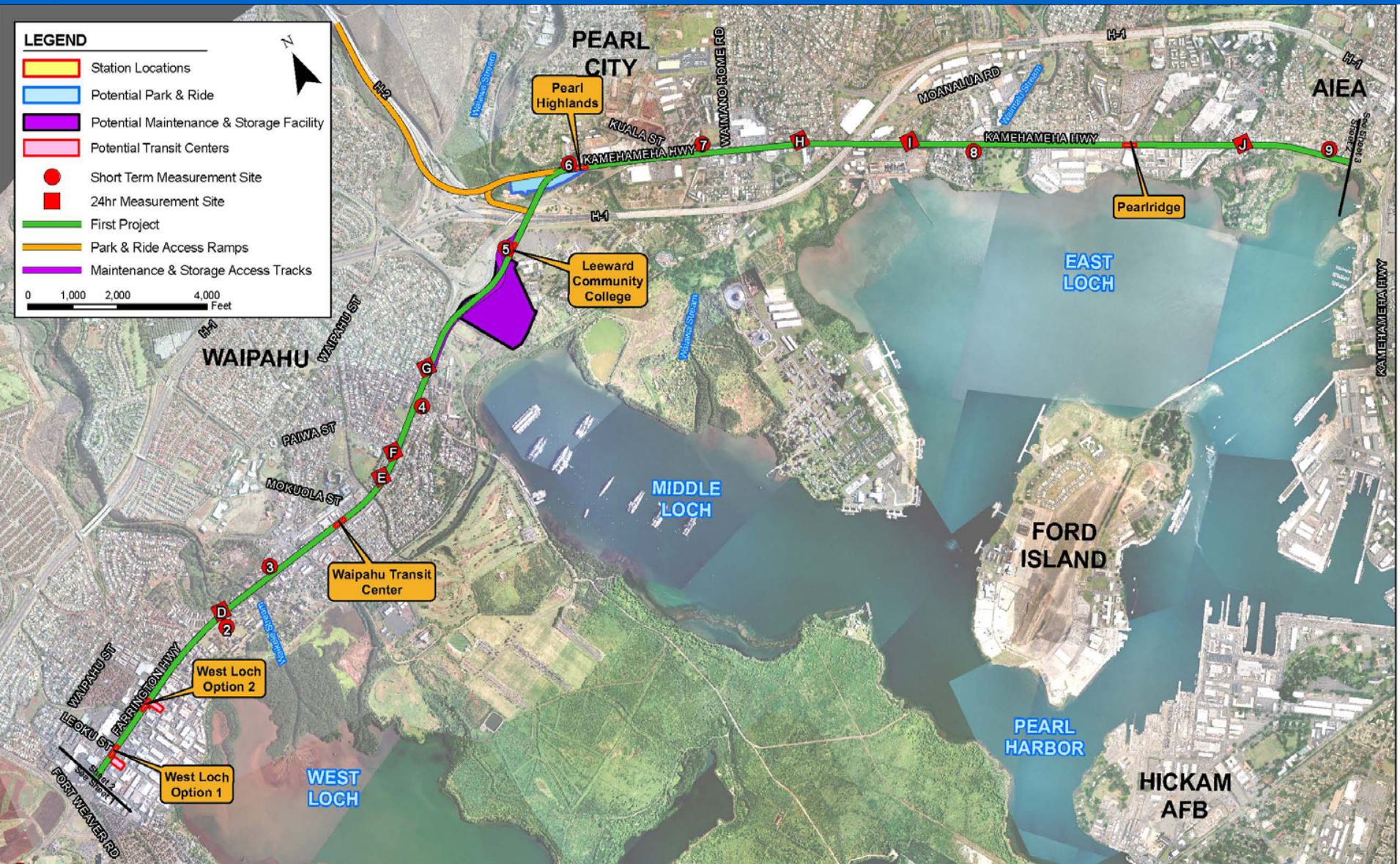
# Study – Honolulu, Hawaii



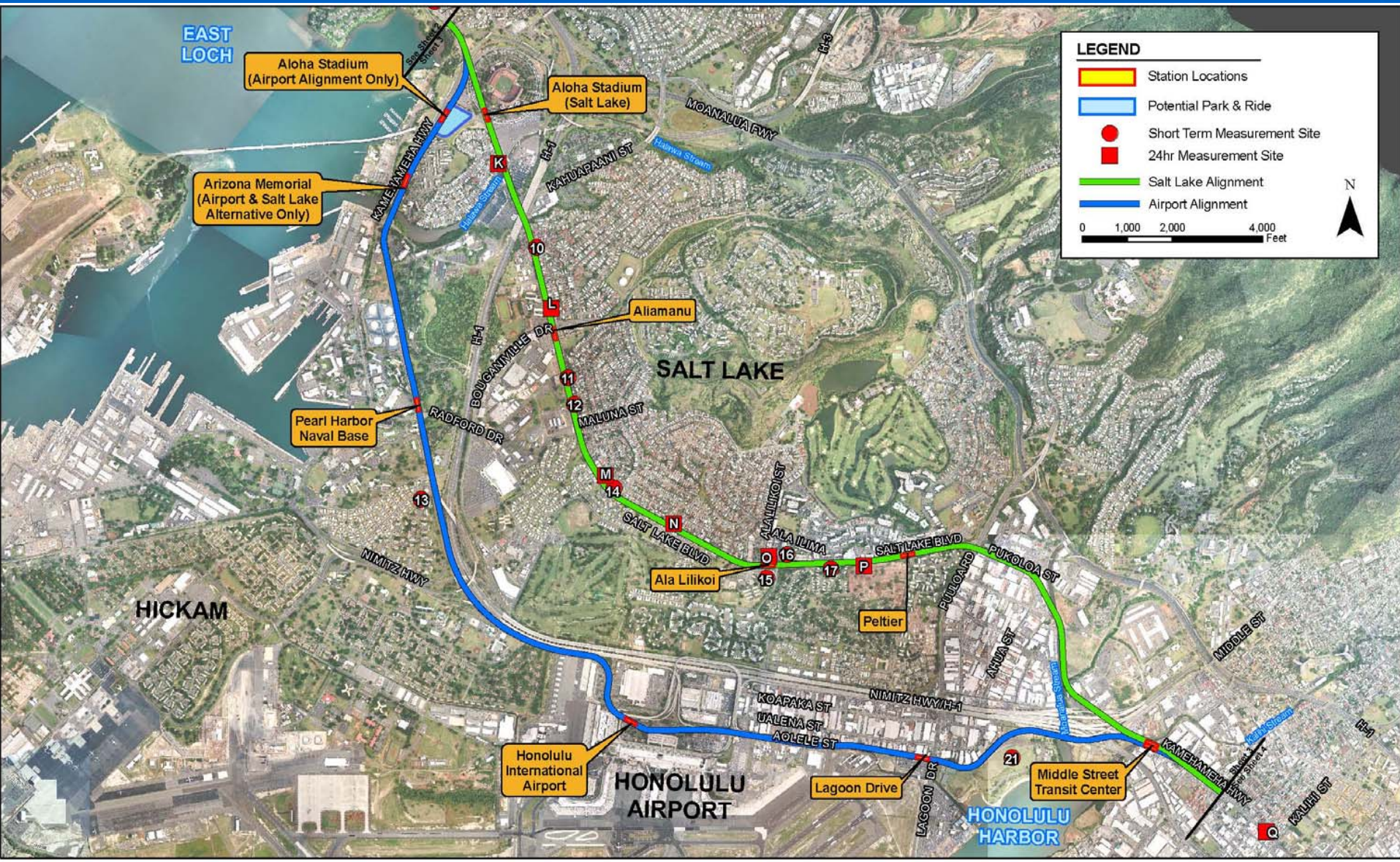
# Kapolei to Fort Weaver Road



# Fort Weaver Road to Aloha Stadium

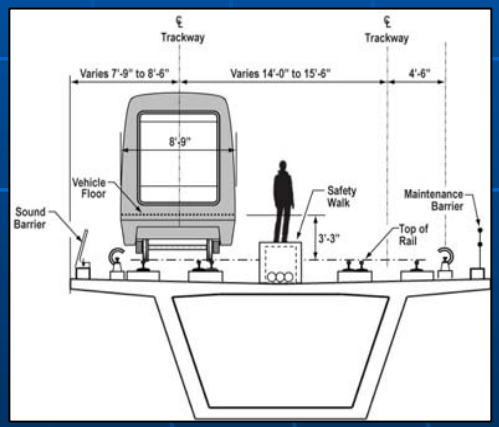


# Aloha Stadium to Kalihi

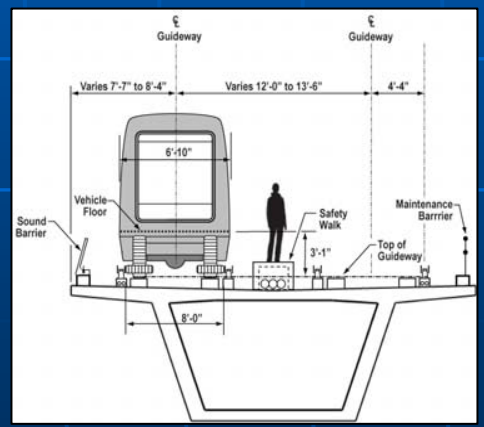


# Kalihi to UH Mānoa and Waikīkī

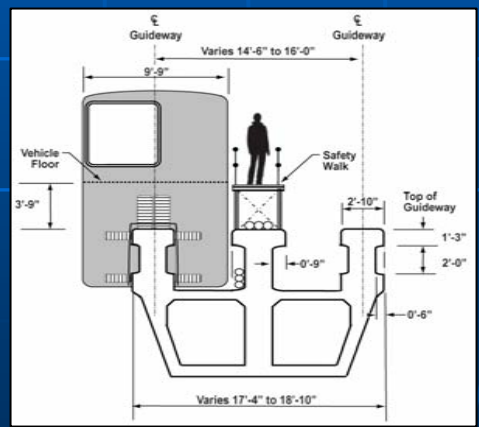
# 5 Technologies



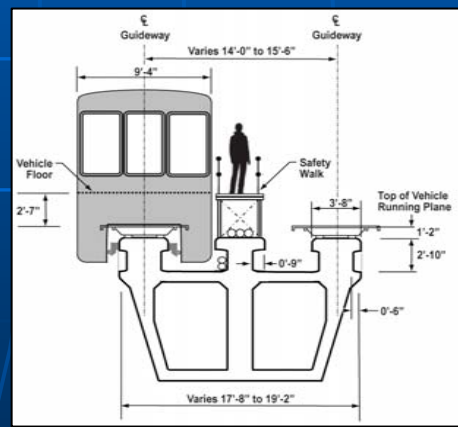

LRT/RRT




AGT




Monorail



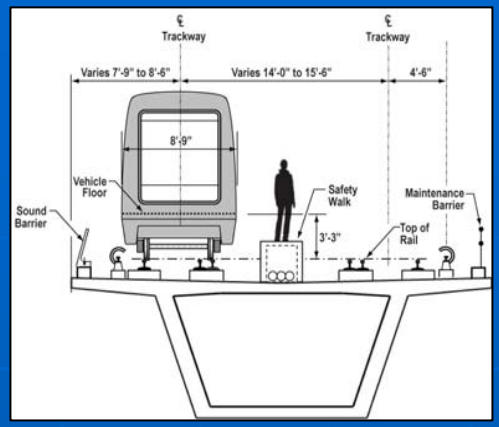

Maglev

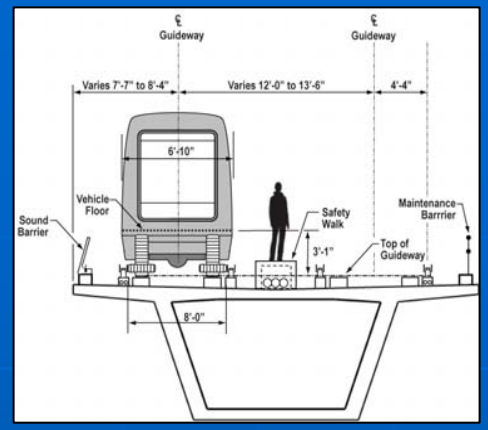
