Cotton Belt Regional Rail Corridor Project

DART Board
Committee of the Whole Briefing
November 1, 2017
Agenda

- Schedule
- Project Overview
- Noise
  - Methodology and Impact Analysis
  - Mitigation and Discussion
- Vibration
  - Methodology and Impact Analysis
  - Mitigation and Discussion
- Visual
  - Methodology and Impact Analysis
  - Mitigation and Discussion
Proposed Schedule
(Handout/Agenda Report Attachment)
Project Overview
Environmental Mitigation and Betterments Policies

• Federal Requirements
  – Use of federal funds requires the identification and mitigation of impacts (e.g., noise, vibration and visual)

• DART Board Policy
  – Will comply with federal requirements for mitigation (Policy IV.07)
  – Provides for Betterments to enhance community integration (Policy IV.11)
    o Potential betterments will be identified in preliminary engineering after application of DART mitigation policies and design criteria
    o If any betterments are called for, they should be identified and approved by the Board before the design reaches the 65% level for any rail segment
What is Mitigation?

Mitigation measures are defined in five ways*:

1. **Avoiding** the impact completely by not taking a certain action or parts of an action;
2. **Minimizing** impacts by limiting the degree or magnitude of the action and its implementation;
3. **Rectifying** the impact by repairing, rehabilitating, or restoring the affected environment;
4. **Reducing or eliminating** the impact over time by preservation and maintenance operations during the life of the action; or
5. **Compensating** for the impact by replacing or providing substitute resources or environments.

*Council on Environmental Quality (CEQ) Regulations (40 CFR Part 1508.20 – *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act*)
What are Betterments?

• DART Board adopted Betterments Policy on October 28, 1997 (Policy IV.11)
• Applied after impact/mitigation analysis
• Considered for adjacent residential areas if majority of residents make the request
  – $147/linear foot (2018 dollars)
• Betterments incorporated into project design
  – Examples: landscaping, wall treatments, enhanced fencing
• Approved by the DART Board and funded through amendments to the project budgets and the Financial Plan (if greater than $1 million)
Noise Methodology
Noise Fact Sheet

Noise is a Common Concern When Planning a Rail Project

The information provided in this fact sheet describes:
- How noise levels between transit and non-transit sources compare
- The typical noise produced from rail operations
- The process by which potential impacts are identified
- Common techniques to mitigate noise impacts

Comparison of Noise Levels

The figure below illustrates how noise levels between transit and non-transit sources compare when experienced by people in their home or neighborhood. For example, the proposed Cotton Belt vehicle at 50 mph causes a momentary maximum noise level of about 79 dBA as it passes, at a distance of 50 ft, a little louder than the steady noise level from an air compressor at 50 ft. The noise level at 50 ft from a Cotton Belt Vehicle sitting at a station is comparable to the noise observed when standing about 3 ft from a clothes washer.

Mitigation measures, such as noise barriers, can provide noise reductions of 5 to 10 dB.

Typical Sources of Noise from Train Operations

Noise generated from train operations is generally associated with:
- Wheel/rail interaction – noise is generally highest where condition of the track and/or wheels are worn and need maintenance, and where there is special track work and tracks cross
- Horns and crossing bells – safety requirements where a train crosses a street
- Diesel engines/cooling fans – when not treated to minimize noise

How are Impacts Identified?
The following steps are used to identify potential noise impacts:

Identify locations of sensitive uses
Measure existing noise levels
Estimate noise levels with project in operation
Identify impacts and propose mitigation

The locations of sensitive uses (homes, churches, parks, etc.) are based on aerial mapping, surveys and community input. Input from the community is important in making sure that all sensitive uses are identified. DART uses established Federal Transit Administration (FTA) standards to identify impacts. A variety of mitigation options are considered to best address the impact.

Options Available to Mitigate Identified Noise Impacts

Techniques that will be used to minimize noise of train operations:
- Insulation of power generators in internal train compartments to minimize noise
- Maintenance of vehicle and track elements to reduce noise levels

Additional techniques to minimize noise at sensitive locations include:
- Reducing noise near street crossings by working with local jurisdictions to obtain waivers to establish “Quiet Zones” where train horns are not routinely sounded and by using lower noise level warning devices (such as electronic horns and bells) targeted at the crossings
- Installing sound barriers (noise walls) to shield sensitive areas along the tracks
- Making alignment modifications (shifting the alignment or raising/lowering the alignment) and
- Incorporating designs that reduce noise at rail discontinuities where tracks cross each other.
Noise and Vibration Guidance

- DART Mitigation Policy IV.07
  - Environmental Impact Assessment and Mitigation Guidelines for Transit Projects
Process

1. Document existing noise and vibration levels at locations representative of sensitive land uses.

2. Estimate noise and vibration levels with the project:
   - Operating plan
   - Vehicle specifications

3. Identify impacts and propose mitigation consistent with FTA and DART guidance.
Sensitive Land Uses

1. Document existing noise and vibration levels at locations representative of sensitive land uses.

What kinds of land uses are considered sensitive?

