MovingAhead

STREETS AND PLACES REIMAGINED

DRAFT FINAL Noise and Vibration Technical Report

Lane Transit District
City of Eugene

In cooperation with
Lane Council of Governments
Lane County
Oregon Department of Transportation

July 7, 2017

DRAFT FINAL Noise and Vibration Technical Report

MovingAhead Project

Prepared in accordance with the
National Environmental Policy Act of 1969, as amended 42 U.S.C. 4322
and the
Federal Transit Act of 1964, as amended 49 U.S.C. 1601 et. seq.

July 7, 2017

Prepared for
Federal Transit Administration
Lane Transit District
City of Eugene

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Americans with Disabilities Act (ADA) Information
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Acronyms, Abbreviations, and Terms

Acronyms and Abbreviations	Definitions
AA	Alternatives Analysis
ADA	Americans with Disabilities Act
API	Area of Potential Impact
BAT	Business Access and Transit
BRT	Bus Rapid Transit
CFR	*Code of Federal Regulations*
dB	Decibel
dBA	A-weighted decibel
EmX	Emerald Express
Draft Eugene 2035 TSP	*DRAFT Eugene 2035 Transportation System Plan* (City of Eugene, 2016)
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
FTA Manual	*Transit Noise and Vibration Impact Assessment* (FTA, 2006)
FTN	Frequent Transit Network
I-5	Interstate 5
LCC	Lane Community College
Ldn	Day-night Sound Level
L_{eq}	equivalent sound level
LTD	Lane Transit District
MPO	Metropolitan Planning Organization
NAC	Noise Abatement Criteria
NEPA	National Environmental Policy Act
ODEQ	Oregon Department of Environmental Quality
ODOT	Oregon Department of Transportation
RTP	Regional Transportation Plan
U.S.C.	United States Code
USDOT	U.S. Department of Transportation
WEEE	West Eugene EmX Extension

Terms

Terms	Definitions
Alternatives Analysis	The process of evaluating the costs, benefits and impacts of a range of transportation alternatives designed to address mobility problems and other locally-defined objectives in a defined transportation corridor, and for determining which particular investment strategy should be advanced for more focused study and development. The Alternatives Analysis (AA) process provides a foundation for effective decision making.
Area of Potential Impact	Alternative specific corridor plus a 1/8-mile buffer area on either side of the corridor alternative centerline.
Business Access and Transit Lane (BAT)	In general, a BAT lane is a concrete lane, separated from general-purpose lanes by a paint stripe and signage. A BAT lane provides BRT priority operations, but general-purpose traffic is allowed to travel within the lane to make a turn into or out of a driveway or at an intersecting street. However, only the BRT vehicle is allowed to use the lane to cross an intersecting street.
Boarding	Boarding is a term used in transit to account for passengers of public transit systems. One person getting on a transit vehicle equals one boarding. In many cases individuals will have to transfer to an additional transit vehicle to reach their destination and may well use transit for the return trip. Therefore, a single rider may account for several transit boardings in one day.
Bus Rapid Transit (BRT)	A transit mode that combines the quality of rail transit and the flexibility of buses. It can operate on bus lanes, HOV lanes, expressways, or ordinary streets. The vehicles are designed to allow rapid passenger loading and unloading, with more doors than ordinary buses.
Busway	Exclusive freeway lane for buses and carpools.
Capital Improvements Program	A Capital Improvement Plan or Program (CIP) is a short-range plan, usually four to 10 years, which identifies capital projects and equipment purchases, provides a planning schedule and identifies options for funding projects in the program.
Categorical Exclusion	A Categorical Exclusion (CE) means a category of actions which do not individually or cumulatively have a significant effect on the human environment and for which, therefore, neither an environmental assessment nor an environmental impact statement is required.
Corridor	A broad geographical band that follows a general directional flow connecting major sources of trips that may contain a number of streets, highways and transit route alignments.
Documented Categorical Exclusion (DCE)	A Documented Categorical Exclusion (DCE) means a group of actions that may also qualify as CEs if it can be demonstrated that the context in which the action is taken warrants a CE exclusion; i.e., that no significant environmental impact will occur. Thus, these actions are referred to as Documented Categorical Exclusions. Such actions require some NEPA documentation, but not an Environmental Assessment or a full-scale Environmental Impact Statement. DCEs documentation must demonstrate that in the context(s) in which these actions are to be performed, they will have no significant environmental impact or that such impacts will be mitigated.

Terms	Definitions
Effects	Effects include ecological, aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions that may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial. Effects include: (1) direct effects that are caused by the action and occur at the same time and place, and (2) indirect effects that are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use; population density or growth rate; and related effects on air and water and other natural systems, including ecosystems (40 CFR 1508.8).
EmX	Lane Transit District's Bus Rapid Transit System, pronounced "MX", short for Emerald Express.
Envision Eugene	The City of Eugene's Comprehensive Plan (latest draft or as adopted). Envision Eugene includes a determination of the best way to accommodate the community's projected needs over the next 20 years.
Environmental Justice	A formal federal policy on environmental justice was established in February 1994, with Executive Order 12898 (EO 12898), "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations." There are three fundamental environmental justice principles: • To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations. • To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process. • To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.
Evaluation Criteria	Evaluation criteria are the factors used to determine how well each of the proposed multimodal alternatives would meet the project's Goals and Objectives. The Evaluation Criteria require a mix of quantitative data and qualitative assessment. The resulting data are used to measure the effectiveness of proposed multimodal alternatives and to assist in comparing and contrasting each of the alternatives to select a preferred alternative.
Fatal Flaw Screening	The purpose of a Fatal Flaw Screening is to identify alternatives that will not work for one reason or another (e.g., environmental, economic, community) By using a Fatal Flaw Screening process to eliminate alternatives that are not likely to be viable, a project can avoid wasting time or money studying options that are not viable and focus on alternatives and solutions that have the greatest probably of meeting the community's needs (e.g., environmentally acceptable, economically efficient, implementable).
Fixed Route	Service provided on a repetitive, fixed-schedule basis along a specific route with vehicles stopping to pick up and deliver passengers at set stops and stations; each fixed-route trip serves the same origins and destinations, unlike demand responsive and taxicabs.

Terms	Definitions
Goals and Objectives	Goals and objectives define the project's desired outcome and reflect community values. Goals and objectives build from the project's Purpose and Need Statement. Goals are overarching principles that guide decision making. Goals are broad statements. Objectives define strategies or implementation steps to attain the goals. Unlike goals, objectives are specific and measurable.
Guideway	A transit right of way separated from general purpose vehicles.
Headway	Time interval between vehicles passing the same point while moving in the same direction on a particular route.
Impacts	A term to describe the positive or negative effects upon the natural or built environments as a result of an action (i.e., project).
Key Transit Corridors	Key Transit Corridors are mapped in Envision Eugene and are anticipated to be significant transit corridors for the City and the region
Maintenance facility	A facility along a corridor used to clean, inspect, repair and maintain rail vehicles, as well as to store them when they are not in use.
Metropolitan Planning Organization (MPO)	The organization designated by local elected officials as being responsible for carrying out the urban transportation and other planning processes for an area.
Mitigation	A means to avoid, minimize, rectify, or reduce an impact, and in some cases, to compensate for an impact.
Mode	A particular form or method of travel distinguished by vehicle type, operation technology and right of way separation from other traffic.
MovingAhead Project	The City of Eugene and LTD are working with regional partners and the community to determine which improvements are needed on some of our most important transportation corridors for people using transit, and facilities for people walking and biking. MovingAhead will prioritize transit, walking and biking projects along these corridors so that they can be funded and built in the near-term. The project will focus on creating active, vibrant places that serve the community and accommodate future growth. During Phase 1, currently underway, the community will weigh in on preferred transportation solutions for each corridor and help prioritize corridors for implementation. When thinking about these important streets, LTD and the City of Eugene refer to them as corridors because several streets may work as a system to serve transportation needs.
Multimodal	Multimodal refers to various modes. For the MovingAhead project, multimodal refers to Corridors that support various transportation modes including vehicles, buses, walking and cycling.
National Environmental Policy Act of 1969 (NEPA)	A comprehensive federal law requiring analysis of the environmental impacts of federal actions such as the approval of grants; also requiring preparation of an Environmental Impact Statement (EIS) for every major federal action significantly affecting the quality of the human environment.
No Action or No-Build Alternative	An alternative that is used as the basis to measure the impacts and benefits of the other alternative(s) in an environmental assessment or other National Environmental Policy Act (NEPA) action. The No-Build alternative consists of the existing conditions, plus any improvements which have been identified in the Statewide Transportation Improvement Program (STIP).

Terms	Definitions
Off-Peak Period	Non-rush periods of the day when travel activity is generally lower and less transit service is scheduled. Also called "base period."
Park and Ride	Designated parking areas for automobile drivers who then board transit vehicles from these locations.
Peak Hour	The hour of the day in which the maximum demand for transportation service is experienced (refers to private automobiles and transit vehicles).
Peak Period	Morning and afternoon time periods when transit riding is heaviest.
Preferred Alternative	An alternative that includes a major capital improvement project to address the problem under investigation. As part of the decision making process, the Preferred Alternative is compared against the No Action or No-Build Alternative from the standpoints of transportation performance, environmental consequences, cost-effectiveness, and funding considerations.
Purpose and Need	The project Purpose and Need provides a framework for developing and screening alternatives. The purpose is a broad statement of the project's transportation objectives. The need is a detailed explanation of existing conditions that need to be changed or problems that need to be fixed.
Ridership	The number of rides taken by people using a public transportation system in a given time period.
Right of Way	Publicly owned land that can be acquired and used for transportation purposes.
Scoping	A formal coordination process used to determine the scope of the project and the major issues likely to be related to the proposed action (i.e., project).
Screening Criteria	Criteria used to compare alternatives.
Study Area	The area within which evaluation of impacts is conducted. The study area for particular resources will vary based on the decisions being made and the type of resource(s) being evaluated.
Transit System	An organization (public or private) providing local or regional multi-occupancy-vehicle passenger service. Organizations that provide service under contract to another agency are generally not counted as separate systems.

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Noise and Vibration Summary

This Noise and Vibration Technical Report presents the results of analyses conducted for the Lane Transit District (LTD) and City of Eugene's MovingAhead Project in Eugene, Oregon. The purpose of the MovingAhead Project is to determine which high-capacity transit corridors identified in the adopted Emerald Express (EmX) System Plan, *Lane Transit District Long-Range Transit Plan* (LTD, 2014) and the Frequent Transit Network (FTN) are ready to advance to capital improvements programming in the near term. LTD and the City of Eugene (City) initiated the MovingAhead Project in 2014 to identify and examine alternatives for improving multimodal safety, mobility, and accessibility in key transit corridors in the City. A main theme of the City's vision is to concentrate new growth along and near the City's key transit corridors and core commercial areas while protecting neighborhoods and increasing access to services for everyone. LTD and the City are jointly conducting the project to facilitate a more streamlined and cost-efficient process through concurrent planning, environmental review, and design and construction of multiple corridors. The purpose of this noise and vibration technical analysis is to assess each of the alternatives for potential impacts under the Federal Transit Administration (FTA) guidance set forth in the *Transit Noise and Vibration Impact Assessment* (FTA, 2006; FTA Manual).

LTD and the City of Eugene examined multimodal transit alternatives in five key transit corridors identified in the *Draft Envision Eugene Comprehensive Plan* (Envision Eugene, 2016, July) and the *DRAFT Eugene 2035 Transportation System Plan* (City of Eugene, 2016a; Draft Eugene 2035 TSP), the region's highest growth centers, and Downtown Eugene:

- Highway 99 Corridor
- River Road Corridor
- 30th Avenue to Lane Community College (LCC) Corridor
- Coburg Road Corridor
- Martin Luther King, Jr. Boulevard Corridor

No-Build, Enhanced Corridor, and EmX Alternatives were developed for each corridor, except the Martin Luther King, Jr. Boulevard Corridor, for which only No-Build and Enhanced Corridor Alternatives were developed. Each proposed corridor location is shown on Figures S.1-1 and S.1-2 for the Enhanced Corridor Alternatives and the EmX Alternatives, respectively. The *MovingAhead Level 2 Definition of Alternatives* (CH2M et al., 2016) contains a detailed description of the project alternatives. The following is a summary of the evaluated project alternatives:

- The **No-Build Alternatives** serve as a reference point to gauge the benefits, costs, and effects of the Enhanced Corridor and EmX Alternatives in each corridor. Each No-Build Alternative is based on the projected conditions in 2035. Capital projects are derived from the financially constrained project lists in the Draft Eugene 2035 TSP, the *Lane County Transportation System Plan* (Lane County Public Works, Engineering Division Transportation Planning, 2004, June 4; update in progress), the *Lane Transit District Capital Improvement Plan* (LTD, 2015), and the *Lane Transit District Long-Range Transit Plan* (LTD, 2014).
- **Enhanced Corridor Alternatives** are intended to address the project's Purpose, Need, Goals, and Objectives without major transit capital investments, instead focusing on lower-cost capital improvements, operational improvements, and transit service refinements, including 15-minute service frequency. Features can include transit queue jumps (lanes for buses that allow the bus to "jump" ahead of other traffic at intersections using a separate signal phase), stop consolidation, and enhanced shelters. These features can improve reliability, reduce transit travel time, and increase passenger comfort, making transit service along the corridor more attractive.