# Project Noise Levels by Technology

| Rec. | Receptor Description | Alternative | B# | Existing Noise Level (dBA) | Unmitigated Project Noise Exposure | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | LRT/RR (dBA) | AGT (dBA) | Monorail (dBA) | Maglev (dBA) |
| All Build Alternatives | | | | | | | | |
| A | Saratoga Ave/ Franklin Ave | All Build Alternatives | 22 | 59 | 66 | 57 | 61 | 55 |
| B | 4235 Independence Road | All Build Alternatives | 20 | 74 | 67 | 59 | 63 | 57 |
| C | 91-1005 Koahi Street | All Build Alternatives | 6 | 54 | 53 | 40 | 44 | 38 |
| 1 | Kahi Mohala Mental Health Facility | All Build Alternatives | 2 | 57 | 63 | 55 | 59 | 53 |
| D | 94-508 Farrington Highway | All Build Alternatives | 40 | 72 | 70 | 62 | 66 | 60 |
| 2 | Waipuhu Intermediate | All Build Alternatives | 1 | 63 | 65 | 57 | 61 | 55 |
| 3 | 94-309 Hanewai Circle | All Build Alternatives | 20 | 63 | 71 | 63 | 67 | 61 |
| E | 94-979 Kahuamoku Place | All Build Alternatives | 16 | 78 | 69 | 61 | 65 | 59 |
| F | 94-1041 Kahua Moku | All Build Alternatives | 15 | 73 | 70 | 62 | 66 | 60 |
| 4 | 91-1144 Awaiki Place | All Build Alternatives | 18 | 59 | 70 | 62 | 66 | 60 |
| G | 94-261 Kahualena | All Build Alternatives | 21 | 69 | 70 | 62 | 66 | 60 |
| 5 | Leeward Community College | All Build Alternatives | 1 | 65 | 62 | 54 | 58 | 52 |
| 6 | 1060 Kamehameha Highway | All Build Alternatives | 1 | 67 | 64 | 56 | 60 | 54 |
| 7 | Pecheco Neighborhood Park—Pearl Ridge Elementary School | All Build Alternatives | 3 | 59 | 67 | 59 | 63 | 57 |
| H | 751 Pu'u Kala | All Build Alternatives | 13 | 66 | 69 | 61 | 65 | 59 |
| I | 98-5 Kuleana Place | All Build Alternatives | 22 | 74 | 69 | 61 | 65 | 59 |
| 8 | Neal S. Blaisdell Park | All Build Alternatives | 1 | 64 | 66 | 58 | 62 | 56 |
| J | 98-124B Kihale Street | All Build Alternatives | 19 | 74 | 70 | 62 | 66 | 60 |