- Land where quiet is essential to purpose:
  - Amphitheater
  - Recording studios
  - Some historic properties

- Places where people sleep:
  - Homes
  - Apartments
  - Hotels
  - Hospitals

- Institutional uses with daytime/evening use:
  - Churches
  - Libraries
  - Schools
  - Theaters
  - Cemeteries
  - Museums
  - Historic sites/parks
Noise Measurements/Existing Conditions

Measured noise levels include existing freight train operations in corridor.
Noise Measurements/Existing Conditions

Measured noise levels include existing freight train operations in corridor.
Noise Measurements/Existing Conditions

Measured noise levels reflect no freight train operations in North Dallas.
Noise Measurements/Existing Conditions

Measured noise levels include existing freight train operations in corridor.
Operations/Vehicle Specifications

- Stadler FLIRT vehicle specifications
- Operating Plan
  - 20-minute peak/60-minute off-peak
  - Double-track buildout
  - Continued freight in corridor except north Dallas
Impact Analysis
How to Determine No, Moderate, or Severe Impact

<table>
<thead>
<tr>
<th>Corridor Segment Description</th>
<th>Side of Track</th>
<th>Distance from Near Track (feet)</th>
<th>Train Speed (mph)</th>
<th>Existing Noise Level</th>
<th>Project Noise Level</th>
<th>Impact Criteria</th>
<th>Total Noise Level</th>
<th>Noise Level Increase</th>
<th>Number of Residential Impacts</th>
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<tr>
<td>Kelley Blvd to Marsh Ln</td>
<td>WB</td>
<td>45 to 70</td>
<td>56 to 71</td>
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<td>57</td>
<td>63</td>
<td>2.2 to 3.1</td>
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</table>

Note: Noise exposure is in terms of $L_{eq}$ (dB) for Category 1 and 2 land uses, $L_{eq}$ for Category 3 land uses.

- 63 dB Severe
- 57 dB Moderate
Noise Impacts and Mitigation
Types of Noise Mitigation

MITIGATION FOR NOISE IMPACTS IF WARRANTED

If Noise or Vibration Impacts are Identified, Mitigation Measures May Involve Treatments:

1. At the Noise Source,
2. Along the Source-to-Receiver Propagation Path, or
3. At the Receiver

Typical Noise Mitigation Techniques Include:

- Stringent transit vehicle and equipment noise specifications
- Rail vehicle treatments to minimize noise
- Quiet Zones to eliminate horn noise
- Installation of sound barriers (noise walls)
- Track treatments (e.g. moveable-point frogs and wayside rail lubricators)
- Enhanced maintenance
- Alignment modifications
- Insulation of affected buildings

Moveable-point frog
Noise Analysis Status

• The draft noise analysis is complete
• Information and recommendations will be presented in next round of public meetings
• Analysis will be incorporated into the Draft EIS for public review and comment
Impact Analysis

• Majority of noise impacts associated with train horns at street crossings
  – 5,362 residential impacts without quiet zones
    o 3,048 are considered severe, rest are moderate
  – 19 institutional impacts without quiet zones
    o 10 severe; 9 moderate

• Quiet zones mitigate 96% of noise impacts:
  – Eliminates all severe and moderate institutional impacts
  – Eliminates all severe residential impacts
  – 235 moderate residential impacts remain to be mitigated if warranted (see handout)
Proposed Noise Mitigation
Quiet Zones in Residential Areas

Quiet Zone with Gates/Non-Mountable Barrier

Non-Mountable Barrier

Quiet Zone with Quad Gates
Noise Analysis Results (Without Quiet Zones)

Noise Legend
- Moderate < 3 dB impact
- Moderate > 3 dB impact
- Severe impact
Noise Analysis Results
(With Quiet Zones)

Noise Legend
- Moderate < 3 dB impact
- Moderate > 3 dB impact
- Severe impact
### Proposed New Quiet Zones (36 locations)

<table>
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<tr>
<th>Street</th>
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<td>PBGT (WB)</td>
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<td>Perry Rd</td>
<td>Carrollton</td>
<td>Meandering Way</td>
<td>Dallas</td>
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</table>

Per FRA rules, cities must apply for Quiet Zones. DART will include Quiet Zone mitigation costs as part of the project.
Mitigation of Impacts

• Noise increase of 3 dB or greater is projected at 185 of the 235 moderate impact receptors
• Consistent with DART policy, impacts over 3 dB will be mitigated
• Mitigation of the remaining impacts under 3 dB would be considered on a case-by-case basis, with factors such as the following taken into consideration:
  – Is the property within a cluster of residences where some residences are impacted and require mitigation?
  – Is the noise level increase near the moderate level and combined with significant community input regarding noise concerns?
Examples of Noise Mitigation

Noise Barriers

Other mitigation examples include:

- Directional crossing bells
- Sound insulation
- Window glazing
- Other
Proposed Noise Wall Cross-Section

One Noise Barrier Wall

Two Noise Barrier Walls
Crossover mitigation options:
- Relocate crossover
- Crossover treatment
- Noise barrier

Noise Legend
- Moderate < 3 dB
- Moderate > 3 dB
- Moderate Bell < 3 dB
- Moderate Bell > 3 dB
- Moderate Train/Bell > 3 dB
- Proposed Noise Barrier
- Proposed Quiet Zone
- Proposed Quiet Zone and Crossing Bell Mitigation
Noise Impact Location Maps
Carrollton (West of Marsh Lane)
Noise Impact Location Maps
Carrollton (At Marsh Lane)

Noise Legend
- Moderate < 3 dB
- Moderate > 3 dB
- Moderate Bell < 3 dB
- Moderate Bell > 3 dB
- Moderate Train/Bell > 3 dB
- Proposed Noise Barrier
- Proposed Quiet Zone
- Proposed Quiet Zone and Crossing Bell Mitigation

Track Legend
- Red: Eastbound track
- Blue: Westbound track
- Yellow: Freight track
- Green: Special track work
Noise Impact Location Maps
Addison (At Spectrum Dr)