Figure S.1-1. Enhanced Corridor Alternative Overview

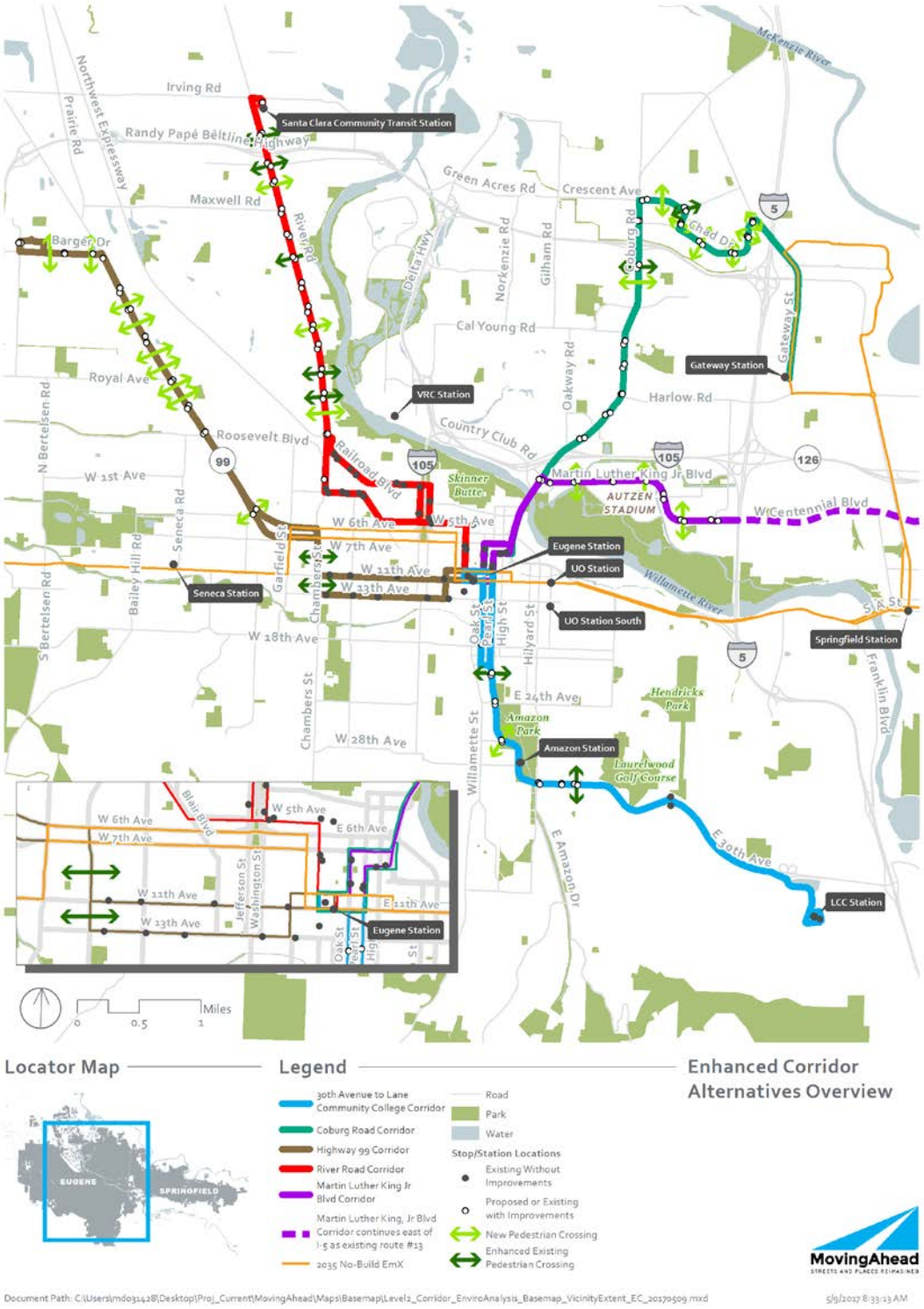
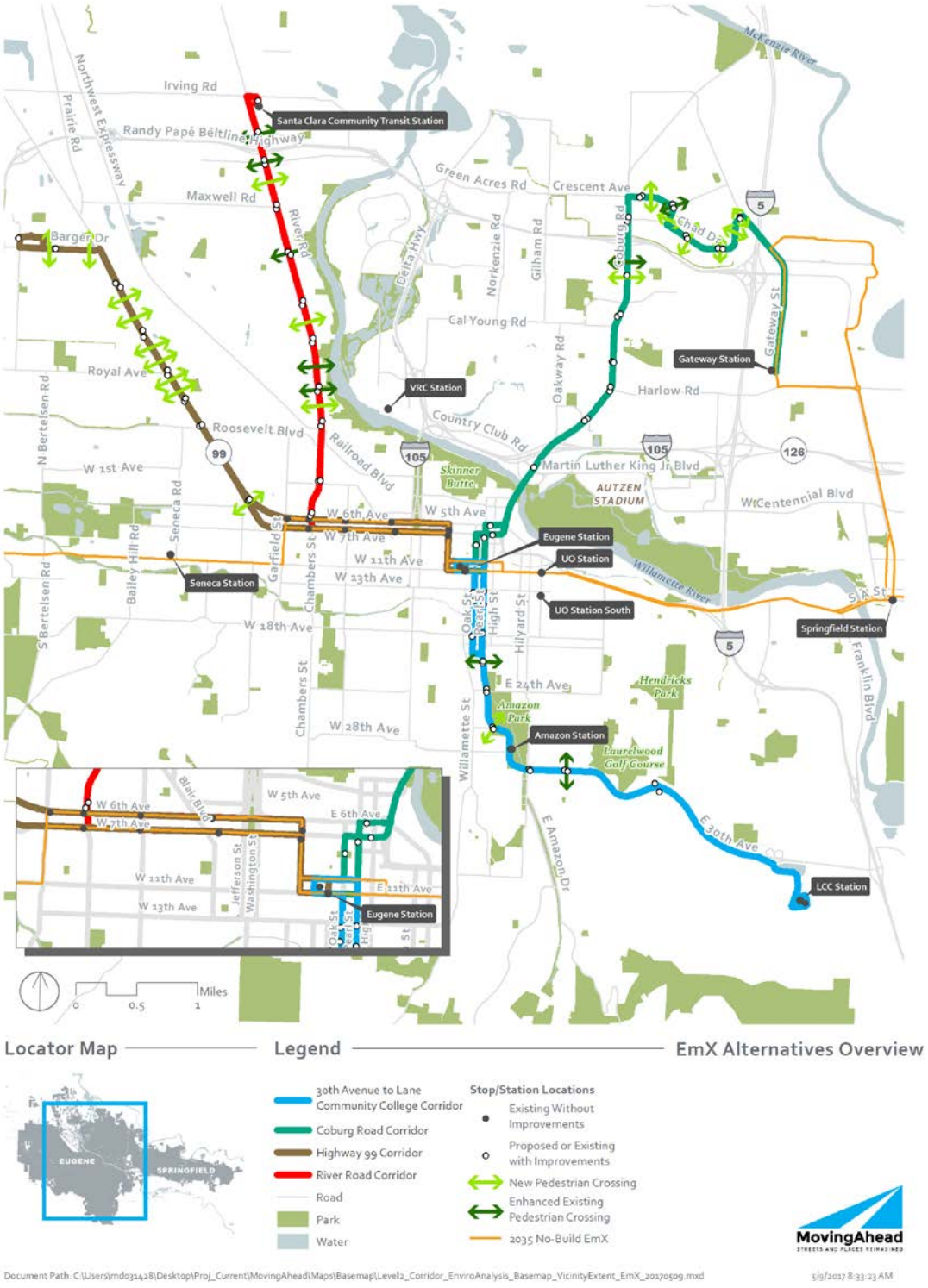


Figure S.1-2. EmX Alternative Overview



- **EmX Alternatives** are characterized by sections of exclusive guideway, branded, multi-door, 60-foot-long bus rapid transit (BRT) vehicles, and enhanced stations with level boarding platforms instead of bus stops; off-board fare collection; transit signal priority; wider stop spacing; and 10-minute service frequencies. In general, EmX is a transit mode positioned between fixed-route bus service, operating in mixed traffic and urban-rail service operating in a separate right of way. EmX service is intended to improve transit speed, reliability, and ridership.

Figure S.1-1 shows the proposed corridors for the Enhanced Corridor Alternatives and Figure S.1-2 shows the proposed corridors for the EmX Alternatives.

This technical report, prepared to support the MovingAhead Project Alternatives Analysis (AA), addresses potential adverse noise and vibration effects that the project alternatives would have on sensitive receivers. It describes how the proposed project alternatives could change the noise and vibration conditions of the five study corridors. It bases the assessments on the proximity of proposed changes to sensitive receivers and identifies potential mitigation measures. This report was prepared in compliance with the National Environmental Policy Act (NEPA) and applicable state environmental policy legislation, as well as local and state planning and land use policies and design standards.

S.1. Affected Environment

The MovingAhead Project's five corridors are primarily located within the City of Eugene, with a portion of the River Road and 30th Avenue to LCC Corridors located within unincorporated Lane County, and a portion of the Coburg Road Corridor located in the City of Springfield.

The Areas of Potential Impact (API) for each build alternative is from 50 to 500 feet from each affected roadway that is part of the project corridor under that alternative, the actual distance depending on the type of noise source and topographical conditions, and shielding between the source and receiver. The Enhanced Corridor Alternatives and EmX Alternatives are presented on Figure S.2-1.

S.2. Environmental Consequences

S.2.1. Highway 99 Corridor Environmental Consequences

S.2.1.1. Noise Impacts

No-Build Alternative Impacts

Under the No-Build Alternative, no noise or vibration impacts are anticipated because there will be no project-related changes to the corridor.

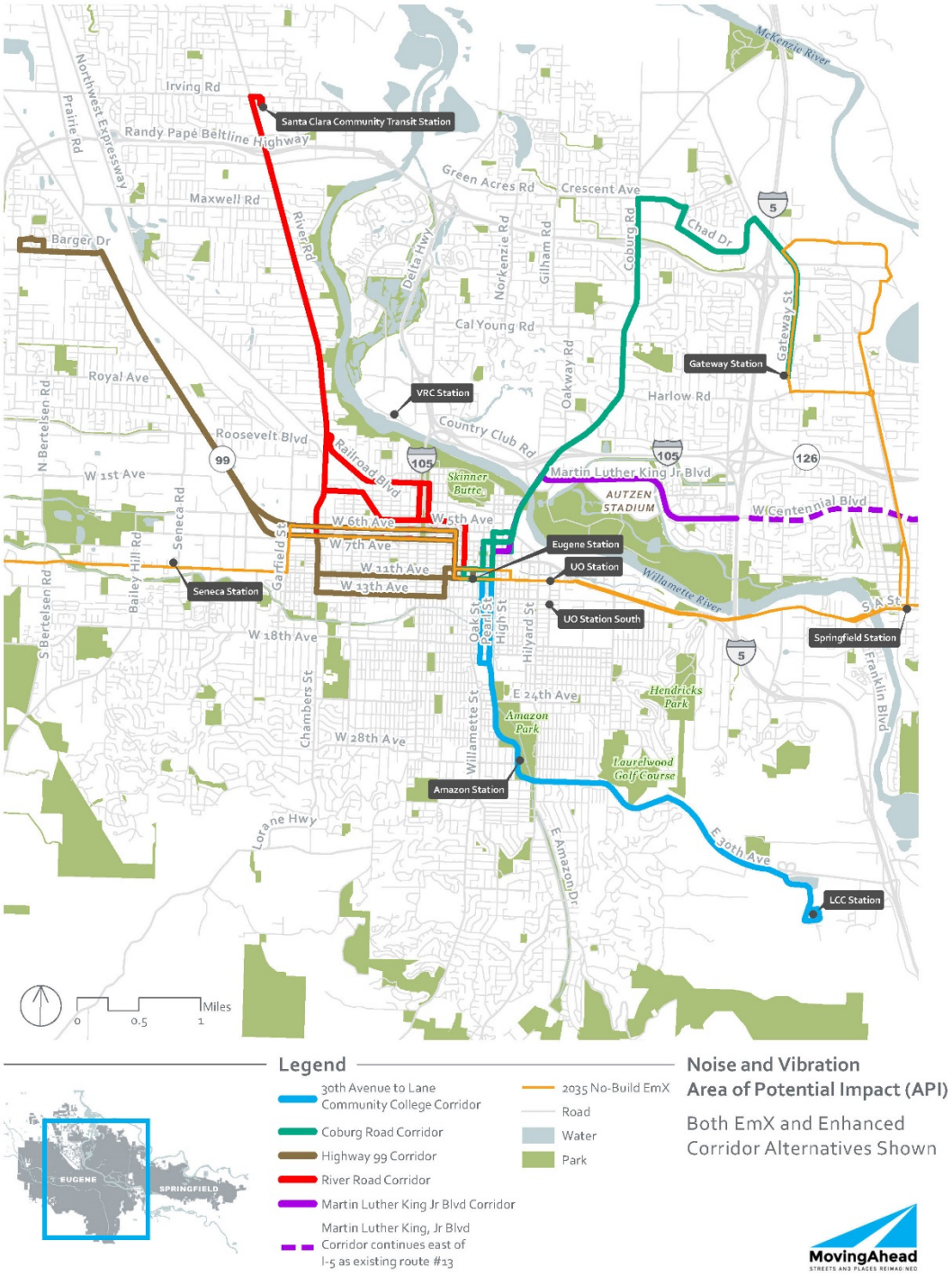
Enhanced Alternative Impacts

There are seven multi-family properties with potential noise impacts under the Highway 99 Corridor Enhanced Corridor Alternative as based upon current guidance contained in the FTA Manual (FTA, 2006).

EmX Alternative Impacts

Under the Highway 99 Corridor EmX Alternative, potential noise impacts to 6 single-family properties and 13 multi-family properties are anticipated as based upon current guidance contained in the FTA Manual (FTA, 2006).

Figure S.2-1. MovingAhead Enhanced Corridor and EmX Alternatives



S.2.1.2. Vibration Impacts

All of the alternatives use rubber-tired vehicles (buses and EmX vehicles) on public rights of way. Vibration levels from rubber-tired vehicles are below the FTA criteria for structures that are greater than 15 to 20 feet from the travel lane. Therefore, no vibration impacts are predicted under any of the alternatives.

S.2.2. River Road Corridor

S.2.2.1. Noise Impacts

No-Build Alternative Impacts

Under the No-Build Alternative, no noise or vibration impacts are anticipated because there will be no project-related changes to the corridor.

Enhanced Alternative Impacts

The River Road Corridor Enhanced Corridor Alternative is not predicted to have any noise impacts.

EmX Alternative Impacts

The River Road Corridor EmX Alternative is predicted to have potential noise impacts on two single-family properties as based upon current guidance contained in the FTA Manual (FTA, 2006).

