

Technical Memo

To	Utah Department of Transportation and Utah Transit Authority
From	Lance Meister, Cross-Spectrum Acoustics, Inc.
Date	January 2026
Re	North of Orem Double Track Project Noise and Vibration Mitigation Assessment

Summary

The purpose of this memorandum is to summarize the noise and vibration mitigation assessment for the North of Orem Double Track Project. The project consists of double tracking approximately 1.7 miles of the FrontRunner Commuter Rail system from north of 400 North in Vineyard to Orem Central Station.

Noise and vibration assessments were completed for this project in 2025¹ to determine impacts from infrastructure changes (adding the double track). In addition, corridor-level noise and vibration assessments were completed in 2023 and 2025² for the entire FrontRunner corridor to determine impacts from service increase (15-min at peak, 30-min off-peak). Noise and vibration impacts were identified, and mitigations were recommended. This mitigation assessment is a detailed review of reasonable and feasible mitigation measures that will be implemented as part of the project.

The results of the mitigation assessment indicate that a ballast mat would need to be installed for vibration mitigation at one location and the use of spring-rail frogs at two locations on the North of Orem Double Track Project area for both noise and vibration mitigation to fully mitigate all noise and vibration impacts. The ballast mat would need to be installed parallel to the location with an existing ballast mat in Orem from Station 580+50 to 607+00 (2,650 feet in length) (all referenced to the stationing in the FrontRunner South plans which are very similar to the current double track project) under the proposed new FrontRunner track on top of an HMA concrete slab. If the existing FrontRunner track with ballast mat will be shifted, the ballast mat will need to be replaced and installed under the track in the new location. The locations of the spring-rail frogs are shown in Figures 3 and 4 for three crossovers near 400 North in Vineyard and one turnout near 525 South in Orem.

¹ Utah Transit Authority, North of Orem Double Track Project Noise and Vibration Analysis, July 2025.

² Utah Transit Authority, FrontRunner Forward Corridor Level Noise and Vibration Assessment, May 18, 2023, and Utah Transit Authority, FrontRunner Forward Corridor Level Noise and Vibration Assessment Addendum, May 20, 2025.