Addison Circle Apartments

Noise Legend
- Moderate < 3 dB
- Moderate > 3 dB
- Moderate Bell < 3 dB
- Moderate Bell > 3 dB
- Moderate Train/Bell > 3 dB
- Proposed Noise Barrier
- Proposed Quiet Zone
- Proposed Quiet Zone and Crossing Bell Mitigation

Track Legend
- Red: Eastbound track
- Blue: Westbound track
- Yellow: Freight track
- Green: Special track work
Noise Impact Location Maps
Dallas (At Knoll Trail Dr)

Track Legend
- Red: Eastbound track
- Blue: Westbound track
- Yellow: Freight track
- Green: Special track work

Noise Legend
- ○: Moderate < 3 dB
- ■: Moderate > 3 dB
- ●: Moderate Bell < 3 dB
- □: Moderate Bell > 3 dB
- ×: Moderate Train/Bell > 3 dB
- ■■: Proposed Noise Barrier
- ●●: Proposed Quiet Zone
- ●●∗: Proposed Quiet Zone and Crossing Bell Mitigation
Noise Impact Location Maps
Dallas (East of Knoll Trail Dr)

Track Legend
- Red: Eastbound track
- Blue: Westbound track
- Yellow: Freight track
- Green: Special track work

Noise Legend
- ○: Moderate < 3 dB
- ●: Moderate > 3 dB
- ○: Moderate Bell < 3 dB
- ●: Moderate Bell > 3 dB
- ■: Moderate Train/Bell > 3 dB
- ▲: Proposed Noise Barrier
- *: Proposed Quiet Zone
- †: Proposed Quiet Zone and Crossing Bell Mitigation

Adair II Apartments

NB3
Noise Impact Location Maps
Dallas (West of Preston Rd)

Noise Legend
- Moderate < 3 dB
- Moderate > 3 dB
- Moderate Bell < 3 dB
- Moderate Bell > 3 dB
- Moderate Train/Bell > 3 dB

Track Legend
- Eastbound track
- Westbound track
- Freight track
- Special track work

- Proposed Noise Barrier
- Proposed Quiet Zone
- Proposed Quiet Zone and Crossing Bell Mitigation
Noise Impact Location Maps
Dallas (East of Preston Rd)
Noise Impact Location Maps
Dallas (South of Campbell)
Noise Impact Location Maps
Dallas (At Campbell)

Track Legend
- Red: Eastbound track
- Blue: Westbound track
- Yellow: Freight track
- Green: Special track work

Noise Legend
- Moderate < 3 dB
- Moderate > 3 dB
- Moderate Bell < 3 dB
- Moderate Bell > 3 dB
- Moderate Train/Bell > 3 dB
- Proposed Noise Barrier
- Proposed Quiet Zone
- Proposed Quiet Zone and Crossing Bell Mitigation
Noise Impact Location Maps
Dallas (Campbell to Davenport)

Track Legend
- Red: Eastbound track
- Blue: Westbound track
- Yellow: Freight track
- Green: Special track work

Noise Legend
- Moderate < 3 dB
- Moderate > 3 dB
- Moderate Bell < 3 dB
- Moderate Bell > 3 dB
- Moderate Train/Bell > 3 dB
- Proposed Noise Barrier
- Proposed Quiet Zone
- Proposed Quiet Zone and Crossing Bell Mitigation
Noise Impact Location Maps
Dallas (At Davenport)

Track Legend
- Eastbound track
- Westbound track
- Freight track
- Special track work

Noise Legend
- Moderate < 3 dB
- Moderate > 3 dB
- Moderate Bell < 3 dB
- Moderate Bell > 3 dB
- Moderate Train/Bell > 3 dB
- Proposed Noise Barrier
- Proposed Quiet Zone
- Proposed Quiet Zone and Crossing Bell Mitigation
Noise Impact Location Maps
Dallas (Davenport to Hillcrest)
Noise Impact Location Maps
Dallas (Hillcrest/McCallum/Meandering Way)
Noise Impact Location Maps
Dallas (East of Coit Rd)

Track Legend
- Red: Eastbound track
- Blue: Westbound track
- Yellow: Freight track
- Green: Special track work

Noise Legend
- ○: Moderate < 3 dB
- □: Moderate > 3 dB
- ●: Moderate Bell < 3 dB
- □□: Moderate Bell > 3 dB
- X: Moderate Train/Bell > 3 dB
- ✯: Proposed Noise Barrier
- ✯✯: Proposed Quiet Zone
- ✯✯✯: Proposed Quiet Zone and Crossing Bell Mitigation
Vibration Methodology
Types of Vibration Mitigation

MITIGATION FOR VIBRATION IMPACTS IF WARRANTED

Common Vibration Mitigation Measures are Similar to Those for Noise Reduction and Include:

- Stringent transit vehicle and equipment specifications
- Rail vehicle treatments
- Track treatments (e.g. moveable-point frogs, resilient rail fasteners, ballast mats, resiliently-supported ties and floating track slabs)
- Enhanced maintenance
- Restricted vehicle speeds
- Use of deep trenches
- Alignment modifications
- Building vibration isolation (for new construction)