S.2.2.2. Vibration Impacts

All of the alternatives use rubber-tired vehicles (buses and EmX vehicles) on public rights of way. Also, vibration levels from rubber-tired vehicles are below the FTA criteria for structures that are greater than 15 to 20 feet from the travel lane. Therefore, no vibration impacts are predicted under any of the alternatives.

S.2.3. 30th Avenue to Lane Community College

S.2.3.1. Noise Impacts

No-Build Alternative Impacts

Under the No-Build Alternative, no noise or vibration impacts are anticipated because there will be no project-related changes to the corridor.

Enhanced Alternative Impacts

The 30th Avenue to LCC Corridor Enhanced Corridor Alternative is not predicted to have any noise impacts.

EmX Alternative Impacts

The 30th Avenue to LCC Corridor EmX Alternative is predicted to have nine potential noise impacts as based upon current guidance contained in the FTA Manual (FTA, 2006). Three of the potential impacts are expected at single-family properties and four are expected at multi-family properties. In addition, one hotel and one church are predicted to have potential noise impacts.

This corridor may require incorporation of FHWA noise prediction and impact assessment procedures. The area of greatest potential for the use of such measures is at 20th Avenue, where a new roadway will be constructed between Oak and Pearl Streets.

S.2.3.2. Vibration Impacts

All of the alternatives use rubber-tired vehicles (buses and EmX vehicles) on public rights of way. Also, vibration levels from rubber-tired vehicles are below the FTA criteria for structures that are greater than 15 to 20 feet from the travel lane. Therefore, no vibration impacts are predicted under any of the alternatives.

S.2.4. Coburg Road Corridor

S.2.4.1. Noise Impacts

No-Build Alternative Impacts

Under the No-Build Alternative, no noise or vibration impacts are anticipated because there will be no project-related changes to the corridor.

Enhanced Alternative Impacts

The Coburg Road Corridor Enhanced Corridor Alternative is not predicted to have any noise impacts.

EmX Alternative Impacts

The Coburg Road Corridor EmX Alternative is predicted to have 46 potential noise impacts as based upon current guidance contained in the FTA Manual (FTA, 2006). Thirty-nine of the potential impacts are expected at single-family properties and three are expected at multi-family properties. In addition, one hotel, two churches, and one school are predicted to have potential noise impacts.

S.2.4.2. Vibration Impacts

All of the alternatives use rubber-tired vehicles (buses and EmX vehicles) on public rights of way. Also, vibration levels from rubber-tired vehicles are below the FTA criteria for structures that are greater than 15 to 20 feet from the travel lane. Therefore, no vibration impacts are predicted under any of the alternatives.

S.2.5. Martin Luther King, Jr, Boulevard Corridor

S.2.5.1. Noise Impacts

No-Build Alternative Impacts

Under the No-Build Alternative, no noise or vibration impacts are anticipated because there will be no project-related changes to the corridor.

Enhanced Alternative Impacts

The Martin Luther King, Jr. Boulevard Corridor Enhanced Corridor Alternative is predicted to have one potential noise impact at a hotel as based upon current guidance contained in the FTA Manual (FTA, 2006).

S.2.5.2. Vibration Impacts

All of the alternatives use rubber-tired vehicles (buses and EmX vehicles) on public rights of way. Also, vibration levels from rubber-tired vehicles are below the FTA criteria for structures that are greater than 15 to 20 feet from the travel lane. Therefore, no vibration impacts are predicted under any of the alternatives.

S.3. Indirect and Cumulative Effects

Regional traffic data were generated and used in this analysis, accounting for expected regional land use and growth. As a result, this noise and vibration assessment has incorporated any expected cumulative and indirect traffic increases in the long-term impacts.

S.4. Short-Term Construction-Related Impacts

Under the build alternatives, during construction of the proposed project improvements, noise and vibration levels in the project corridor may increase due to normal construction activities. However, daytime construction noise is exempt from provisions contained in the City of Eugene Municipal Code. Under the City of Eugene Municipal Code noise ordinance, project construction could be performed during the normal daytime hours of 7:00 a.m. to 7:00 p.m. Similarly, under the City of Springfield Municipal Code noise ordinance, project construction could be performed during the normal daytime hours of 7:00 a.m. to 6:00 p.m. without having to obtain a variance or other exemption. No construction noise impacts are predicted for any alternative if construction is performed during the allowable hours.

If construction was planned outside the hours of 7:00 a.m. to 7:00 p.m., the project would be required to obtain a noise variance from local jurisdictions. As part of the variance process, a construction noise analysis would be performed. The construction specifications would contain limitations, if any, specific to the night work proposed and potential construction noise impacts.

S.5. Mitigation Options

The FTA criteria are used to evaluate mitigation for all project noise (and vibration) impacts. Mitigation of potential noise impacts under all of the build alternatives, except for the River Road Corridor, 30th Avenue to LCC Corridor and Coburg Road Corridor Enhanced Corridor alternatives where no mitigation is needed, can be achieved by measures taken at the noise source (e.g., quiet buses), along the path (e.g., sound walls), or, under certain circumstances, at the receivers (e.g., sound insulation). Because the build alternative corridors are generally in an urban area where land is at a premium, sound walls may not be feasible or cost-effective. Detailed mitigation planning will be developed in the National Environmental Policy Act (NEPA) documentation phase of the project in accordance with the FTA criteria. Prior to determining mitigation measures, additional analyses would be performed to verify impacts and assess the severity. If impacts are identified, and mitigation is warranted, then mitigation for both moderate and severe noise impacts would begin with source treatment, followed by treatments in the noise path. If source and path treatments are not sufficient to mitigate the impacts, affected properties where the existing building does not already achieve sufficient exterior-to-interior reduction of noise levels would be evaluated for sound insulation implementation.

S.6. Permits and Approvals

There are no noise- or vibration-related permits required for system operations. During construction, a noise variance may be necessary if construction is proposed outside the allowable hours of the local jurisdiction.

S.7. Conclusions

All build alternatives would be constructed in the Eugene-Springfield region. Potential noise impacts were identified for each build alternative. It is expected that all of these impacts can be mitigated either at the source, along the path or, where required, at the impacted receivers.

Because there are no potential vibration related impacts expected to occur from project operations under any build alternative, no vibration mitigation measures were analyzed.

Table S.5-1 summarizes noise and vibration environmental consequences by corridor and alternative.

Table S.5-1. Summary of Noise and Vibration Environmental Consequences by Corridor and Alternative

Alternatives	Temporary/Short-Term Construction Related Impacts/Benefits	Long-Term Direct Impacts/Benefits	Indirect/Cumulative Effects	Mitigation Measures	Unavoidable Adverse Effects
Highway 99 Corridor					
No-Build Alternative	• None	• None	• None	• None	• None
Enhanced Corridor Alternative	• No noise or vibration impacts anticipated	• Potential noise impacts on up to seven properties • No vibration impacts anticipated	• Potential indirect/cumulative effects incorporated into direct effects analysis	• Detailed mitigation planning will be developed in the NEPA documentation phase of the project in accordance with the FTA criteria	• None anticipated
EmX Alternative	• No noise or vibration impacts anticipated	• Potential noise impacts on up to 19 properties • No vibration impacts anticipated	• Potential indirect/cumulative effects incorporated into direct effects analysis	• Detailed mitigation planning will be developed in the NEPA documentation phase of the project in accordance with the FTA criteria	• None anticipated
River Road Corridor					
No-Build Alternative	• None	• None	• None	• None	• None
Enhanced Corridor Alternative	• No noise or vibration impacts anticipated	• No noise or vibration impacts anticipated	• Potential indirect/cumulative effects incorporated into direct effects analysis	• None anticipated	• None anticipated
EmX Alternative	• No noise or vibration impacts anticipated	• Potential noise impacts on up to two properties • No vibration impacts anticipated	• Potential indirect/cumulative effects incorporated into direct effects analysis	• Detailed mitigation planning will be developed in the NEPA documentation phase of the project in accordance with the FTA criteria	• None anticipated

Table S.5-1. Summary of Noise and Vibration Environmental Consequences by Corridor and Alternative

Alternatives	Temporary/Short-Term Construction Related Impacts/Benefits	Long-Term Direct Impacts/Benefits	Indirect/Cumulative Effects	Mitigation Measures	Unavoidable Adverse Effects
30th Avenue to LCC Corridor					
No-Build Alternative	• None	• None	• None	• None	• None
Enhanced Corridor Alternative	• No noise or vibration impacts anticipated	• No noise or vibration impacts anticipated	• Potential indirect/cumulative effects incorporated into direct effects analysis	• None anticipated	• None anticipated
EmX Alternative	• No noise or vibration impacts anticipated	• Potential noise impacts on up to nine properties • No vibration impacts anticipated	• Potential indirect/cumulative effects incorporated into direct effects analysis	• Detailed mitigation planning will be developed in the NEPA documentation phase of the project in accordance with the FTA criteria	• None anticipated
Coburg Road Corridor					
No-Build Alternative	• None	• None	• None	• None	• None
Enhanced Corridor Alternative	• No noise or vibration impacts anticipated	• No noise or vibration impacts anticipated	• Potential indirect/cumulative effects incorporated into direct effects analysis	• None anticipated	• None anticipated
EmX Alternative	• No noise or vibration impacts anticipated	• Potential noise impacts on up to 46 properties • No vibration impacts anticipated	• Potential indirect/cumulative effects incorporated into direct effects analysis	• Detailed mitigation planning will be developed in the NEPA documentation phase of the project in accordance with the FTA criteria	• None anticipated

Table S.5-1. Summary of Noise and Vibration Environmental Consequences by Corridor and Alternative

Alternatives	Temporary/Short-Term Construction Related Impacts/Benefits	Long-Term Direct Impacts/Benefits	Indirect/Cumulative Effects	Mitigation Measures	Unavoidable Adverse Effects
Martin Luther King, Jr. Boulevard Corridor					
No-Build Alternative	• None	• None	• None	• None	• None
Enhanced Corridor Alternative	• No noise or vibration impacts anticipated	• Potential noise impacts on up to 1 property • No vibration impacts anticipated	• Potential indirect/cumulative effects incorporated into direct effects analysis	• Detailed mitigation planning will be developed in the NEPA documentation phase of the project in accordance with the FTA criteria	• None anticipated

1. Introduction

1.1. MovingAhead Technical Reports

A total of 20 technical reports have been prepared for the MovingAhead Project. The technical reports have been prepared to support the selection of preferred alternatives for the MovingAhead Project and subsequent environmental documentation. The technical reports assume that any corridors advanced for environmental review will require a documented categorical exclusion under the National Environmental Policy Act (NEPA). Any corridors requiring a higher level of environmental review would be supported by the technical evaluation but might not be fully covered by the technical evaluation.

Technical reports have been prepared for the following disciplines:

- Acquisitions and Displacements
- Air Quality
- Capital Cost Estimating
- Community Involvement, Agency and Tribal Coordination
- Community, Neighborhood, and Environmental Justice
- Cultural Resources
- Ecosystems (Biological, Fish Ecology, Threatened and Endangered Species, Wetlands and Waters of the U.S. and State)
- Energy and Sustainability
- Geology and Seismic
- Hazardous Materials
- Land Use and Prime Farmlands
- Noise and Vibration
- Operating and Maintenance Costs
- Parklands, Recreation Areas, and Section 6(f)
- Section 4(f)
- Street and Landscape Trees
- Transportation
- Utilities
- Visual and Aesthetic Resources
- Water Quality, Floodplain, and Hydrology

In general, each technical report includes the following information for identifying effects:

- Relevant laws and regulations
- Contacts and coordination
- Summary of data sources and analysis methods described in the *MovingAhead Environmental Disciplines Methods and Data Report* (CH2M HILL, Inc. [CH2M] et al., 2015)
- Affected environment
- Adverse and beneficial effects including short-term, direct, indirect and cumulative
- Mitigation measures
- Permits and approvals
- References

1.2. Noise and Vibration Technical Report and Purpose

This technical report presents the results of the Noise and Vibration assessment for the MovingAhead corridor alternatives. Potential effects to ecosystems analyzed for this report include those related to fish and wildlife habitats, waterways, wetlands, designated critical habitat and species listed under the federal Endangered Species Act and the Oregon Endangered Species Act. The potential effects to ecosystems and possible mitigation measures are considered in the selection of corridor preferred alternatives.

1.3. Discipline Experts

Table 1.3-1 identifies discipline experts who contributed to the preparation of this report. This table includes their areas of expertise, affiliated organizations, titles, and years of experience.