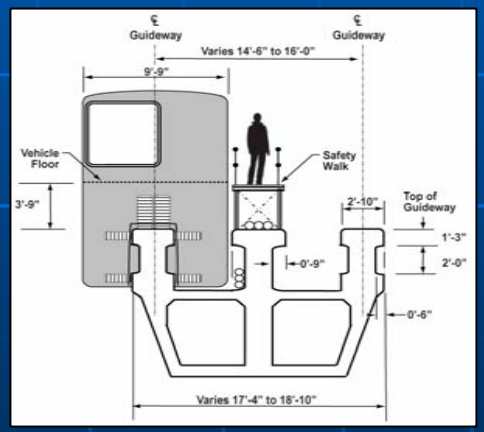
# Impacts by Technology

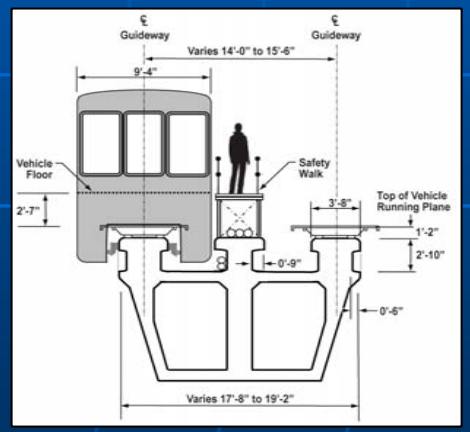
| Stations | Site | Impacts by Technology | | | |
|---|---|---|---|---|---|
| | | LRT and Rapid Rail | RTG | Monorail | Maglev |
| **Common to All Build Alternatives** | | | | | |
| Kapolei Transit Center to Kalaeloa | A | Severe impacts at 15 receivers | No impacts | Moderate impacts at 15 receivers | No impacts |
| Kalaeloa to Fort Barrette Road | A | Severe impacts at 7 receivers | No impacts | Moderate impacts at 7 receivers | No impacts |
| Fort Barrette Road to Kapolei Parkway | B | Moderate impacts at 10 receivers | No impacts | No impacts | No impacts |
| Kapolei Parkway to East Kapolei | C | No impacts | No impacts | No impacts | No impacts |
| Hoʻopili to West Loch | 1 | Severe impacts at 2 receivers | No impacts | Moderate impacts at 2 receivers | No impacts |
| West Loch to Waipahu Transit Center | D, 2, 3 | Severe impacts at 20 receivers; Moderate impacts at 41 receivers | Moderate impacts at 20 receivers | Severe impacts at 20 receivers; Moderate impacts at 40 receivers | Moderate impacts at 20 receivers |
| Waipahu Transit Center to Leeward Community College | E, F, 4, G | Severe impacts at 18 receivers; Moderate impacts at 52 receivers | Moderate impacts at 18 receivers | Severe impacts at 18 receivers; Moderate impacts at 36 receivers | Moderate impacts at 18 receivers |
| Leeward Community College to Pearl Highlands | 5, 6 | Moderate impacts at 1 receiver | No impacts | No impacts | No impacts |
| Pearl Highlands to Pearlridge | 7, H, I, 8 | Severe impacts at 22 receivers; Moderate impacts at 15 receivers | No impacts | Moderate impacts at 15 receivers | No impacts |
| Pearlridge to Aloha Stadium | J, 9 | Severe impacts at 14 receivers; Moderate impacts at 19 receivers | Moderate impacts at 14 receivers | Severe impacts at 14 receivers; Moderate impacts at 19 receivers | Moderate impacts at 14 receivers |