Example of deep vibration trench
Proposed Vibration Mitigation

Track treated with Tire Derived Aggregate (TDA)
Vibration Analysis Status

• Draft vibration analysis is complete
• Recent comment from UTD regarding potential sensitive facilities
• Potential for updates if sensitive facilities are determined
  – Research and site visits in process
• Updated information will be presented at public meetings and incorporated into Draft EIS for public review and comment
Vibration Impacts and Mitigation
Vibration Impact Location Maps
Carrollton and Dallas
Vibration Impact Location Maps
Carrollton

Lakehill Townhomes

Vibration Legend

- Vibration Impact
- Vibration Mat

Noise Barrier
Vibration Impact Location Maps
Dallas

Track Legend
- Red: Eastbound track
- Blue: Westbound track
- Yellow: Freight track
- Green: Special track work

Vibration Legend
- Vibration Impact
- Vibration Mat

Noise Barrier
Oakington Ct
Visual Impacts
Visual Impacts

Impacts on the visual and aesthetic character of an area may occur if:

• Project results in loss of important existing views
• Project conflicts with existing visual elements
• Undesirable views of existing urban features are exposed
• Project is out of character for significant community activities
• Project features do not meet municipal ordinances
Visual Analysis Methodology

1. Document visual character of segments along the corridor

2. Assessment of project elements on the visual character
   - New track, stations, facilities, bridges/structures, walls/fencing

3. Identify potential mitigation where impacts are potentially significant
Potential Visual Impact Areas

Much of the corridor is commercial/industrial and no visual impacts expected. Potential areas for mitigation include:

- Adjacent residential areas in Coppell, Carrollton, Dallas, Richardson, Plano where no buffer exists or to soften noise walls
- Cotton Belt structure over BNSF in downtown Carrollton
- Addison Wheeler signature bridge
- Knoll Trail Station
- Preston Road Station
- 12th Street Station complex
Visual Mitigation Examples

- Landscaping at intervals along residential areas for:
  - Visual screening
  - Soften views of sound walls, corridor fencing
- Preservation of existing vegetation/buffers
- Station landscaping/appropriate lighting in residential areas
- Station materials/finishes to complement surrounding character (e.g. historic Downtown Carrollton)
- Complementary structure design (e.g. Wheeler Bridge)
- Public and agency coordination to define types of vegetation
Visual Mitigation Examples
Landscaping with Noise Barrier
Visual Mitigation Examples

Landscaping with Fencing

- Landscaping with Standard Fencing
- Landscaping with Vinyl Coated Fencing
Visual Mitigation Examples
Preserving Existing Vegetation

Bruton Road – Green Line
Visual Mitigation Examples

Appropriate Light Distribution

North Lake Station
Visual Mitigation Concepts
Complementary Design (Wheeler Bridge)

Existing View
Midway looking south to Arapaho

Cotton Belt Bridge without Arch

Cotton Belt Bridge with Arch
Visual Mitigation Examples
Screening Wall/Noise Barrier

Spring Valley Station

Hampton Station
# Impact Analysis (Handout)

## Table N-1. SUMMARY OF RESIDENTIAL NOISE IMPACTS WITH IMPLEMENTATION OF QUIET ZONES

<table>
<thead>
<tr>
<th>Corridor Segment Description</th>
<th>Side of Track</th>
<th>Distance from Near Track (feet)</th>
<th>Train Speed (mph)</th>
<th>Existing Noise Level</th>
<th>Project Noise Level&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Impact Criteria</th>
<th>Total Noise Level&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Noise Level Increase&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Number of Residential Impacts</th>
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</table>
## Impact Analysis (Handout)