Table 1.3-1. Discipline Experts

Discipline	Technical Expert	Affiliated Organization	Title/Years of Experience
Ecosystems	Patrick Hendrix	ES&A	Senior Scientist/21 years
	Wallace Leake	ES&A	Principal/24 years
Editors	Lynda Wannamaker	Wannamaker Consulting	President/33 years
	Scott Richman	CH2M	Senior Project Manager/24 years
	Sasha Luftig	LTD	Development Project Manager/9 years

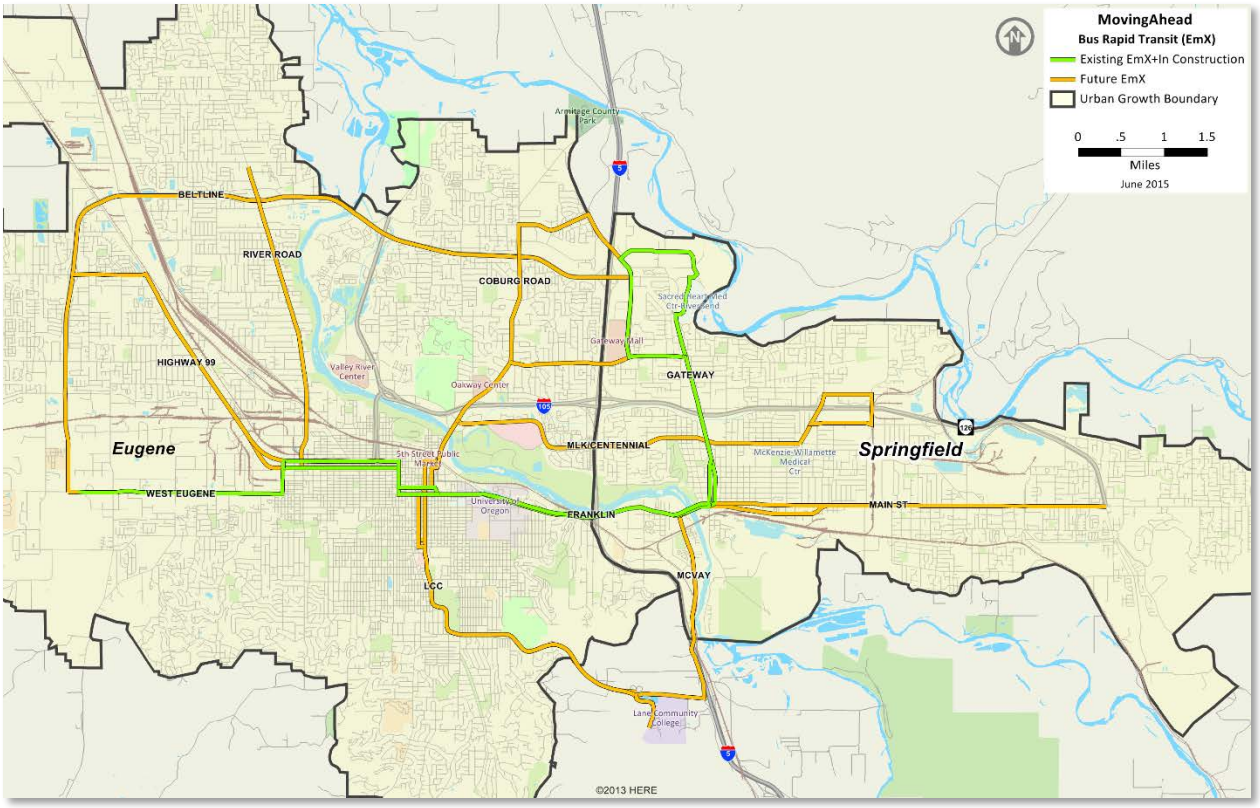
Source: MovingAhead Project Team. (2017).

1.4. Study Background

The purpose of the MovingAhead Project is to determine which high-capacity transit corridors identified in the adopted *Central Lane Metropolitan Planning Organization Regional Transportation Plan* (Lane Council of Governments [LCOG], 2011; RTP) and the *Lane Transit District Long Range Transit Plan* (Lane Transit District [LTD], 2014) as part of the Frequent Transit Network (FTN) are ready to advance to capital improvements programming in the near term. The study is being conducted jointly with the City of Eugene and LTD to facilitate a streamlined and cost-efficient process through concurrent planning, environmental review, and design and construction of multiple corridors. The study area includes Eugene and portions of unincorporated Lane County.

The *Lane Transit District Long-Range Transit Plan* (LTD, 2014) identifies the full Martin Luther King, Jr. Boulevard/Centennial Boulevard Corridor as a future part of the FTN. Initially, MovingAhead considered options on Centennial Boulevard to serve Springfield as part of this corridor. Because Springfield does not have the resources available to consider transit enhancements on Centennial Boulevard at this time, MovingAhead will only develop Emerald Express (EmX) and Enhanced Corridor Alternatives within Eugene. Figure 1.4-1 presents LTD's existing and future bus rapid transit (BRT) system.

Figure 1.4-1. Lane Transit District's Bus Rapid Transit (BRT) System



Source: LTD. (2015, Amended 2015, June).

1.5. Screening and Evaluation of Multimodal Options

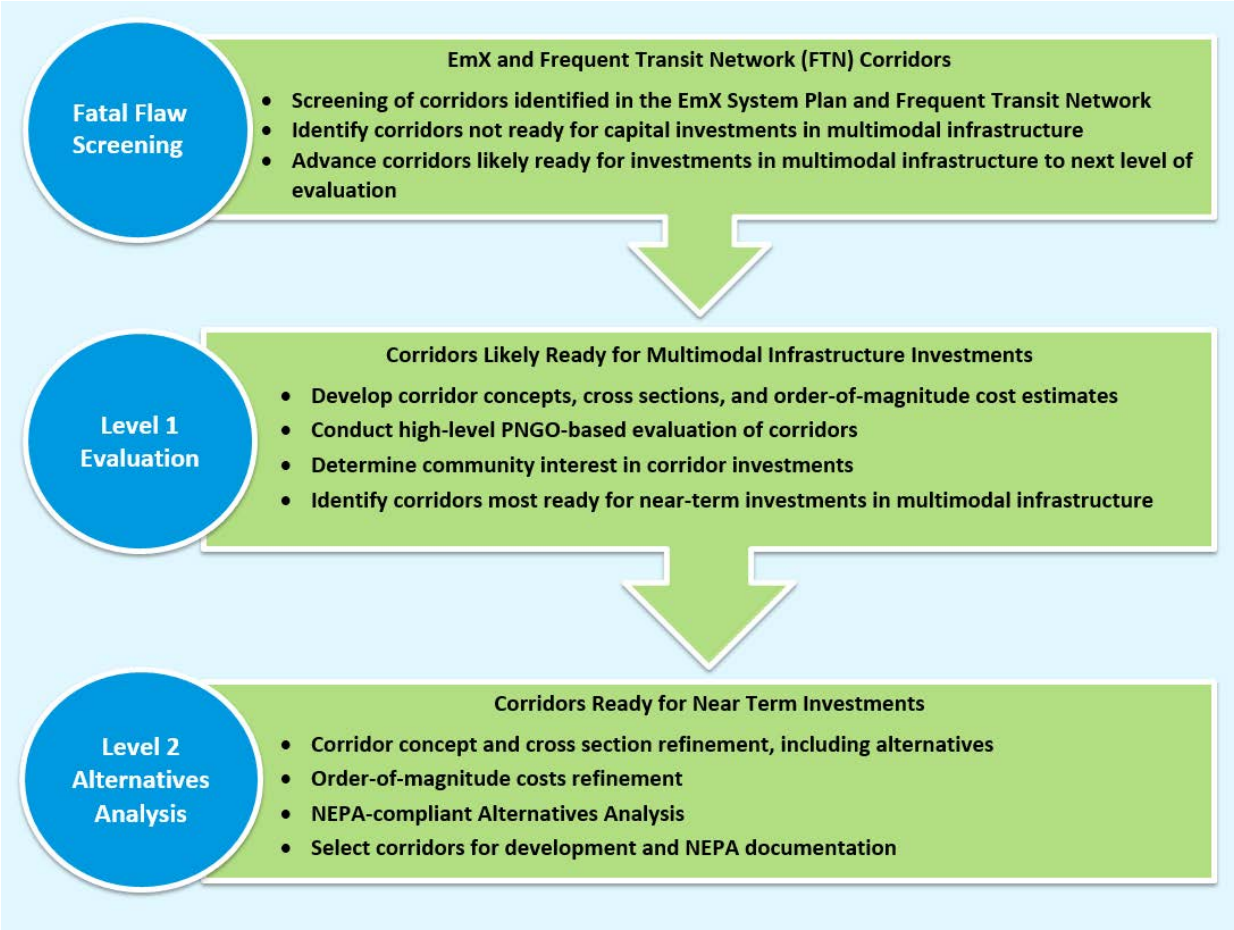
The MovingAhead Project process includes two phases. This first phase has three discrete but closely related tasks: identifying transit improvements; identifying improvements for bicyclists, pedestrians, and users of mobility devices; and preparing a NEPA-compliant evaluation of alternatives focused on the region's transportation system. Corridor options identified as part of the first phase were developed using multimodal cross sections that include variations on automobile, truck, and bus travel lanes; bicycle lanes; landscaping strips; and sidewalks. At the end of the first phase, the City of Eugene and LTD will select the corridors that are most ready for near-term capital improvements and prioritize improvements for funding. The selected corridors will be advanced to the second phase, which will focus on preparing NEPA environmental reviews (Documented Categorical Exclusions), and initiating the Federal Transit Administration (FTA) project development process.

1.5.1. Fatal Flaw Screening

The project team conducted a fatal flaw screening in February 2015 to identify which of the 10 corridors should not move forward to the Level 1 Screening Evaluation (Figure 1.5-1). This high-level evaluation used criteria based on MovingAhead's Purpose, Need, Goals, and Objectives (LTD, 2015, Amended 2015, June) and existing data to determine which corridors were not ready for capital investment in BRT or multimodal infrastructure in the next 10 years. The screening was conducted with local, regional, and state agency staff. Of the 10 corridors identified, the following three corridors were not advanced from

the fatal flaw screening to the Level 1 Screening Evaluation: 18th Avenue, Bob Straub Parkway, and Randy Papé Beltline Highway. Table 1.5-1 shows the results of the fatal flaw screening.

Figure 1.5-1. MovingAhead Phase 1 Steps



Source: Wannamaker Consulting. (2015).

Although originally advanced from the fatal flaw screening, the Main Street-McVay Highway Corridor was also not advanced to the Level 1 Screening Evaluation because the Springfield City Council (on May 18, 2015) and LTD Board (on May 20, 2015) determined that the corridor is ready to advance to a study to select a locally preferred transit solution. At the time (May 2015), the Main Street-McVay Highway Corridor was on a schedule ahead of the MovingAhead Project schedule. If the Main Street-McVay Highway Corridor study schedule is delayed and its progress coincides with this project, the corridor could be reincorporated back into MovingAhead.

Table 1.5-1. Results of the Fatal Flaw Screening

Corridor	Advanced to Level 1	Consider Later
Highway 99	✓	
River Road	✓	
Randy Papé Beltline		✓
18th Avenue		✓
Coburg Road	✓	
Martin Luther King Jr. Boulevard/Centennial Boulevard	✓	
30th Avenue to Lane Community College	✓	
Main Street-McVay Highway	✓	
Valley River Center	✓	
Bob Straub Parkway		✓

Source: LTD and City of Eugene. (2015).

The six remaining multimodal corridors were advanced to the Level 1 Screening Evaluation to determine how they compared with each other in meeting the Purpose, Need, Goals, and Objectives.

1.5.2. Level 1 Screening Evaluation

The Level 1 Screening Evaluation assessed how each corridor would perform according to the Purpose, Need, Goals, and Objectives of MovingAhead. The Level 1 Screening Evaluation used existing studies and readily available data to evaluate each corridor. Based on community input and technical analysis, the following corridors and alternatives were advanced from the Level 1 Screening Evaluation to the Level 2 Alternatives Analysis (AA) (Table 1.5-2):

- No-Build Alternatives: all corridors
- Enhanced Corridor and EmX Alternatives:
  - Highway 99 Corridor
  - River Road Corridor
  - 30th Avenue to Lane Community College (LCC) Corridor
  - Coburg Road Corridor
- Enhanced Corridor Alternative:
  - Martin Luther King Jr. Boulevard Corridor

The Valley River Center Corridor received the least public support during public outreach and was not carried forward to the Level 2 AA.

Table 1.5-2. Corridors and Transit Alternatives Advanced to the Level 2 Alternatives Analysis

Corridor	No Build	Enhanced Corridor	EmX
Highway 99	✓	✓	✓
River Road	✓	✓	✓
30th Avenue to Lane Community College	✓	✓	✓
Coburg Road	✓	✓	✓
Martin Luther King, Jr. Boulevard	✓	✓	

Source: CH2M. (2016).

For a detailed discussion of alternatives and design options considered for each corridor, but not carried forward to the Level 2 AA, please refer to the *Alternatives and Design Options Considered but Eliminated Technical Memorandum (CH2M, 2016).*

1.5.3. Level 2 Alternatives Analysis

To guide the Level 2 AA, LTD prepared new ridership forecasts and related evaluation measures using the LCOG regional model. Base-year and future-year forecasts were prepared for corridor alternatives based upon updated inputs and transit networks specific to each corridor. The planning horizon year used for the Level 2 AA is 2035. The built and natural environments, transit operations, traffic, finance, historical resources, and other areas were also evaluated as part of the Level 2 AA. The findings from the Level 2 AA will aid LTD and the City of Eugene in determining how corridors should be prioritized for capital investments over the next 5 years. Selected corridors will be advanced to Phase 2.

1.6. Purpose and Need

The prioritization of capital investments in multimodal transit corridors is a powerful tool for implementing local and regional comprehensive land use and transportation plans, agency strategic plans, and other community planning documents. Capital investments in multimodal transit corridors can have a substantial impact on patterns of growth and development. By coordinating the timing of, and prioritizing the funding for, strategic multimodal capital investments, the MovingAhead Project (a multimodal transit corridor study) helps ensure that future development is consistent with our region's plans and vision.

The Purpose and Need Statement was refined based on public and agency input.

1.6.1. Purpose

The purpose of the MovingAhead Project is to:

- Develop a Capital Improvements Program that forecasts and matches projected revenues and capital needs over a 10-year period
  - Balance desired multimodal transit corridor improvements with the community's financial resources
  - Ensure the timely and coordinated construction of multimodal transit corridor infrastructure
  - Eliminate unanticipated, poorly planned, or unnecessary capital expenditures

- Identify the most economical means of financing multimodal transit corridor capital improvements
- Establish partnerships between LTD, City of Eugene, and other local agencies that prioritize multimodal transit infrastructure needs and promote interagency cooperation
- Ensure that multimodal transit corridor investments are consistent with local comprehensive land use and transportation plans

1.6.2. Need

The need for the MovingAhead Project is based on the following factors:

- LTD's and the region's commitment to implementing the region's vision for BRT in the next 20 years consistent with the RTP that provides the best level of transit service in a cost-effective and sustainable manner.
- Need for streamlined environmental reviews to leverage systemwide analysis.
- Need to build public support for implementation of the systemwide vision.
- Selection of the next EmX/FTN corridors is based on long-range operational and financial planning for LTD's service.