LRT/RRT and AGT Structure would allow sound barrier




Monorail and Maglev Structure would not allow sound barrier

# Project Noise Levels with Mitigation

| Rec. | Receptor Description | Alternative | B# | Existing Noise Level (dBA) | Unmitigated Project Noise Exposure | | | |
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| All Build Alternatives | | | | | | | | |
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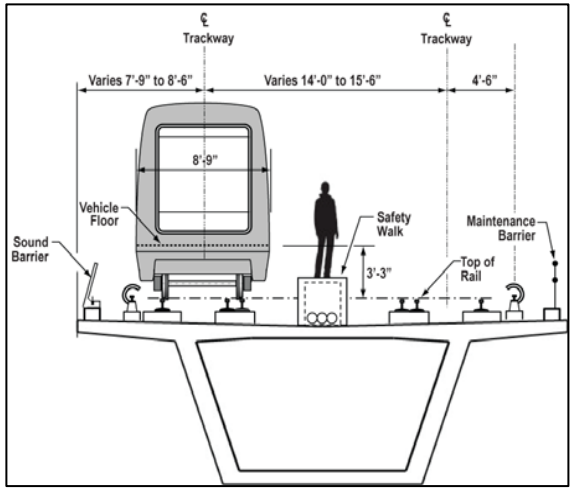
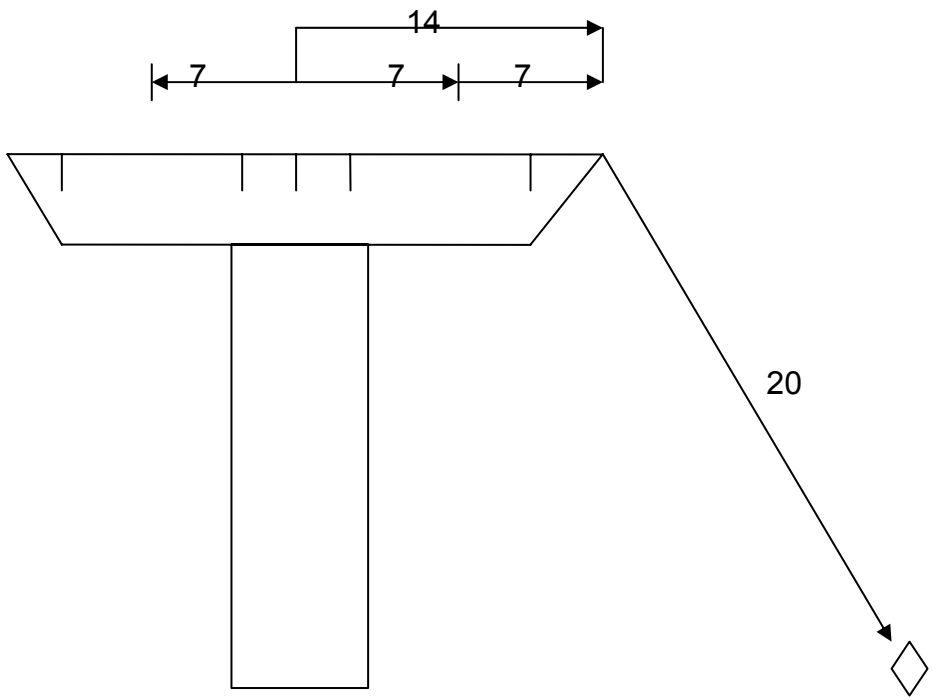
# Impacts with Mitigation

| Stations | Site | Impacts by Technology | | | |
|---|---|---|---|---|---|
| | | LRT and Rapid Rail | RTG | Monorail | Maglev |
| Common to All Build Alternatives | | | | | |
| Kapolei Transit Center to Kalaeloa | A | None | None | Moderate impacts at 15 receivers | No impacts |
| Kalaeloa to Fort Barrette Road | A | None | None | Moderate impacts at 7 receivers | No impacts |
| Fort Barrette Road to Kapolei Parkway | B | None | None | No impacts | No impacts |
| Kapolei Parkway to East Kapolei | C | None | None | No impacts | No impacts |
| Hoʻopili to West Loch | 1 | None | None | Moderate impacts at 2 receivers | No impacts |
| West Loch to Waipahu Transit Center | D, 2, 3 | None | None | Severe impacts at 20 receivers; Moderate impacts at 40 receivers | Moderate impacts at 20 receivers |
| Waipahu Transit Center to Leeward Community College | E, F, 4, G | None | None | Severe impacts at 18 receivers; Moderate impacts at 36 receivers | Moderate impacts at 18 receivers |
| Leeward Community College to Pearl Highlands | 5, 6 | No impacts at ground level to 43 feet above grade; Moderate impacts to outdoor uses above 43 feet. | None | No impacts | No impacts |
| Pearl Highlands to Pearlridge | 7, H, I, 8 | None | None | Moderate impacts at 15 receivers | No impacts |
| Pearlridge to Aloha Stadium | J, 9 | Moderate impacts at 14 receivers | None | Severe impacts at 14 receivers; Moderate impacts at 19 receivers | Moderate impacts at 14 receivers |