### Table N-1. SUMMARY OF RESIDENTIAL NOISE IMPACTS WITH IMPLEMENTATION OF QUIET ZONES

<table>
<thead>
<tr>
<th>Corridor Segment Description</th>
<th>Side of Track</th>
<th>Distance from Near Track (feet)</th>
<th>Train Speed (mph)</th>
<th>Existing Noise Level</th>
<th>Project Noise Level</th>
<th>Impact Criteria</th>
<th>Total Noise Level</th>
<th>Noise Level Increase</th>
<th>Number of Residential Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Predicted</td>
<td>Impact Criteria</td>
<td></td>
<td></td>
<td></td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Moderate</td>
<td>Severe</td>
<td></td>
<td></td>
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<tr>
<td>Marsh Ln to Midway Rd</td>
<td>WB</td>
<td>76</td>
<td>68</td>
<td>57</td>
<td>56</td>
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<td>62</td>
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<td>EB</td>
<td>471</td>
<td>60</td>
<td>61</td>
<td>40</td>
<td>58</td>
<td>64</td>
<td>61</td>
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</tr>
<tr>
<td>Midway Rd to Dallas Pkwy</td>
<td>WB</td>
<td>71</td>
<td>35</td>
<td>61</td>
<td>59 to 60</td>
<td>58</td>
<td>64</td>
<td>63</td>
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<tr>
<td>Midway Rd to Dallas Pkwy</td>
<td>EB</td>
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<td>61</td>
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<td>58</td>
<td>64</td>
<td>61</td>
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<td>Dallas Pkwy to Preston Rd</td>
<td>WB</td>
<td>67</td>
<td>50 to 58</td>
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<td>56</td>
<td>55</td>
<td>61</td>
<td>59</td>
<td>3.5</td>
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<td>Dallas Pkwy to Preston Rd</td>
<td>EB</td>
<td>45 to 84</td>
<td>35 to 55</td>
<td>56 to 59</td>
<td>56 to 58</td>
<td>56 to 57</td>
<td>62 to 63</td>
<td>59 to 62</td>
<td>2.2 to 3.2</td>
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<tr>
<td>Preston Rd to Campbell Rd</td>
<td>WB</td>
<td>47 to 117</td>
<td>37 to 40</td>
<td>52</td>
<td>54 to 57</td>
<td>54</td>
<td>60</td>
<td>56 to 60</td>
<td>4.2 to 6.1</td>
</tr>
<tr>
<td>Preston Rd to Campbell Rd</td>
<td>EB</td>
<td>39 to 128</td>
<td>40</td>
<td>52</td>
<td>55 to 59</td>
<td>54</td>
<td>60</td>
<td>56 to 60</td>
<td>4.5 to 8.1</td>
</tr>
<tr>
<td>Campbell Rd to Hillcrest Rd</td>
<td>WB</td>
<td>48 to 144</td>
<td>40 to 72</td>
<td>52</td>
<td>54 to 59</td>
<td>54</td>
<td>60</td>
<td>56 to 60</td>
<td>4.2 to 7.9</td>
</tr>
<tr>
<td>Campbell Rd to Hillcrest Rd</td>
<td>EB</td>
<td>47 to 115</td>
<td>40 to 74</td>
<td>52</td>
<td>54 to 59</td>
<td>54</td>
<td>60</td>
<td>56 to 60</td>
<td>4.2 to 7.9</td>
</tr>
<tr>
<td>Hillcrest Rd to Colt Rd</td>
<td>WB</td>
<td>80 to 133</td>
<td>58 to 63</td>
<td>52</td>
<td>54 to 58</td>
<td>54</td>
<td>60</td>
<td>56 to 59</td>
<td>4.3 to 7.2</td>
</tr>
<tr>
<td>Hillcrest Rd to Colt Rd</td>
<td>EB</td>
<td>40 to 124</td>
<td>54 to 67</td>
<td>52 to 55</td>
<td>54 to 60</td>
<td>54 to 55</td>
<td>60 to 61</td>
<td>56 to 61</td>
<td>3.8 to 6.1</td>
</tr>
<tr>
<td>Colt Rd to Synergy Park Blvd</td>
<td>WB</td>
<td>148</td>
<td>61</td>
<td>55</td>
<td>50</td>
<td>55</td>
<td>61</td>
<td>56</td>
<td>1.3</td>
</tr>
<tr>
<td>Colt Rd to Synergy Park Blvd</td>
<td>EB</td>
<td>41 to 62</td>
<td>35 to 59</td>
<td>55</td>
<td>55 to 59</td>
<td>55</td>
<td>61</td>
<td>58 to 60</td>
<td>3.2 to 5.2</td>
</tr>
<tr>
<td>Synergy Park Blvd to Alma Rd</td>
<td>WB</td>
<td>96</td>
<td>73</td>
<td>60</td>
<td>55</td>
<td>58</td>
<td>63</td>
<td>61</td>
<td>1.3</td>
</tr>
<tr>
<td>Synergy Park Blvd to Alma Rd</td>
<td>EB</td>
<td>396</td>
<td>62</td>
<td>58</td>
<td>49</td>
<td>57</td>
<td>62</td>
<td>59</td>
<td>0.6</td>
</tr>
<tr>
<td>Alma Rd to E Plano Pkwy</td>
<td>WB</td>
<td>39</td>
<td>41</td>
<td>70</td>
<td>62</td>
<td>64</td>
<td>69</td>
<td>71</td>
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</tr>
<tr>
<td>Alma Rd to E Plano Pkwy</td>
<td>EB</td>
<td>189</td>
<td>30</td>
<td>69</td>
<td>51</td>
<td>64</td>
<td>69</td>
<td>69</td>
<td>0.1</td>
</tr>
</tbody>
</table>
# Impact Analysis (Handout)

Table N-1. SUMMARY OF RESIDENTIAL NOISE IMPACTS WITH IMPLEMENTATION OF QUIET ZONES

<table>
<thead>
<tr>
<th>Corridor Segment Description</th>
<th>Side of Track&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Distance from Near Track (feet)</th>
<th>Train Speed (mph)</th>
<th>Existing Noise Level&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Project Noise Level&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Impact Criteria</th>
<th>Total Noise Level&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Noise Level Increase&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Number of Residential Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>E Plano Pkwy to Jupiter Rd&lt;sup&gt;5&lt;/sup&gt;</td>
<td>WB</td>
<td>520</td>
<td>30</td>
<td>63</td>
<td>45</td>
<td>59</td>
<td>65</td>
<td>63</td>
<td>0.1</td>
</tr>
<tr>
<td>E Plano Pkwy to Jupiter Rd&lt;sup&gt;5&lt;/sup&gt;</td>
<td>EB</td>
<td>215</td>
<td>35</td>
<td>63</td>
<td>52</td>
<td>59</td>
<td>65</td>
<td>63</td>
<td>0.3</td>
</tr>
<tr>
<td>Jupiter Rd to end&lt;sup&gt;5&lt;/sup&gt;</td>
<td>WB</td>
<td>94</td>
<td>65</td>
<td>58</td>
<td>54</td>
<td>57</td>
<td>62</td>
<td>60</td>
<td>1.5</td>
</tr>
</tbody>
</table>

**TOTAL NUMBER OF NOISE IMPACTS:** 50 185 0

---

<sup>1</sup> Eastbound (EB) or Westbound (WB)

<sup>2</sup> Noise levels are based on $L_{dn}$ and measured in dBA (rounded to the nearest decibel). For better resolution, noise level increases are shown to the nearest 0.1 decibel.