1.6.3. Goals and Objectives

Goal 1: Improve multimodal transit corridor service

Objective 1.1: Improve transit travel time and reliability
Objective 1.2: Provide convenient transit connections that minimize the need to transfer
Objective 1.3: Increase transit ridership and mode share in the corridor
Objective 1.4: Improve access for people walking and bicycling, and to transit
Objective 1.5: Improve the safety of pedestrians and bicyclists accessing transit, traveling in and along the corridor, and crossing the corridor

Goal 2: Meet current and future transit demand in a cost-effective and sustainable manner

Objective 2.1: Control the increase in transit operating cost to serve the corridor
Objective 2.2: Increase transit capacity to meet current and projected ridership demand
Objective 2.3: Implement corridor improvements that provide an acceptable return on investment
Objective 2.4: Implement corridor improvements that minimize impacts to the environment and, where possible, enhance the environment
Objective 2.5: Leverage funding opportunities to extend the amount of infrastructure to be constructed for the least amount of dollars

Goal 3: Support economic development, revitalization, and land use redevelopment opportunities for the corridor

Objective 3.1: Support development and redevelopment as planned in other adopted documents
Objective 3.2: Coordinate transit improvements with other planned and programmed pedestrian and bicycle projects
Objective 3.3: Coordinate transit improvements with other planned and programmed roadway projects
Objective 3.4: Minimize adverse impacts to existing businesses and industry
Objective 3.5: Support community vision for high capacity transit in each corridor
Objective 3.6: Improve transit operations on state facilities in a manner that is mutually beneficial to vehicular and freight traffic flow around transit stops and throughout the corridor
Objective 3.7: Improve transit operations in a manner that is mutually beneficial to vehicular traffic flow for emergency service vehicles

1.6.4. Evaluation Criteria

Evaluation criteria will be used during the Trade-off Analysis, which is part of the Level 2 AA, to aid in determining how well each of the corridor alternatives would meet the project's Purpose, Need, Goals, and Objectives. The evaluation criteria require a mix of quantitative data and qualitative assessment. The resulting data will be used to measure the effectiveness of each proposed corridor alternative and to assist in comparing and contrasting the alternatives and options. In Table 1.6-1, evaluation criteria are listed for each of the project's objectives. Some objectives have only one criterion for measuring effectiveness, while others require several criteria.

Table 1.6-1. Evaluation Criteria

Goals and Objectives		Evaluation Criteria
Goal 1: Improve multimodal transit corridor service		
Objective 1.1:	Improve transit travel time and reliability	• Round trip p.m. peak transit travel time between select origins and destinations • On-time performance (no more than 4 minutes late) of transit service
Objective 1.2:	Provide convenient transit connections that minimizes the need to transfer	• Number of transfers required between heavily used origin-destination pairs
Objective 1.3:	Increase transit ridership and mode share in the corridor	• Average weekday boardings on corridor routes • Transit mode share along the corridor • Population within 0.5 mile of transit stop • Employment within 0.5 mile of transit stop
Objective 1.4:	Improve access for people walking and bicycling, and to transit	• Connectivity to existing pedestrian facilities • Connectivity to existing bicycle facilities
Objective 1.5:	Improve the safety of pedestrians and bicyclists accessing transit, traveling in and along the corridor, and crossing the corridor	• Opportunity to provide a safe and comfortable environment for pedestrians and bicyclists in the corridor
Goal 2: Meet current and future transit demand in a cost-effective and sustainable manner		
Objective 2.1:	Control the increase in transit operating cost to serve the corridor	• Cost per trip • Impact on LTD operating cost • Cost to local taxpayers
Objective 2.2:	Increase transit capacity to meet current and projected ridership demand	• Capacity of transit service relative to the current and projected ridership
Objective 2.3:	Implement corridor improvements that provide an acceptable return on investment	• Benefit/cost assessment of planned improvements
Objective 2.4:	Implement corridor improvements that minimize impacts to the environment and, where possible, enhance the environment	• Results of screening-level assessment of environmental impacts of transit solutions

Table 1.6-1. Evaluation Criteria

Goals and Objectives		Evaluation Criteria
Objective 2.5:	Leverage funding opportunities to extend the amount of infrastructure to be constructed for the least amount of dollars	• Number and dollar amount of funding opportunities that could be leveraged • Meet the FTA's Small Starts funding requirements
Goal 3:	**Support economic development, revitalization and land use redevelopment opportunities for the corridor**	
Objective 3.1:	Support development and redevelopment as planned in other adopted documents	• Consistent with the BRT System Plan and FTN concept • Consistent with the *Regional Transportation System Plan* (Central Lane Metropolitan Planning Organization [MPO], 2007) • Consistent with local comprehensive land use plans
Objective 3.2:	Coordinate transit improvements with other planned and programmed pedestrian and bicycle projects	• Capability of transit improvement to coordinate with other planned and programmed pedestrian and bicycle projects identified in adopted plans and Capital Improvements Programs
Objective 3.3:	Coordinate transit improvements with other planned and programmed roadway projects	• Capability of transit improvement to coordinate with other planned and programmed roadway projects identified in adopted plans and Capital Improvements Programs
Objective 3.4:	Minimize adverse impacts to existing businesses and industry	• Impacts to businesses along the Corridor measured in number and total acres of properties acquired, parking displacements, and access impacts. • Impact on freight and delivery operations for Corridor businesses
Objective 3.5:	Support community vision for high capacity transit in corridor	• Community vision includes high capacity transit in corridor
Objective 3.6:	Improve transit operations on state facilities in a manner that is mutually beneficial to vehicular and freight traffic flow around transit stops and throughout the corridor	• Impact on current and future year intersection level of service (LOS) on state facilities • Impact on current and future year p.m. peak hour auto/truck travel times on state facilities
Objective 3.7:	Improve transit operations in a manner that is mutually beneficial to vehicular traffic flow for emergency service vehicles	• Qualitative assessment of potential impacts to emergency service vehicle traffic flow and access

Source: LTD and City of Eugene. (2015).

LOS = level of service

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2. Alternatives Considered

This section briefly reviews the major features of the alternatives considered in the Level 2 AA. For full details on each alternative and the five corridors described in this technical report – Highway 99, River Road, 30th Avenue to LCC, Coburg Road, and Martin Luther King, Jr. Boulevard – refer to the *MovingAhead Level 2 Definition of Alternatives* (CH2M et al., 2016). Each corridor location is shown on Figures 2.1-1 and 2.1-2 for the Enhanced Corridor Alternatives and the EmX Alternatives, respectively.

Figure 2.1-1. Enhanced Corridor Alternatives Overview

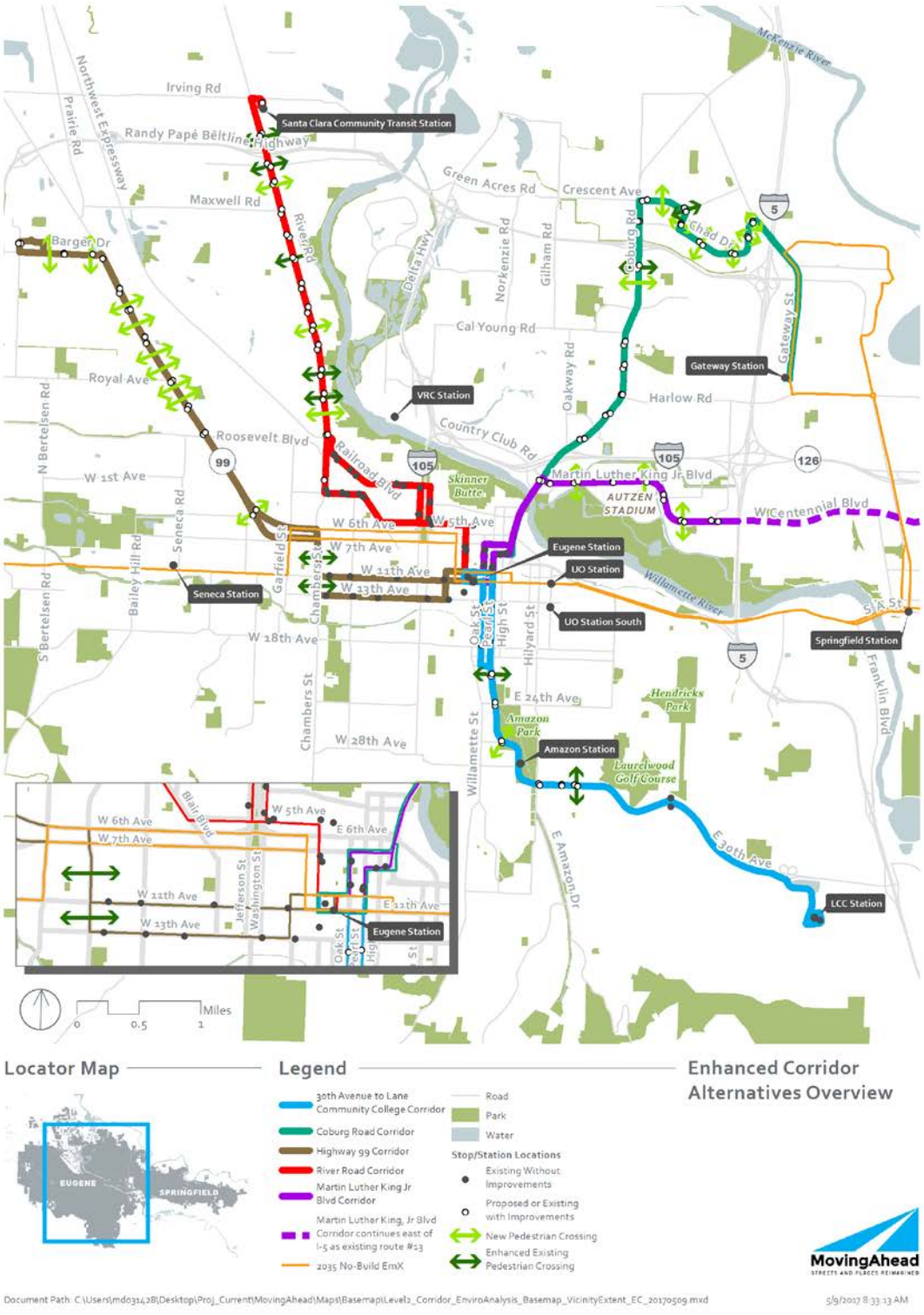
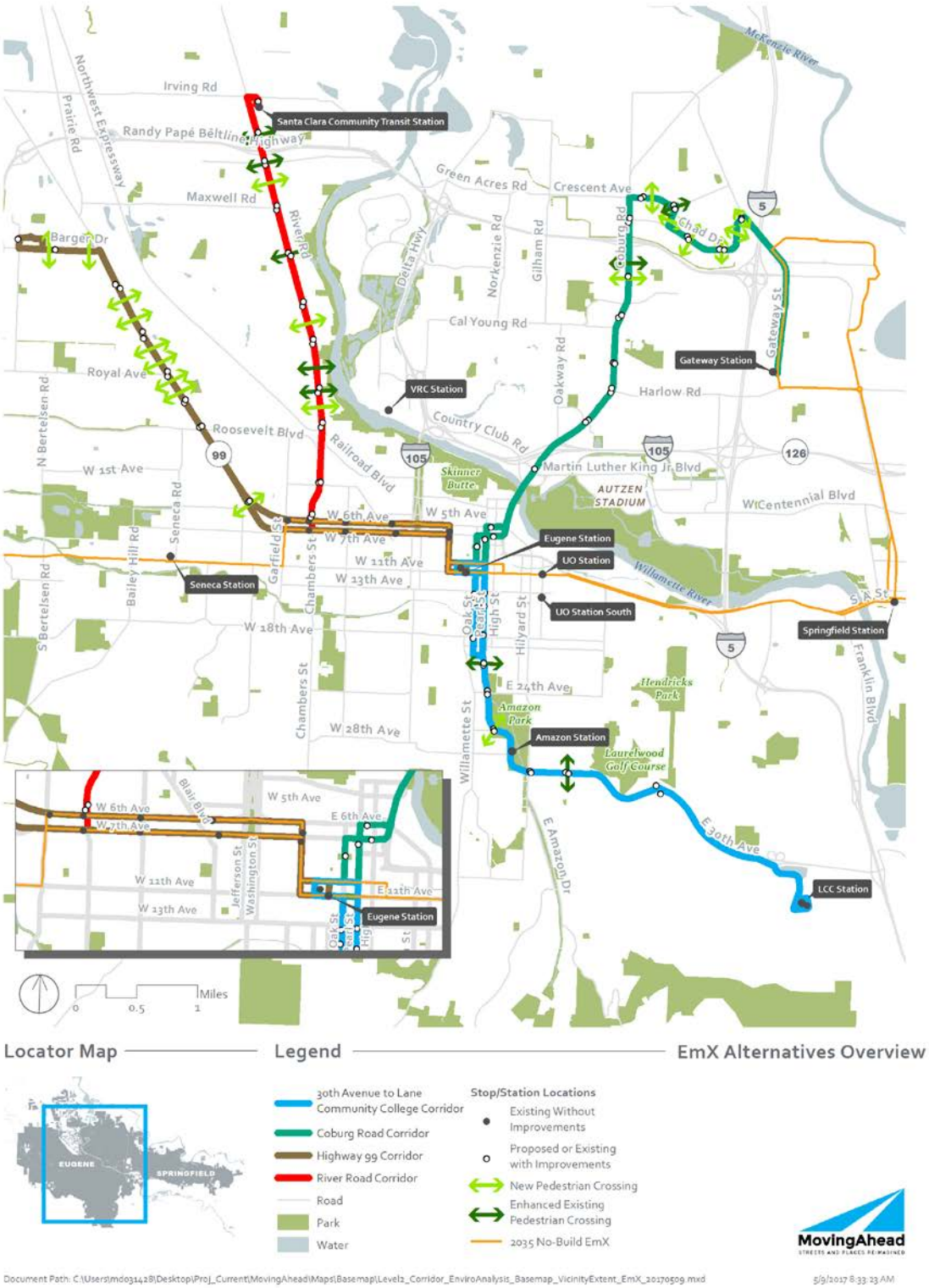


Figure 2.1-2. EmX Alternatives Overview



2.1. No-Build Alternative Transit Network

This section describes the No-Build Alternative transit network, which is based on projected conditions in the year 2035, the project's environmental forecast year. For each corridor, the No-Build Alternative serves as a reference point to gauge the benefits, costs, and effects of the build alternatives.