Figure 1. North of Orem Double Track Project Overview

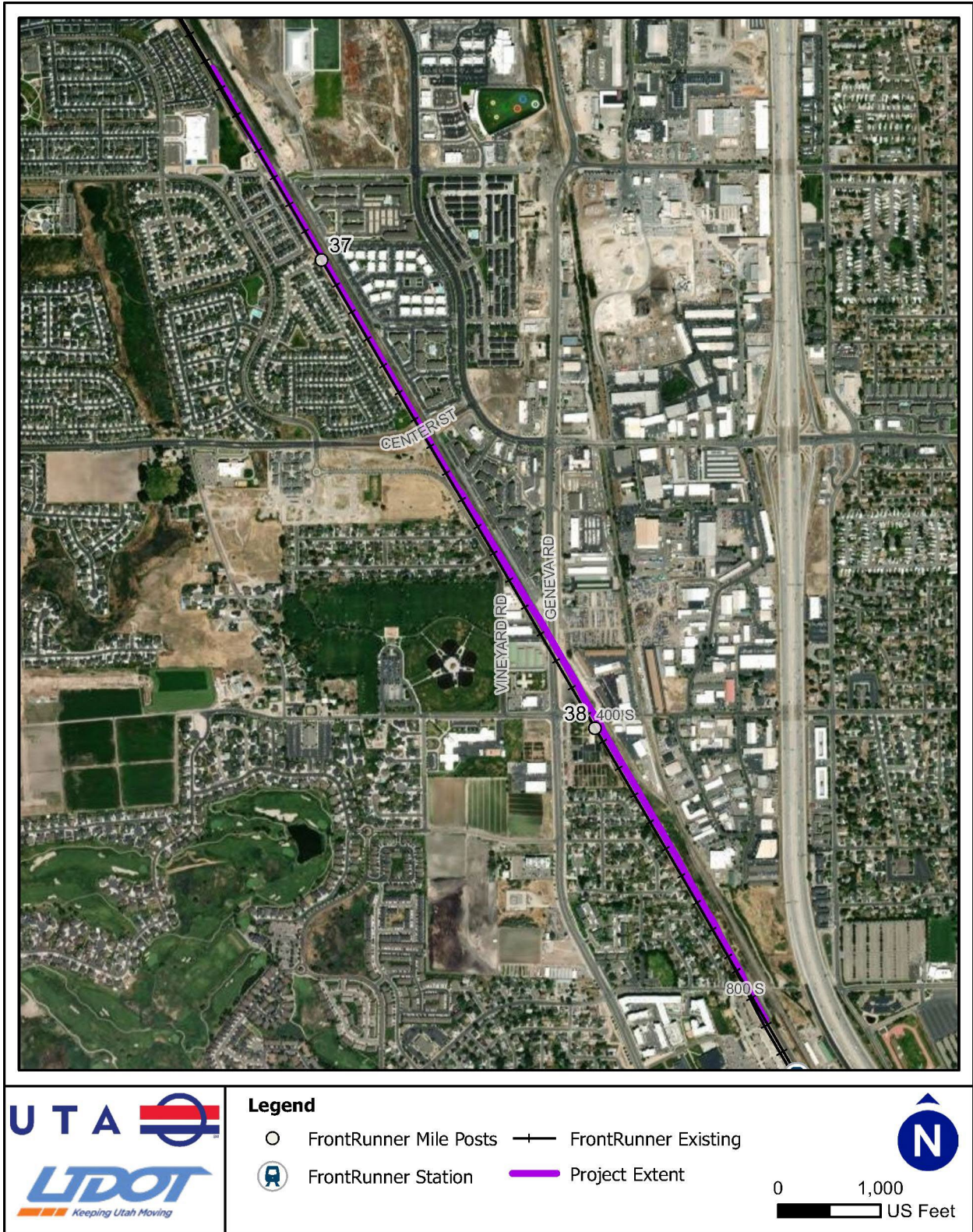


Figure 2. North of Orem Double Track Project Area

Noise

The Federal Transit Administration (FTA) noise and vibration guidance manual³ was used in the assessment of impacts and the design of the noise mitigation. There were 12 moderate and one severe noise impacts identified in the North of Orem Double Track Project area due to the combined effects of the double track project and the service increase. The locations of the impacts are shown in Figures 3 and 4.

One of the moderate impacts was due to proximity to the tracks to the property. However, that property is owned by UTA and the building has recently been demolished under a separate action not related to this project, so there would be no impact at that location and mitigation is not required for this property. The property is identified in Figure 4.

All of the other 12 noise impacts are due to the presence of special trackwork, including crossovers and turnouts for both FrontRunner and Union Pacific trains. Crossovers and turnouts have a gap in the rail for the wheel, and this gap creates additional noise as the wheel impacts the gap. Four moderate noise impacts and one severe impact are due to new and relocated crossovers between Station 674+00 and Station 683+00, shown in Figure 3 (near 460 E Street and N 290 East in Vineyard) and the remaining seven moderate noise impacts are due to a new Union Pacific Railroad (UPRR) turnout near Station 609+00, shown in Figure 4 (near 525 South in Orem).

The moderate noise impacts meet the mitigation threshold established in the UTA noise policy⁴ because the existing noise levels are above 65 dBA Ldn. At all 12 residences, the mitigation recommendation is to install spring-rail frogs (on both the new FrontRunner and the to-be-shifted Union Pacific tracks) at the locations described above to eliminate the gap in the main direction of travel and the associated increase in noise. For turnouts, where there are train movements in the main direction and diverging direction, the noise levels would be reduced by approximately 2 dB, and for crossovers between two tracks, where almost all train movements are in the main direction, the noise levels would be reduced by approximately 5 dB. With the inclusion of spring-rail frogs, all the noise impacts would be mitigated.

³ Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual, FTA Report No. 0123, September 2018.

⁴ Utah Transit Authority Office of Capital Services SOP, No. OCS.01.01, Noise Assessment and Mitigation, May 1, 2024.



Figure 3. North of Orem Double Track Project, Noise Impact Locations – Vineyard

Noise Impact Locations – Orem



Figure 4. North of Orem Double Track Project

Vibration

The Federal Transit Administration (FTA) noise and vibration guidance manual was used in the assessment of impacts and the design of the vibration mitigation. At most locations, the change in vibration levels due to the additional track would not be above the impact threshold for an increase of 3 VdB, due to the small change in distance to sensitive receivers. However, there are two situations where the vibration increases can be greater.

The first situation is due to the presence of new or relocated special trackwork. Crossovers and turnouts have a gap in the rail for the wheel, and this gap creates additional vibration as the wheel impacts the gap. There are eighteen residences at the northern end of the segment near new and relocated special trackwork with vibration impacts, as shown in Figure 5 (near 460 E Street and 290 East in Vineyard). With the installation of spring-rail frogs at these locations, all the vibration impacts would be eliminated.

The second situation is due to an existing ballast mat that was installed as a part of the FrontRunner South project (2008-2012) to mitigate vibration impacts identified during that project, from just north of 525 South to just south of 800 South in Orem. At this location, because the existing vibration is lower due to the ballast mats, the increase in the vibration levels with the new track without a ballast mat would be greater than 3 VdB, and there would be vibration impacts due to the new track, as shown in Figure 6. The vibration mitigation at this location would be to provide an identical ballast mat as the one previously installed, which would lower the increase in vibration level due to the new track to less than 3 VdB.