<sup>3</sup> Predicted levels include horn and bell noise, where applicable (rounded to the nearest decibel).

<sup>4</sup> There are no noise-sensitive receptors of this type in this segment.

<sup>5</sup> There are no receptors with noise impact in this section. It should be noted that the data for this section represent the receiver with the highest Project noise level which may not be the closest receiver to the track due to differences in train speed, acceleration, distance to special trackwork or track structure (aerial vs. at grade).

---

Source: Cross-Spectrum Acoustics, 2017
# Proposed Noise Mitigation (Handout)

## Table N-2. SUMMARY OF RECOMMENDED NOISE BARRIER LOCATIONS

<table>
<thead>
<tr>
<th>Noise Barrier Number</th>
<th>Corridor Segment</th>
<th>Street and Community</th>
<th>Side of Track</th>
<th>Barrier Civil Station Location</th>
<th>Barrier Length (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NB1</td>
<td>I-35E to Josey Lane</td>
<td>Cecil Drive, Carrollton</td>
<td>WB</td>
<td>2134+00 to 2150+00</td>
<td>1,600</td>
</tr>
<tr>
<td>NB2</td>
<td>Kelley Blvd to Marsh Lane</td>
<td>Lakehill Townhomes, Carrollton</td>
<td>WB</td>
<td>2252+00 to 2262+00</td>
<td>1,000</td>
</tr>
<tr>
<td>NB3</td>
<td>Dallas Pkwy to Preston Rd</td>
<td>Adair II Apartments, Dallas</td>
<td>WB</td>
<td>3038+00 to 3044+00</td>
<td>600</td>
</tr>
<tr>
<td>NB4</td>
<td></td>
<td>Chalfont Circle, Dallas</td>
<td>EB</td>
<td>3055+00 to 3067+00</td>
<td>1,200</td>
</tr>
<tr>
<td>NB5</td>
<td>Preston Rd to Campbell Rd</td>
<td>Prestonwood Trails, Dallas</td>
<td>WB</td>
<td>3082+00 to 3097+50</td>
<td>1,550</td>
</tr>
<tr>
<td>NB6</td>
<td>Prestonwood Trails Apartments, Dallas</td>
<td>Prestonwood Trails Apartments, Dallas</td>
<td>WB</td>
<td>3099+50 to 3106+00</td>
<td>650</td>
</tr>
<tr>
<td>NB7</td>
<td>Southpoint Dr, Preston Green, Dallas</td>
<td>Southpoint Dr, Preston Green, Dallas</td>
<td>EB</td>
<td>3100+00 to 3105+50</td>
<td>950</td>
</tr>
<tr>
<td>NB8</td>
<td>Campbell Rd to Hillcrest Rd</td>
<td>Bent Creek North Condominiums, Dallas</td>
<td>WB</td>
<td>3111+00 to 3118+00</td>
<td>700</td>
</tr>
<tr>
<td>NB9</td>
<td></td>
<td>Davenport Ct, Pepperwood Estates, Dallas</td>
<td>EB</td>
<td>3111+00 to 3126+00</td>
<td>1,500</td>
</tr>
<tr>
<td>NB10</td>
<td>Brushfield/Spangy Branch/Wester Way, Highlands of McKamy, Dallas</td>
<td>Brushfield/Spangy Branch/Wester Way, Highlands of McKamy, Dallas</td>
<td>EB</td>
<td>3127+50 to 3143+50</td>
<td>1,600</td>
</tr>
<tr>
<td>NB11</td>
<td></td>
<td></td>
<td>EB</td>
<td>3148+50 to 3161+50</td>
<td>1,300</td>
</tr>
<tr>
<td>NB12</td>
<td>Duffield Dr, Oakington Pt, Preston Green North, Dallas</td>
<td>Duffield Dr, Oakington Pt, Preston Green North, Dallas</td>
<td>WB</td>
<td>3130+00 to 3148+00</td>
<td>1,800</td>
</tr>
<tr>
<td>NB13</td>
<td></td>
<td></td>
<td>WB</td>
<td>3155+00 to 3162+00</td>
<td>700</td>
</tr>
<tr>
<td>NB14</td>
<td>Hillcrest Rd to Coit Rd</td>
<td>Highland Heather Lane, Highland Square, Dallas</td>
<td>EB</td>
<td>3163+00 to 3170+00</td>
<td>700</td>
</tr>
<tr>
<td>NB15</td>
<td></td>
<td>Nicole Place, Dallas</td>
<td>EB</td>
<td>3172+00 to 3179+00</td>
<td>700</td>
</tr>
<tr>
<td>NB16</td>
<td></td>
<td>Rocky Top Circle, Highlands of McKamy, Dallas</td>
<td>WB</td>
<td>3171+00 to 3179+00</td>
<td>800</td>
</tr>
<tr>
<td>NB17</td>
<td></td>
<td>Energy Lane, Dallas</td>
<td>EB</td>
<td>3180+00 to 3186+00</td>
<td>600</td>
</tr>
<tr>
<td>NB18</td>
<td>Coit Rd to Synergy Park Blvd</td>
<td>University Place, Dallas (Sunflower)</td>
<td>EB</td>
<td>3217+00 to 3227+50</td>
<td>1,050</td>
</tr>
<tr>
<td>NB19</td>
<td></td>
<td>University Place, Dallas (Snapdragon)</td>
<td>EB</td>
<td>3232+00 to 3245+00</td>
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<tr>
<td><strong>TOTAL BARRIER LENGTH:</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>20,300</strong></td>
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</table>