2.1.1. Capital Improvements

Under the No-Build Alternative, the following capital improvements are anticipated by 2035:

- **West Eugene EmX Extension**. Currently under construction, the West Eugene EmX Extension (WEEE) project and its associated capital improvements will be completed in 2017.
- **Santa Clara Community Transit Center**. The existing River Road Station is located at the southeast corner of the River Road/Randy Papé Beltline Highway interchange between the eastbound on-ramp and River Avenue. To meet growing demand and avoid the impacts of increasing congestion, LTD plans to relocate the River Road Station to a site north of the Randy Papé Beltline Highway at the southeast corner of River Road and Hunsaker Lane. Once relocated to the new site, the River Road Station would be renamed the Santa Clara Community Transit Center. This new transit center is planned to include a mix of uses including a park and ride lot, residential housing, community space, and commercial uses. The River Road Station relocation to the new site is anticipated to be completed by the end of 2018.
- **Main Street EmX Extension**. Included in the RTP and currently under study, the extension of the existing Franklin EmX line on Main Street from Springfield Station to Thurston Station and associated capital improvements (e.g., stations, bicycle and pedestrian facilities, and signal modifications) is anticipated to be completed within the 20-year planning horizon (2035). The No-Build Alternative transit network assumes EmX service on Main Street. However, the outcome of this study, and the ultimate improvements chosen, are uncertain at this time.
- **McVay Highway Enhanced Corridor**. Included in the RTP and currently under study, Enhanced Corridor service from Springfield Station on McVay Highway to LCC and associated capital improvements (e.g., improved stops, transit queue jumps, and improved bicycle and pedestrian crossings) is anticipated to be completed within the 20-year planning horizon (2035).

2.1.2. Transit Operations

The No-Build Alternatives for each corridor include changes to transit service anticipated as a result of the WEEE project, Main Street EmX Extension project, development of the Santa Clara Community Transit Center, and other changes to fixed route service. The following changes to the existing 2016 fixed route services are anticipated by 2035:

- Eliminated routes:
  - Route 11 (replaced by Main Street EmX service)
  - Route 32 (replaced by WEEE service)
  - Route 76 (replaced by WEEE service)
  - Route 85 (replaced by Enhanced Corridor service on the McVay Highway)
  - Route 43 (replaced by WEEE service)
- Other route modifications:
  - Add WEEE service (replaces Route 43 service on W. 11th Avenue) as extension of existing EmX service

  - Add Main Street EmX service from Springfield Station to Thurston Station
  - Add Route 2 with service from Barger Drive/Echo Hollow Road to Eugene Airport
  - Add Route 16 to connect north and south of Main Street with EmX service
  - Add Enhanced Corridor service on McVay Highway from Springfield Station to LCC (replaces Route 85)
  - Reroute Route 33 and extend to Amazon Parkway
  - Reroute Route 36 to extend north of W. 11th Avenue to Barger Drive (replaces Route 43)
  - Reroute Route 41 via Highway 99/Royal Avenue/W. 11th Avenue
  - Reroute Route 40 via Royal Avenue/Elmira Road/Roosevelt Boulevard/Chambers Street/W. 2nd Avenue/Oak and Pearl Streets
  - Add Route 44 paralleling Route 40 above to serve West Eugene
  - Reroute Route 55 to extend to Santa Clara Community Transit Center
  - Reroute Route 93 with service continuing to Eugene Station via Seneca Station and service terminating at the WEEE terminus
- Change in service frequencies:
  - Increase service on Route 24 from 30-minute peak frequencies to 15-minute peak frequencies
  - Increase service on Route 28 from approximately 30-minute peak frequencies (varying 20- to 30-minute intervals) to 15-minute peak frequencies
  - Increase service on Route 41 from 30- and 15-minute peak frequencies to 15-minute peak frequencies
  - Increase service on Route 51 from 60-minute off-peak frequencies to 30-minute off-peak frequencies
  - Increase service on Route 52 from 60-minute off-peak frequencies to 30-minute off-peak frequencies
  - Increase service on Route 66 from 30- and 15-minute weekday a.m. peak, off-peak, and p.m. peak frequencies to 15-minute weekday a.m. peak, off-peak, and p.m. peak frequencies
  - Increase service on Route 67 from approximately 30-minute weekday a.m. peak, off-peak, and p.m. peak frequencies to 15-minute weekday a.m. peak, off-peak, and p.m. peak frequencies
  - Increase service on Route 78 from approximately 60-minute frequencies from 8 a.m. to 6 p.m. to 30-minute weekday a.m. peak, off-peak, and p.m. peak frequencies
  - Increase service on Route 79x from 30-minute peak frequencies to 10-minute peak frequencies, and modify off peak frequencies to 15 minutes from between 10 and 30 minutes currently
  - Decrease a.m. peak service on Route 93 from 60-minute frequencies to 120-minute frequencies during a.m. peak hours, and increase from no service between Veneta and the WEEE terminus to 120-minute frequencies during p.m. peak hours (off-peak service is 120-minute frequencies between Veneta and the WEEE terminus)
  - Decrease a.m. peak service on Route 96 from 30-minute frequencies to 60-minute frequencies, and increase off-peak service from no service between 8:20 a.m. and 3:40 p.m. to 60-minute off-peak frequencies

Key transportation improvements specific to each corridor are described under each corridor's No-Build Alternative.

2.2. Enhanced Corridor Alternatives

Enhanced Corridor Alternatives are intended to address the project's Purpose, Need, Goals, and Objectives without major transit capital investments, instead focusing on lower-cost capital improvements, operational improvements, and transit service refinements. Features could include

transit queue jumps (lanes for buses that allow the bus to "jump" ahead of other traffic at intersections using a separate signal phase), stop consolidation, enhanced shelters, and redesigned service to improve cross-town connectivity. These features improve reliability, reduce transit travel time, and increase passenger comfort.

Enhanced Corridor service would run from 6:45 a.m. to 11:30 p.m. weekdays, 7 a.m. to 11 p.m. Saturdays, and 8 a.m. to 8 p.m. Sundays. Service frequencies are assumed to be 15 minutes during all periods.

2.3. EmX Alternatives

EmX (BRT) Alternatives are characterized by exclusive guideways (business access and transit lanes [BAT] or bus-only lanes); branded, multi-door 60-foot-long BRT vehicles; enhanced stations with level boarding platforms instead of stops; off-board fare collection; signal priority; wider stop spacing; and frequent and redesigned service to improve cross-town connectivity.

EmX service is assumed to run from 6:45 a.m. to 11:30 p.m. weekdays, 7 a.m. to 11 p.m. Saturdays, and 8 a.m. to 8 p.m. Sundays. Service frequencies are assumed to be 10 minutes during all periods.

2.4. Highway 99 Corridor

The Highway 99 Corridor begins at the Eugene Station, travels through downtown, then extends northwest along Highway 99 to Barger Drive, turning west at Barger Drive to terminate on Cubit Street north of the intersection of Barger Drive and Cubit Street east of the Randy Papé Beltline Highway. This corridor is approximately 10.5 round-trip miles.

2.4.1. No-Build Alternative

The Highway 99 Corridor No-Build Alternative includes existing roadway, bicycle, pedestrian, and transit facilities in the corridor, as well as planned improvements in the Draft *Eugene 2035 Transportation System Plan* (City of Eugene, 2016; Draft Eugene 2035 TSP). The No-Build Alternative would not include capital improvements on Highway 99. As part of the Draft Eugene 2035 TSP, the following transportation improvements are planned along or adjacent to the corridor:

- Upgrade Bethel Drive, from Highway 99 to Roosevelt Boulevard, to a two-lane urban facility with sidewalks on both sides of the road, bicycle lanes, and planting strips
- Widen Barger Drive immediately west of the Randy Papé Beltline Highway interchange to include an additional travel lane in each direction
- Add a shared-use path on the west side of Highway 99 from Roosevelt Boulevard south to the intersection of W. 7th Avenue and Garfield Street (the section of this project from Roosevelt to W. 5th Avenue has been completed)
- Add bicycle lanes on Garfield Street from Roosevelt Boulevard south to W. 6th Avenue
- Add a bicycle lane on W. 6th Avenue from Garfield Street to W. 5th Avenue
- Complete the sidewalk network on Highway 99 from Roosevelt Boulevard south to Garfield Street
- Add a shared-use path on Roosevelt Boulevard from Maple Street to Highway 99
- Add a bicycle lane on Roosevelt Boulevard from Highway 99 east to railroad tracks

Under the No-Build Alternative, Highway 99 Corridor service would remain at 15-minute headways during peak periods and 30-minute headways during off-peak periods and evenings. Under the No-Build

Alternative, a slight change is also made to Route 93, which would stop at the Pearl Buck Center in the absence of Route 44.

2.4.2. Enhanced Corridor Alternative

Capital improvements under the Highway 99 Corridor Enhanced Corridor Alternative would include enhanced bicycle and pedestrian crossings; improvements to existing bus stops and the construction of new stops; construction of queue jumps at some intersections; traffic signal reconstruction; construction of bus-only left turn lanes; and roadway widening at some locations in the corridor.

Existing conventional fixed-service routes would remain the same as with the No-Build Alternative, with the exception of the elimination of Route 41. Service west of WinCo would also remain the same or be improved.

2.4.3. EmX Alternative

The Highway 99 Corridor EmX Alternative would include creating BAT lanes on segments of W. 7th Avenue and Highway 99; reconstructing the Highway 99/Roosevelt Boulevard intersection (traffic signal, turn lanes, and queue jump); completing other intersection modifications in the corridor; roadway widening at some locations; and constructing nine new enhanced pedestrian and bicycle crossings, new sidewalks, and a pedestrian bridge across the railroad line from Highway 99 to the Trainsong neighborhood. Four existing bus stop locations would be improved to EmX stations, in addition to constructing new stations. Some existing EmX stations would be used for the Highway 99 Corridor EmX service.

Route 44 is a conventional service line added to this alternative only, providing coverage on 11th and 13th Avenues as well as service to the Pearl Buck Center on W. 1st Avenue, with 30-minute headways during all periods. This would be a decrease in service for the 11th and 13th Avenue corridors that currently have 15-minute peak service. Route 44 is primarily intended to replace conventional service lost with the removal of the existing Route 41. Route 41 would be replaced with the Highway 99 Corridor EmX service described in this alternative.

2.5. River Road Corridor

The River Road Corridor begins at the Eugene Transit Center, travels through downtown and then north to the Santa Clara Community Transit Center (intersection of Hunsaker Lane and River Road). This corridor is approximately 10.3 round-trip miles.

2.5.1. No-Build Alternative

The River Road Corridor No-Build Alternative would include existing roadway, bicycle, pedestrian, and transit facilities in the corridor, as well as planned improvements in the Draft Eugene 2035 TSP. There would be no additional major bus capital improvements under the No-Build Alternative.

As part of the Draft Eugene 2035 TSP, the following transportation improvements are planned adjacent to and along the River Road Corridor:

- Upgrade the Hunsaker Lane/Beaver Street intersection to urban collector standards, including two travel lanes, a center turn lane, bicycle lanes, sidewalks on both sides of the road, and planting strips from River Road to Division Avenue
- Provide bicycle boulevards on Ruby Avenue, Horn Lane, Arbor Drive, and Park Avenue

- Include sidewalks on Hunsaker Lane, Howard Avenue, and Hilliard Lane
- Provide protected bicycle lanes on River Road from the Northwest Expressway to Division Avenue

Under the No-Build Alternative, River Road Corridor service would remain at 30-minute headways for both Routes 51 and 52 (which together effectively provide 15-minute service during peak periods) and off-peak periods. After 6:15 p.m., there is no longer a combined 15-minute frequency, and headways return to 30 minutes.

2.5.2. Enhanced Corridor Alternative

Capital improvements constructed as part of the River Road Corridor Enhanced Corridor Alternative would include BAT lanes on River Road approaching the Randy Papé Beltline Highway and other roadway improvements, like traffic signal reconstruction at certain locations along the corridor. Improvements to existing bus stops and the construction of new stops would also occur.

Routes 51 and 52 would be eliminated, and Enhanced Corridor service for River Road includes a split alignment in order to serve portions covered by those routes at 30-minute headways. In this arrangement, the area from Railroad Boulevard to W. 1st Avenue is served by one Enhanced Corridor service as a replacement for the Route 51 service, while the area along Blair Boulevard and W. 2nd Avenue is served by the other alignment to replace service lost with removal of Route 52. Those alignments meet at Railroad Boulevard and River Road to serve the River Road Corridor with consistent 15-minute headways.

2.5.3. EmX Alternative

New construction under the River Road Corridor EmX Alternative would include lane repurposing on River Road for BAT lanes, constructing short sections of exclusive bus lanes near the Randy Papé Beltline Highway, reconstructing traffic signals and intersections at several locations, constructing new bicycle and pedestrian crossings, improving existing stops to EmX stations, and constructing new stations. Some existing EmX stations would be used with the River Road EmX service.

Transit service changes would also include modifying headways on Route 40 during the a.m. and p.m. peak hours to 15 minutes, developing a new Route 50 "River Road Connector" with 30-minute headways all day, and eliminating Routes 51, 52, and 55. These replacements ensure no loss in existing coverage or service.

2.6. 30th Avenue to Lane Community College Corridor

The 30th Avenue to LCC Corridor begins at Eugene Station and travels south along Pearl Street (outbound) to Amazon Parkway, then on E. 30th Avenue to its terminus at the LCC Station. The return trip travels on Oak Street (inbound), which is the northbound couplet to Pearl Street. This corridor is approximately 10.2 round-trip miles.

2.6.1. No-Build Alternative

The 30th Avenue to LCC Corridor No-Build Alternative would include existing roadway, bicycle, pedestrian, and transit facilities in the corridor, as well as planned improvements in the Draft Eugene 2035 TSP. There would be no additional major bus capital improvements to the 30th Avenue to LCC Corridor under the No-Build Alternative.