# Questions




LRT/RRT




Typical Section

Calculating the noise levels from the center line of the structure (34 feet) and combine the traffic(20 trains daytime and 8 trains nighttime) at 45 mph, gave the following noise levels;

| Noise Levels at Edge of Receiver | Leq-Day | Leq-Night | LDN |
|---|---|---|---|
| Total Noise using one noise source at centerline. | 63 | 59 | 66 |

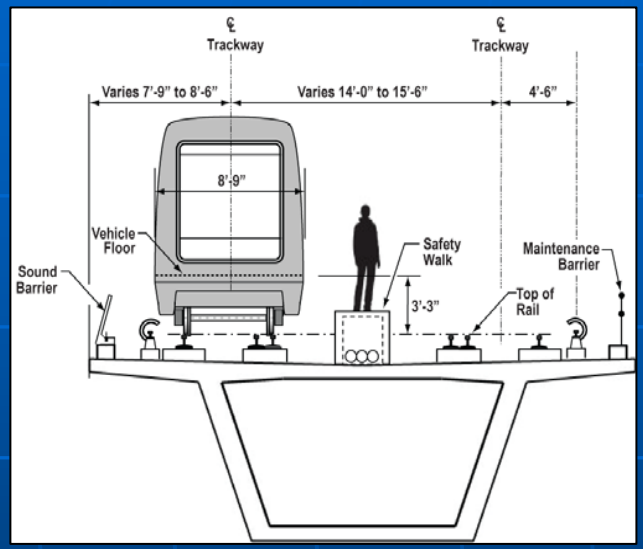
Calculating the noise levels by splitting the traffic to near and far track, using the following:
Far Side – 21 feet from edge of structure, 41 feet from receiver.
Near Side – 7 feet from edge of structure, 27 feet from receiver.
Traffic – 10 trains per direction day time, 4 per direction nighttime, 45 MPH.

| Noise Levels at Edge of Structure | Leq-Day | Leq-Night | LDN |
|---|---|---|---|
| Near Side | 70.1 | 66.8 | 74 |
| Far Side | 61.1 | 57.2 | 64.4 |

| Noise Levels at Edge of Receiver | Leq-Day | Leq-Night | LDN |
|---|---|---|---|
| Near Side | 61.8 | 57.8 | 65 |
| Far Side | 56.8 | 52.8 | 60.1 |

| | Leq-Day | Leq-Night | LDN |
|---|---|---|---|
| Total noise using near and far sources | 63 | 59 | 66 |

- Question, does a solid platform provided noise reduction, if so can it be calculated using the FTA spreadsheet?