Source: Cross-Spectrum Acoustics, 2017
### Proposed Crossing Bell Mitigation (Handout)

#### Table N-2. SUMMARY OF RECOMMENDED CROSSING BELL MITIGATION LOCATIONS

<table>
<thead>
<tr>
<th>Crossing Number</th>
<th>Corridor Segment</th>
<th>Street/Community</th>
<th>Civil Station</th>
<th>Crossing Quadrant</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Kelly Blvd to Marsh Lane</td>
<td>Marsh Lane / Willow Lane Condominium</td>
<td>2286+50</td>
<td>NW</td>
</tr>
<tr>
<td>C2</td>
<td>Midway Road to Dallas Pkwy</td>
<td>Spectrum Drive / Addison Circle Apartments</td>
<td>2361+00</td>
<td>NW</td>
</tr>
<tr>
<td>C3</td>
<td>Dallas Parkway to Preston Road</td>
<td>Knoll Trail Drive / Aura Prestonwood Apartments</td>
<td>3019+50</td>
<td>SE</td>
</tr>
<tr>
<td>C4</td>
<td>Preston Road to Campbell Road</td>
<td>Campbell Road, Bent Creek North Condominiums (NE) and Southpoint Drive home (SW)</td>
<td>3110+50</td>
<td>NW/SE</td>
</tr>
<tr>
<td>C5</td>
<td>Campbell Road to Hillcrest Road</td>
<td>Davenport Road, Davenport Road Home (NW) and Brushfield Drive home (SE)</td>
<td>3127+00</td>
<td>NE/SW</td>
</tr>
<tr>
<td>C6</td>
<td></td>
<td>Hillcrest Road, Highland Heather Lane home</td>
<td>3162+50</td>
<td>SE</td>
</tr>
<tr>
<td>C7</td>
<td>Hillcrest Road to Coit Road</td>
<td>McCallum Blvd, Rocky Top Circle home (NE) and Highland Heather Lane home (SW)</td>
<td>3170+50</td>
<td>NE/SW</td>
</tr>
<tr>
<td>C8</td>
<td></td>
<td>Meandering Way, Nicole Place home</td>
<td>3179+50</td>
<td>SW</td>
</tr>
</tbody>
</table>

Source: Cross-Spectrum Acoustics, 2017
# Vibration Impacts

## Table V-1. Summary of Residential Ground-Borne Vibration Impacts without Mitigation

<table>
<thead>
<tr>
<th>Corridor Segment Description</th>
<th>Side of Track</th>
<th>Distance from Near Track (feet)</th>
<th>Train Speed (mph)</th>
<th>Vibration Level (VdB)</th>
<th>Number of Residential Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeport Plwy to S Denton Tap Rd(^1)</td>
<td>WB</td>
<td>658</td>
<td>40</td>
<td>61</td>
<td>72</td>
</tr>
<tr>
<td>Freeport Plwy to S Denton Tap Rd(^1)</td>
<td>EB</td>
<td>193</td>
<td>25</td>
<td>60</td>
<td>72</td>
</tr>
<tr>
<td>S Denton Tap Rd to S Moore Rd(^1)</td>
<td>WB</td>
<td>1097</td>
<td>41</td>
<td>61</td>
<td>72</td>
</tr>
<tr>
<td>S Moore Rd to S MacArthur Blvd(^1)</td>
<td>WB</td>
<td>89</td>
<td>79</td>
<td>64</td>
<td>72</td>
</tr>
<tr>
<td>S Moore Rd to S MacArthur Blvd(^2)</td>
<td>EB</td>
<td>483</td>
<td>78</td>
<td>52</td>
<td>72</td>
</tr>
<tr>
<td>S MacArthur Blvd to Elm Fork Trinity River(^1)</td>
<td>WB</td>
<td>111</td>
<td>70</td>
<td>68</td>
<td>72</td>
</tr>
<tr>
<td>S MacArthur Blvd to Elm Fork Trinity River(^2)</td>
<td>EB</td>
<td>224</td>
<td>72</td>
<td>53</td>
<td>72</td>
</tr>
<tr>
<td>Elm Fork Trinity River to Prp. George Bush Turnpike(^1)</td>
<td>WB</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Prp. George Bush Turnpike to I-35E(^2)</td>
<td>EB</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>I-35E to N Jexy Ln(^1)</td>
<td>WB</td>
<td>73</td>
<td>51</td>
<td>67</td>
<td>72</td>
</tr>
<tr>
<td>I-35E to N Jexy Ln(^2)</td>
<td>EB</td>
<td>122</td>
<td>54</td>
<td>60</td>
<td>72</td>
</tr>
<tr>
<td>N Jexy Ln to Kelley Blvd(^1)</td>
<td>WB</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>N Jexy Ln to Kelley Blvd(^2)</td>
<td>EB</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Kelly Blvd to Marsh Ln</td>
<td>WB</td>
<td>45</td>
<td>67</td>
<td>72</td>
<td>72</td>
</tr>
<tr>
<td>Marsh Ln to Midway Rd(^1)</td>
<td>WB</td>
<td>76</td>
<td>68</td>
<td>64</td>
<td>72</td>
</tr>
<tr>
<td>Marsh Ln to Midway Rd(^2)</td>
<td>EB</td>
<td>368</td>
<td>68</td>
<td>52</td>
<td>72</td>
</tr>
<tr>
<td>Midway Rd to Dallas Pkwy(^1)</td>
<td>WB</td>
<td>63</td>
<td>35</td>
<td>64</td>
<td>72</td>
</tr>
<tr>
<td>Midway Rd to Dallas Pkwy(^2)</td>
<td>EB</td>
<td>195</td>
<td>50</td>
<td>57</td>
<td>72</td>
</tr>
<tr>
<td>Dallas Pkwy to Preston Rd(^1)</td>
<td>WB</td>
<td>67</td>
<td>56</td>
<td>64</td>
<td>72</td>
</tr>
<tr>
<td>Dallas Pkwy to Preston Rd(^2)</td>
<td>EB</td>
<td>45</td>
<td>55</td>
<td>70</td>
<td>72</td>
</tr>
<tr>
<td>Preston Rd to Campbelle Rd(^1)</td>
<td>WB</td>
<td>47</td>
<td>40</td>
<td>67</td>
<td>72</td>
</tr>
<tr>
<td>Preston Rd to Campbelle Rd(^2)</td>
<td>EB</td>
<td>39</td>
<td>40</td>
<td>72</td>
<td>72</td>
</tr>
<tr>
<td>Campbelle Rd to Hillcrest Rd</td>
<td>WB</td>
<td>48</td>
<td>69</td>
<td>76</td>
<td>72</td>
</tr>
<tr>
<td>Campbelle Rd to Hillcrest Rd(^2)</td>
<td>EB</td>
<td>47</td>
<td>54</td>
<td>72</td>
<td>72</td>
</tr>
<tr>
<td>Hillcrest Rd to Campbelle Rd(^1)</td>
<td>WB</td>
<td>80</td>
<td>62</td>
<td>65</td>
<td>72</td>
</tr>
<tr>
<td>Hillcrest Rd to Campbelle Rd(^2)</td>
<td>EB</td>
<td>50 to 66</td>
<td>60</td>
<td>70 to 78</td>
<td>72</td>
</tr>
<tr>
<td>Campbelle Rd to Synergy Park Blvd(^1)</td>
<td>WB</td>
<td>149</td>
<td>63</td>
<td>52</td>
<td>72</td>
</tr>
</tbody>
</table>