The Draft Eugene 2035 TSP identifies the following transportation improvements along or adjacent to the corridor:

- Bicycle boulevard on Alder Drive

For the portion of E. 30th Avenue in unincorporated Lane County, Lane County does not plan to improve bicycle facilities along the road.

Under the No-Build Alternative, 30th Avenue to LCC Corridor service would remain at 30-minute headways on Route 81. The Route 82 service would remain at 10-minute headways during the a.m. peak, 15-minute headways during off-peak periods, and 20-minute headways during the p.m. peak, with no weekend service.

2.6.2. Enhanced Corridor Alternative

Capital improvements as part of the 30th Avenue to LCC Corridor Enhanced Corridor Alternative would include the construction of new bus stops, capital improvements to some existing bus stops, a new traffic signal on Amazon Parkway at E. 20th Avenue, and new bike facilities on Oak and Pearl Streets.

Under the 30th Avenue to LCC Corridor Enhanced Corridor Alternative, service to LCC provided by Routes 81 and 82 would be eliminated and replaced by Enhanced Corridor service. The direct connection between LCC and the University of Oregon Station along Route 81 would be eliminated. It would be replaced by connecting the 30th Avenue to LCC Corridor Enhanced Corridor Alternative to the Franklin EmX line with a transfer at Eugene Station.

2.6.3. EmX Alternative

The 30th Avenue to LCC Corridor EmX Alternative would include repurposing parking and general-purpose lanes to BAT lanes on Oak and Pearl Streets, constructing queue jumps, extending E. 20th Avenue, adding a new traffic signal on Amazon Parkway, and adding a new cycle track on High Street. In addition to constructing new EmX stations, existing bus stops would be improved to EmX stations in certain locations.

Service to LCC provided by Routes 81 and 82 would be replaced with EmX service. The direct connection between LCC and the University of Oregon Station along Route 81 would be eliminated. It would be replaced by connecting the 30th Avenue to LCC Corridor EmX Alternative to the Franklin EmX line with a transfer at Eugene Station.

2.7. Coburg Road Corridor

The Coburg Road Corridor begins at Eugene Station and continues to Coburg Road using the Ferry Street Bridge. The corridor continues north on Coburg Road to Crescent Avenue, east on Crescent Avenue and Chad Drive to N. Game Farm Road, and south on N. Game Farm Road and Gateway Street to the existing Gateway Station at the Gateway Mall. Although service extends from N. Game Farm Road to the Gateway Station, capital improvements for the corridor terminate at Interstate 5 (I-5). This corridor is approximately 11.2 round-trip miles.

2.7.1. No-Build Alternative

The Coburg Road Corridor No-Build Alternative includes existing roadway, bicycle, pedestrian, and transit facilities in the corridor, as well as planned improvements in the Draft Eugene 2035 TSP. There

would be no additional major transportation improvements to the Coburg Road Corridor under the No-Build Alternative.

Under the No-Build Alternative, the Coburg Road Corridor service would remain at 15-minute headways on Routes 66 and 67 at all weekday times, 30-minute headways on Saturdays, and 60-minute headways on Sundays.

2.7.2. Enhanced Corridor Alternative

The Coburg Road Corridor Enhanced Corridor Alternative would include new traffic signal construction, intersection reconstruction at several locations on Coburg Road, the addition of queue jumps, and the addition of BAT lanes south of the Interstate 105 (I-105) interchange. New crossings for bicyclists and pedestrians would be constructed. Existing bus stops would be improved and new stops would also be constructed.

Route 12 would be altered to serve Valley River Center and Marcola Road. A new route (Route 60) would be added to serve Valley River Center, and Routes 66 and 67 would be eliminated. This change would provide new service and coverage to the Cal Young neighborhood and along Hayden Bridge Way in Springfield. It would require current passengers along Harlow Road to transfer in order to get downtown.

2.7.3. EmX Alternative

Improvements to the corridor under the Coburg Road Corridor EmX Alternative would include construction of exclusive transit lanes at several locations on Coburg Road and intersection reconstruction at multiple locations. New bicycle and pedestrian crossings and EmX stations would be constructed, and some existing bus stops would be improved to EmX stations.

As in the Coburg Road Corridor Enhanced Corridor Alternative, Route 12 would be altered to serve Valley River Center and Marcola Road, and Route 60 would be added to serve Valley River Center, while Routes 66 and 67 would be eliminated. This change would provide new service and coverage to the Cal Young neighborhood and along Hayden Bridge Way in Springfield. It would require current passengers along Harlow Road to transfer in order to get downtown.

2.8. Martin Luther King, Jr. Boulevard Corridor

The Martin Luther King, Jr. Boulevard Corridor begins at Eugene Station and travels through downtown Eugene on Oak and Pearl Streets and on 7th and 8th Avenues. The corridor uses the Ferry Street Bridge to reach Martin Luther King, Jr. Boulevard and continues east on Martin Luther King, Jr. Boulevard past Autzen Stadium to Centennial Boulevard. Although transit service continues along Centennial Boulevard, capital improvements for the corridor terminate at I-5. The corridor is approximately 6.0 round-trip miles.

2.8.1. No-Build Alternative

The Martin Luther King, Jr. Boulevard Corridor No-Build Alternative includes existing roadway, bicycle, pedestrian, and transit facilities in the corridor, as well as planned improvements in the Draft Eugene 2035 TSP. The Draft Eugene 2035 TSP identifies the following transportation improvements along or adjacent to the Martin Luther King, Jr. Corridor:

- Add a center turn lane along sections of Martin Luther King, Jr. Boulevard from Club Road to Leo Harris Parkway

Under the No-Build Alternative, the Martin Luther King, Jr. Boulevard Corridor service would remain at 30-minute headways.

2.8.2. Enhanced Corridor Alternative

Capital improvements associated with the Martin Luther King, Jr. Boulevard Corridor Enhanced Corridor Alternative would include reconstructing traffic signals at the intersections of Coburg Road and Martin Luther King, Jr. Boulevard and of Martin Luther King, Jr. Boulevard and Centennial Loop; repurposing existing outside general-purpose lanes to BAT lanes on Martin Luther King, Jr. Boulevard; adding a new traffic signal at the intersection of Martin Luther King, Jr. Boulevard and Leo Harris Parkway; enhancing pedestrian crossings; constructing new bus stops; and improving existing bus stops. Existing Route 13 would be eliminated.

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3. Methods and Data

This section of the report describes the noise and vibration-related methods and data the project team used for the Moving Ahead Project's Level 1 Screening Evaluation and Level 2 AA. The noise and vibration-related methods and data and analysis are closely tied to the transportation methods and data and analysis that were also prepared for the project, which are documented in a separate report, titled *Transportation Analysis Methodology Report* (DKS et al., 2016) and *Transportation Impact Analysis Technical Report* (DKS and CH2M, 2017).

3.1. Study Area

The API for each build alternative is from 50 to 500 feet from each affected roadway that is part of the project corridor under that alternative, with the actual distance depending on the type of noise source and topographical conditions, and the shielding between the source and receiver. For vibration, the API is no more than 20 feet from the source, with the type of vibration source and substrate conditions between the source and receiver affecting the API distance for each build alternative.

3.2. Noise and Vibration

The purpose of this Noise and Vibration Technical Analysis is to compare the project related noise and vibration for each of the alternatives using the FTA Manual (FTA, 2006). The report includes a discussion of the following elements:

- Regulations and policy governing evaluation of impacts and mitigation
- Existing noise and vibration conditions in areas potentially affected by the alternatives
- Methodology used in the analysis
- Impacts of the alternatives (short-term, long-term, cumulative, and indirect)
- Potential mitigation measures

3.2.1. Relevant Laws and Regulations

This section summarizes the federal, state, and local environmental laws and regulations related to noise and vibration.

3.2.1.1. Federal

- **Background on FTA and** Federal Highway Administration **(FHWA) Guidance and Regulations**. The U.S. Department of Transportation's (USDOT's) guidance and regulations related to noise and vibration impact analyses for transit projects include the FTA Manual (FTA, 2006) and the FHWA Procedures for Abatement of Highway Traffic Noise and Construction Noise (USDOT, 2011). With regard to noise, the FTA guidance states that if sufficient evidence shows that highway noise dominates, the methods of FHWA, including the latest authorized version of the FHWA Traffic Noise Model, should be used for the analysis. FHWA recently clarified the type of noise analysis needed for transit-only projects along federal aid highways and roadways. Specifically, FHWA stated that transit-only projects meeting the three criteria below should use the FTA guidance manual procedures to assess noise associated with the transit project and any highway elements directly affected by the transit project:

1. FTA is the lead agency in the NEPA process. FHWA's limited participation is as a cooperating agency.
2. The main transportation purpose of the project, as stated in the purpose and need statement of the NEPA document, is transit-related and not highway-related.
3. No federal-aid highway funds are being used to fund the project.

Because all three of the FHWA transit-only project criteria listed above are met by this project, FTA methods are used to assess project related noise impacts. These methods may incorporate FHWA prediction and impact assessment procedures for dedicated BRT type improvements that include the construction of new roadway lanes (including bus lanes) or significantly alter the horizontal or vertical alignment of existing roadways, including the conversion of parking lanes to through traffic lanes. The analysis for roadway and highway improvements would meet the requirements for an FHWA traffic study under Oregon Department of Transportation (ODOT) impact criteria.

Improvements that involve bus priority systems and bus systems that use existing roadways will rely on FTA methods for determining noise levels. In all cases, the sources of potential impacts to be evaluated include not only bus operations, but also park and rides, maintenance bases and other project related ancillary facilities. Regardless of the noise source or evaluation methods used, the FTA criteria are used to evaluate mitigation for all project noise (and vibration) impacts. In addition, according to the FTA Manual (FTA, 2006), project construction, park and rides, maintenance bases and other project-related ancillary facilities must also comply with the appropriate state, county, or city noise control ordinance.

- **FTA Criteria**. Noise impacts for the proposed project under the FTA Manual (FTA, 2006) are determined based on the criteria defined in the manual. The FTA noise impact criteria are based on well-documented research on community reaction to noise and on change in noise exposure rated using a sliding scale. Although more transit noise is allowed in neighborhoods with high levels of existing noise, as existing noise levels increase, smaller increases in total noise exposure are allowed than in areas with lower existing noise levels. The FTA noise impact criteria group noise-sensitive land uses into the following three categories:

  1. **Category 1:** Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, land uses such as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use. Also included in this category are recording studios and concert halls.
  2. **Category 2:** Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
  3. **Category 3:** Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches where it is important to avoid interference with activities such as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds, and recreational facilities are also considered to be in this category. Certain historical sites and parks are also included, but their sensitivity to noise must be related to their defining characteristics; generally, parks with active recreational facilities are not considered noise sensitive.

Day-night Sound Level (Ldn) is used to characterize noise exposure for residential areas (Category 2). For other noise-sensitive land uses, such as outdoor amphitheaters and school buildings (Categories 1 and 3), the maximum 1-hour equivalent sound level (Leq) during the facility's operating period is used.

The two levels of impact included in the FTA criteria (severe and moderate) are as follows:

1. **Severe Impact:** Project-generated noise in the severe impact range can be expected to cause a large percentage of people to be highly annoyed by the new noise and represents the most compelling need for mitigation. Noise mitigation will normally be specified for severe impact areas unless there are truly extenuating circumstances that prevent mitigation.
2. **Moderate Impact:** In this range of noise impact, the change in the cumulative noise level is noticeable to most people but may not be sufficient to cause strong, adverse reactions from the community. In this transitional area, other project-specific factors must be considered to determine the magnitude of the impact and the need for mitigation. These factors include the existing level, the projected level of increase over existing noise levels, the types and numbers of noise-sensitive land uses affected, the noise-sensitivity of the properties, the effectiveness of the mitigation measures, community views, and the cost of mitigating noise to more acceptable levels.

   The FTA noise impact criteria are summarized in graphical form in Figure 3.1-1, which shows the existing noise exposure and the allowable noise exposure from the transit project that would cause either moderate or severe impact. The future noise exposure would be the combination of the existing noise exposure and the additional noise exposure caused by the transit project. Figure 3.1-2 expresses the same criteria in terms of the increase in total or cumulative noise that can occur in the overall noise environment before an impact occurs.

   The FTA guidance manual provides details on how parks are analyzed for noise in Chapter 3, Section 2, Application of Noise Impact Criteria, of the manual. FTA assumes that parks are a special case, and how they are used and where they are located should be considered when considering whether or not a particular park, or an area in a park, is considered noise-sensitive. Parks that are used for outdoor recreation are typically not considered noise-sensitive. This includes parks with baseball diamonds, soccer fields, basketball courts, football fields, and other active recreation areas.

   Noise-sensitive parks are defined as those where quiet is an essential element in their intended purpose, or places where it is important to avoid interference with activities such as speech, meditation, and reading. The existing noise levels at a park can indicate the sensitivity of its use. All parks along each project corridor were evaluated for consideration under the FTA criteria, and based on the park locations and existing noise levels, none met the requirements for noise-sensitivity under the FTA Category 3 criteria.

- **FHWA Criteria:** The criteria for traffic noise impacts are taken from the FHWA Procedures for Abatement of Highway Traffic Noise and Construction Noise, *Code of Federal Regulations* (CFR) Title 23, Subchapter H, Section 772 (USDOT, 2010). A traffic noise impact occurs if predicted traffic noise levels approach the criteria levels for specific land use categories or substantially exceed existing noise levels (e.g., a 10-dB increase). These levels are defined as noise abatement criteria (NAC), and are based on hourly Leq levels for the peak hour of traffic noise. The FHWA criterion applicable for residences is an exterior hourly Leq that approaches or exceeds 67 dBA. The exterior criterion for places of worship, schools, recreational uses, and similar areas is also 67 dBA Leq. The criterion applicable for hotels, motels, offices, restaurants/bars, and other developed lands is an exterior Leq that approaches or exceeds 72 dBA. There are no FHWA noise impact criteria for retail facilities, industrial and warehousing uses, undeveloped lands that are not permitted, or construction noise. No analysis of traffic noise impacts is required for those uses for which no criteria exist.