To document the field performance of existing FrontRunner ballast mats, vibration measurements of existing FrontRunner trains were conducted in July 2025 in Lehi in the North of American Fork Project area. The ballast mat in this area was also installed as a part of the FrontRunner South project (2008-2012) to provide vibration mitigation for that project. Measurements collected in Lehi included those from an area near the track where a ballast mat is present and a nearby area without a ballast mat. The vibration measurements followed the procedures outlined in Section 6.5 of the FTA guidance manual. Details regarding the measurements can be found in the North of American Fork Double Track Project Noise and Vibration Mitigation Assessment⁵, and results are shown in Figure 7.

The measurements were used to determine the performance of the existing ballast mat at this location and to determine if the ballast mat has a resonance frequency that might increase vibration levels⁶. The ballast mat performance, shown in Figure 7, shows that there is only a small reduction in vibration levels at frequencies below 50 Hz, and more significant reductions at 80 Hz and above, which is consistent with typical ballast mat performance. Additionally, there is a potential small resonance at 31.5 Hz, but the increase is less than 1 VdB.

With the installation of a ballast mat with similar characteristics as those installed for the FrontRunner South project, the new vibration levels would be comparable to the existing vibration levels, and the change in vibration level would be below the impact threshold increase of 3 VdB. To mitigate the vibration impacts identified for the project, a ballast mat would need to be installed parallel to the location with

⁵ Utah Department of Transportation and Utah Transit Authority, North of American Fork Double Track Project Noise and Vibration Mitigation Assessment, January 2026.

⁶ A resonance occurs when the input vibration from the train matches the ballast mat's natural resonant frequency. This resonance provides an excitation which increases the vibration levels at that frequency and can increase the overall vibration levels, depending on the frequency content of the vibration. All vibration mitigation materials have a resonance frequency. Generally, below that frequency, the mitigation does not provide any reduction in vibration levels.

existing ballast mat from Station 580+50 to 607+00 (2,650 feet in length) (all referenced to the stationing in the FrontRunner South plans which are very similar to the current double track project) under the proposed new FrontRunner track on top of an HMA concrete slab. If the existing FrontRunner track with ballast mat will be shifted, the ballast mat would need to be replaced and installed under the track in the new location.

Vibration Impact Locations - Vineyard



Figure 5. North of Orem Double Track Project

Vibration Impact Locations – Orem



Figure 6. North of Orem Double Track Project

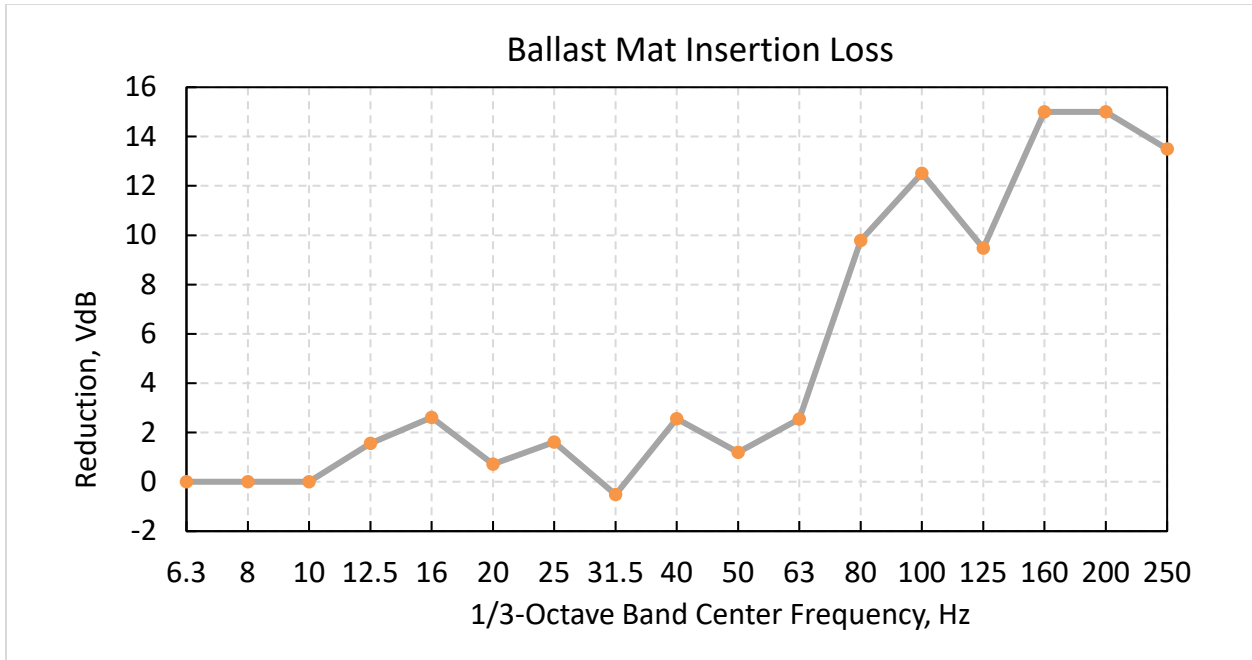


Figure 7. Existing Ballast Mat Performance
 (From field data collected in Lehi, July 2025)