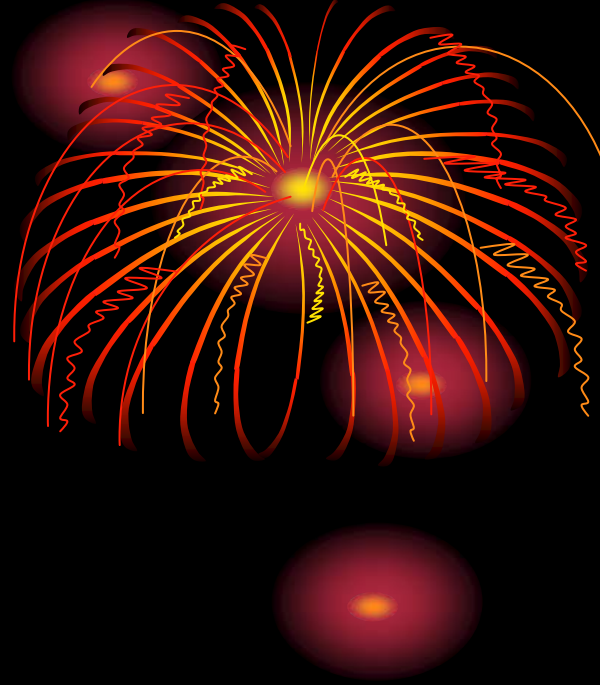


| New Site ID | D | E | N | S | Y | Z |
|---|---|---|---|---|---|---|
| 0:00:00 | 61.6 | 68.4 | 55 | 64.1 | 65.8 | 65.9 |
| 1:00:00 | 60.2 | 66.8 | 54 | 63.7 | 63.8 | 63.8 |
| 2:00:00 | 59.8 | 65.6 | 53.4 | 61.5 | 63.7 | 63.9 |
| 3:00:00 | 59.8 | 65.7 | 55.9 | 60.3 | 62.6 | 62.1 |
| 4:00:00 | 65.3 | 66.8 | 56.7 | 62.4 | 64 | 65.2 |
| 5:00:00 | 67.3 | 71.4 | 60.4 | 66.7 | 67.7 | 67.6 |
| 6:00:00 | 67.6 | 72.6 | 65.8 | 71.3 | 70.5 | 71.2 |
| 7:00:00 | 67.9 | 73.7 | 65.9 | 71.7 | 71.7 | 71.8 |
| 8:00:00 | 68.5 | 74.3 | 64.8 | 71.7 | 72 | 72.7 |
| 9:00:00 | 68 | 74.1 | 64.7 | 70.6 | 72 | 72.1 |
| 10:00:00 | 64.9 | 76.7 | 64.4 | 69.9 | 71.5 | 72.1 |
| 11:00:00 | 69.1 | 77 | 64.9 | 72.4 | 71.8 | 72.9 |
| 12:00:00 | 68 | 77.4 | 64.9 | 72.2 | 72.3 | 76.1 |
| 13:00:00 | 67.6 | 76.5 | 64.6 | 69.6 | 72 | 72.3 |
| 14:00:00 | 68.4 | 79.8 | 64.8 | 70.6 | 72 | 72.3 |
| 15:00:00 | 68 | 79.4 | 67.6 | 69.6 | 72.7 | 72.2 |
| 16:00:00 | 67.7 | 79.2 | 67 | 70.3 | 72.6 | 72.9 |
| 17:00:00 | 67.6 | 76.9 | 66.3 | 69.4 | 72.3 | 72 |
| 18:00:00 | 68.2 | 75.7 | 65.1 | 68.4 | 74.6 | 75.9 |
| 19:00:00 | 67.6 | 75.4 | 63.1 | 68.8 | 70.2 | 71 |
| 20:00:00 | 66.8 | 73 | 61 | 69.9 | 70.3 | 70.6 |
| 21:00:00 | 66 | 73 | 60.7 | 68.3 | 69.9 | 69.6 |
| 22:00:00 | 64 | 71.6 | 60.2 | 68.3 | 68.4 | 68.8 |
| 23:00:00 | 63.7 | 70.7 | 57.1 | 66.5 | 67.6 | 68.4 |

| | D | E | N | S | Y | Z |
|---|---|---|---|---|---|---|
| LDN | 72 | 78 | 68 | 74 | 75 | 75 |

| | | | | | | |
|---|---|---|---|---|---|---|
| LRT LDN | 70 | 69 | 74 | 71 | 70 | 69 |
| LRT Impact | M | M | S | M | M | M |
| LRT Peak Hour Leq | 66 | 66 | 70 | 67 | 66 | 64 |
| LRT Off Hour Leq | 63 | 62 | 66 | 64 | 63 | 62 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Mono LDN | 66 | 65 | 70 | 67 | 66 | 65 |
| Mono Impact | M | N | S | M | M | N |
| Mono Peak Hour Leq | 62 | 62 | 66 | 63 | 62 | 60 |
| Mono Off Hour Leq | 59 | 58 | 62 | 60 | 59 | 58 |



# Questions