## Table V-1. Summary of Residential Ground-Borne Vibration Impacts without Mitigation

<table>
<thead>
<tr>
<th>Corridor Segment Description</th>
<th>Side of Track</th>
<th>Distance from Near Track (feet)</th>
<th>Train Speed (mph)</th>
<th>Vibration Level (VdB)</th>
<th>Number of Residential Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coll Rd to Synergy Park Blvd(^1)</td>
<td>EB</td>
<td>41</td>
<td>55</td>
<td>68</td>
<td>72</td>
</tr>
<tr>
<td>Synergy Park Blvd to Alma Rd(^1)</td>
<td>WB</td>
<td>94</td>
<td>74</td>
<td>66</td>
<td>72</td>
</tr>
<tr>
<td>Synergy Park Blvd to Alma Rd(^2)</td>
<td>EB</td>
<td>284</td>
<td>69</td>
<td>60</td>
<td>72</td>
</tr>
<tr>
<td>Alma Rd to E Plano Pkwy(^1)</td>
<td>WB</td>
<td>39</td>
<td>41</td>
<td>67</td>
<td>72</td>
</tr>
<tr>
<td>Alma Rd to E Plano Pkwy(^2)</td>
<td>EB</td>
<td>216</td>
<td>39</td>
<td>50</td>
<td>72</td>
</tr>
<tr>
<td>E Plano Pkwy to Jupiter Rd(^1)</td>
<td>WB</td>
<td>415</td>
<td>44</td>
<td>56</td>
<td>72</td>
</tr>
<tr>
<td>E Plano Pkwy to Jupiter Rd(^2)</td>
<td>EB</td>
<td>1245</td>
<td>20</td>
<td>56</td>
<td>72</td>
</tr>
<tr>
<td>Jupiter Rd to end(^3)</td>
<td>WB</td>
<td>94</td>
<td>65</td>
<td>58</td>
<td>72</td>
</tr>
</tbody>
</table>

**Total Number of Vibration Impacts:** 5

Source: Cross-Spectrum Acoustics, 2017

\(^1\) Eastbound (EB) or Westbound (WB)

\(^2\) Ground-borne vibration levels are measured in VdB, referenced to 1 μm/sec (rounded to the nearest decibel).

\(^3\) There are no residential receptors in this section.

\(^4\) There are no receptors with vibration impact in this section. Data are for the receptor with the highest Project vibration level.
# Vibration Mitigation Locations

## Table V-2: Summary of Recommended Vibration Mitigation Locations

<table>
<thead>
<tr>
<th>Vibration Mitigation Number</th>
<th>Vibration Mitigation Location</th>
<th>Tire Derived Aggregate (TDA) Civil Station Location</th>
<th>Length of TDA Installation (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>Kelly Blvd to Marsh Lane</td>
<td>Lakehills Townhomes, Carrollton</td>
<td>From 2253+00 to 2263+00</td>
</tr>
<tr>
<td>V2</td>
<td>Campbell Rd to Hillcrest Rd</td>
<td>Oakington Ct</td>
<td>From 3158+00 to 3162+00</td>
</tr>
<tr>
<td>V3</td>
<td>Hillcrest Rd to Coit Rd</td>
<td>Energy Lane, Dallas</td>
<td>From 3180+50 to 3185+50</td>
</tr>
</tbody>
</table>

**Total TDA Length:** 1,900 ft

Source: Cross-Spectrum Acoustics, 2017