Figure 3.1-1. FTA Project Noise Impact Criteria

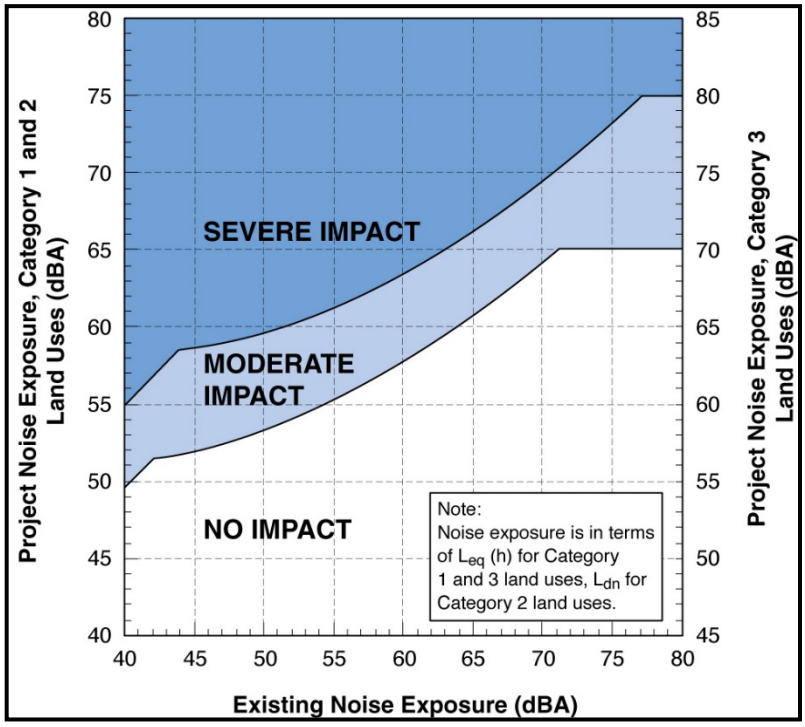
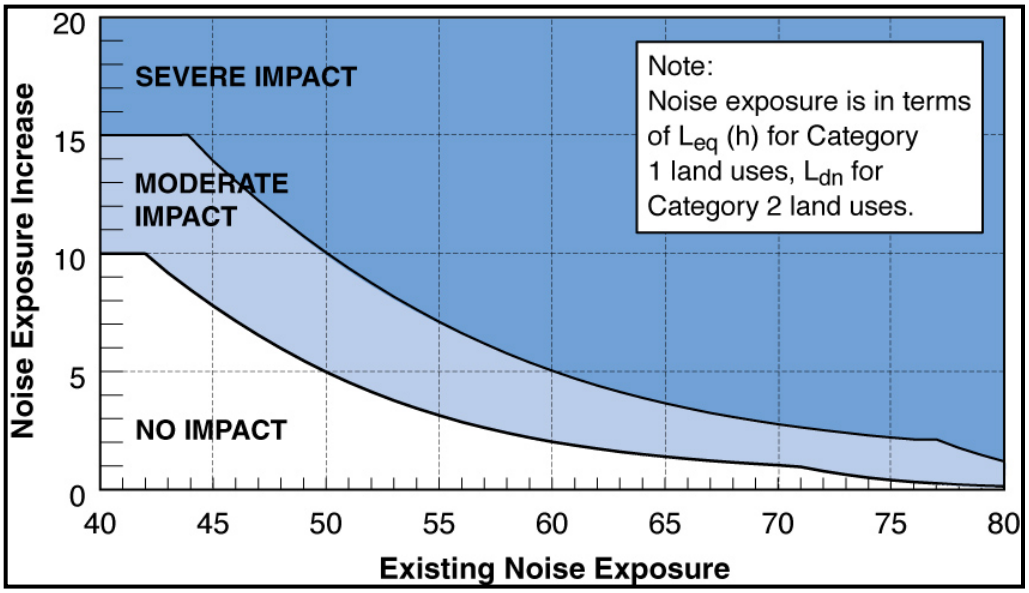


Figure 3.1-2. Increase in Cumulative Noise Exposure Allowed by FTA Criteria



The criteria for noise impact assessments for traffic on public roadways are found in the ODOT Noise Manual (2011). Under ODOT regulations, a traffic noise impact occurs if predicted noise levels are within 2 dB of the NAC level identified in Table 3.1-1. As a result, in Oregon, residential impacts (category B property) begin to occur at 65 dBA. Impacts at places of worship, schools and recreational areas (category C properties) also begin to occur at 65 dBA in Oregon. Hotel/motel, office building, and restaurant/bar impacts (category E property) begin to occur at 70 dBA. In addition, ODOT considers a 10 dB increase over the existing noise levels a substantial increase, and therefore an impact. Table 3.1-1 summarizes the FHWA NAC and the ODOT traffic noise approach abatement criteria. Whenever FHWA prediction and impact assessment procedures are used for the AA, they incorporate the criteria set forth in the ODOT Noise Manual (2011).

Table 3.1-1. Roadway Noise Abatement Criteria and Land Use Categories

	Activity Criteria in hourly Leq (dBA)			
Activity Category	**FHWA NAC**	**ODOT NAAC**	**Evaluation Location**	**Activity Description**
A	57	55	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[a]	67	65	Exterior	Residential
C[a]	67	65	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings
D	52	50	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E[a]	72	70	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	--	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	--	--	--	Undeveloped lands that are not permitted

Source: Procedures for Abatement of Highway Traffic Noise and Construction Noise (USDOT, 2010) and ODOT Noise Manual (ODOT, 2011).

[a] Includes undeveloped lands permitted for this activity category

3.2.1.2. State

The State of Oregon Department of Environmental Quality (ODEQ) has noise regulations that are primarily applicable to noise produced by residential, commercial and industrial properties. These regulations limit the amount of noise that is allowable at other nearby properties. However, for areas with a local noise control ordinance, like Lane County and the Cities of Eugene and Springfield, the local noise ordinance would be the applicable ordinance for any noise impact analysis. Therefore, the ODEQ noise regulations are not used for this analysis.

3.2.1.3. Local

- **Lane County Noise Ordinance.** The Lane County Noise Control Ordinance is found in Chapter 5, Section 5.600 of the Lane County Code. The Lane County Code provides specific property boundary maximum allowable noise levels and would be applicable to noise related to maintenance bases, park and rides, and other fixed project-related ancillary facilities. Under the Lane Code, noise levels are restricted to 60 dBA between the hours of 7:00 am and 10:00 pm, and 50 dBA between the hours of 10:00 pm and 7:00 am. Sounds caused by construction organizations or workers during their normal operations are exempt from these provisions.
- **City of Eugene Noise Ordinance.** The City of Eugene Municipal Code has a Noise Disturbance section that is found in the City Code Sections 6.750. The City of Eugene's Noise Code restricts commercial and industrial noise to 60 dBA at the property line of any nearby residential land use (city zone R-1, R-2, R-3 or R-4). Further, the code restricts general construction noise to the hours of 7:00 am to 7:00 pm; therefore, a noise variance would be required for construction between the hours of 7:00 pm and 7:00 am the following day.
- **City of Springfield Noise Ordinance.** The City of Springfield noise ordinance is also mainly for disturbances. However, the Springfield Noise Control Ordinance, found in the Springfield Municipal Code, Section 5.220, also limits construction noise and activities between the hours of 6:00 pm and 7:00 am without a variance from the from the Springfield City Council.

3.2.2. Analysis Area

The analysis areas for noise and vibration studies typically include all nearby lands that could meet, or exceed the noise or vibration criteria. For bus transit systems, this is typically between 50 and 500 feet from the project noise source, depending on the type, volume, and speed of the noise source and topographical conditions and shielding between the source and receiver. For noise studies, all project-related noise impacts must ultimately be identified; therefore, the analysis area for the Level 2 AA was chosen so that all potential noise impacts are identified.

Because the modes of transportation for all alternatives are rubber-tired vehicles, there is a potential for project vibration impacts only if a proposed travel lane results in a bus within 10 to 15 feet of a vibration-sensitive structure. Based on this, and in order to maintain a conservative analysis, the vibration analysis was performed by identifying all vibration-sensitive structures within 20 feet of the travel lanes.

3.2.3. Contacts and Coordination

Project staff used previous planning efforts as guiding documents to help scale the level of analysis. Information sources included the following:

3.2.3.1. Federal

- FTA
- FHWA

3.2.3.2. State

- ODOT
- ODEQ

3.2.3.3. Local

- Lane County Noise Control Ordinance
- City of Eugene Municipal Code
- City of Springfield Municipal Code

3.2.4. Level 2 Alternatives Analysis

3.2.4.1. FTA Methods

The Level 2 AA of potential noise and vibration impacts is based on the current guidance contained in the FTA Manual. Based on FTA's guidance and a review of the design specifics of the proposed alternatives, the study team conducted a Screening Assessment, as defined in Chapter 4 of the FTA Manual (FTA, 2006), to determine these potential impacts. In addition, a qualitative review of the proposed corridors was performed to determine if any project elements may require incorporation of FHWA prediction and impact assessment procedures. The results of that review can be used to guide future impact analyses, but they are not included in this Level 2 AA.

The noise impact analysis area for this Level 2 AA consisted of an area between 50 and 500 feet from either side of the proposed alignment alternatives and facilities. The analysis area is based on the requirements from the FTA and is summarized in Table 3.1-2. The distances from the noise source to the receiver are provided for areas with direct (unobstructed) lines of sight to the noise source and for areas with intervening buildings or other physical shielding that would reduce the transmission of noise.

For areas where potential noise or vibration impacts exist, later analyses will identify the exact number and location of those impacts, and FTA criteria contained in the FTA Manual (FTA, 2006) will be used to evaluate mitigation for all of those impacts.

3.2.4.2. FHWA Methods

While the project's potential noise impacts were determined based on the guidance and criteria contained in the FTA Manual (2006, May), a qualitative review of the proposed corridors was performed to determine if any project elements, such as roadway widening or the conversion of parking lanes to through traffic lanes, will require incorporation of FHWA prediction and impact assessment procedures. Wherever FHWA prediction and impact assessment procedures are found to be applicable, the procedures and criteria contained in the Noise Manual (ODOT, 2011) will be taken into consideration to determine the project noise impacts.

Unlike the FTA guidance, there is no typical distance for traffic noise impacts given by the FHWA. However, because the corridors are current and well established transportation corridors, with speed limits of 45 mph or lower, the potential for traffic noise impacts is likely limited to residences within 500 feet of the centerline of the roadway.

Table 3.1-2. Screening Distances for Bus Related Transit Projects

System and Subsystem		Screening Distance in Feet[a]	
		Unobstructed	Intervening Building
General Roadway Traffic[b]		500[b]	350[b]
Busway		500	250
BRT on exclusive roadway		200	100
Bus Facilities	Access Roads	100	50
	Transit Mall	225	150
	Transit Center	225	150
	Storage & Maintenance	350	225
	Park & Ride Lots w/Buses	225	150

Source: FTA Manual (FTA, 2006) and modeling and measured data from previous project in the greater Springfield-Eugene area

[a] Distance measured from the centerline of roadway or from the center of noise generating activity for stationary sources

[b] Distance for traffic noise impacts is based on noise measurements and noise modeling in the greater Springfield and Eugene areas and other similar areas

This is based on several noise measurements taken in, and noise modeling performed for, the greater Springfield and Eugene areas, in addition to noise monitoring and modeling in other similar areas. Regardless of the method used to predict impacts, the FTA criteria are used to evaluate mitigation for all noise impacts.

3.2.4.3. Data Collection

The following data and information were obtained and used in the analysis.

- Average annual regional traffic volumes taken from the *MovingAhead Transportation Technical Report* (CH2M and DKS 2017)
- Project alignment files from the project design team
- Aerial corridor photos and property information taken from Google Earth
- PARLAY 2.0 National Parcel Data Layer for Google Earth

3.2.4.4. Impact Analysis

Methods for determining potential noise and vibration impacts from project sources are described in this section.

Long-Term Impacts Analysis Approach

The project's noise and vibration impacts were assessed through a Screening Assessment, as defined in Chapter 4 of the FTA Manual (FTA, 2006). That assessment takes account of the FTA noise impact criteria, the type of project, and noise- or vibration-sensitive land uses. The Screening Assessment consisted of the following steps:

- First, the screening distance was determined from Table 3.1-2 based on the operational features of the project. The screening distance was varied appropriately by area depending on whether receivers were unobstructed or shielded by intervening buildings. In addition, the appropriate screening distance determination took into account the FTA vehicle volume and speed assumptions used in determining the distances contained in Table 3.1-2. Where necessary, screening distances were varied. For example, where project roadway speed limits are greater than the FTA assumptions, screening distances were increased. For the impact assessment, if project features necessitate the incorporation of FHWA prediction and impact assessment procedures, the screening distance will be adjusted to ensure the maximum number of impacts will be predicted.
- Second, all of the noise-sensitive land uses described in Section 3.1.1.1 were located within the applicable screening distance, which in each case was applied from the nearest right of way line on both sides of the roadway. Single- and multi-family properties were differentiated and noted, but no effort was made to determine the exact number of multi-family units in any given building.
- For maintenance bases, park and rides, and other fixed project-related ancillary facilities, potential impacts were tallied using the same screening distances, as measured from the various facility noise and vibration sources. The number of potential impacts for such facilities was assumed to be the same under the FTA and local noise ordinance criteria.
- Last, the total number of single- and multi-family properties, as well as all other noise and vibration sensitive properties, such as schools, hotels and churches, were tallied to determine the potential noise and vibration impacts from project sources.

Short-Term Impacts Approach

During construction, noise and vibration levels in the project corridor may increase due to vehicles and equipment used for normal construction activities. These activities include site clearing, excavation, grading, and pile driving, and they occasionally create temporary impacts on nearby properties. Rather than try to predict the nature, location and extent of such impacts, this AA identifies the times during which construction activities are permitted without regard to potential impacts and, as described below, the measures that generally might be taken to nevertheless mitigate any potential inconvenience associated with construction of the project.

Cumulative and Indirect Impact Analysis Approach

Regional traffic data were generated and used in this analysis, accounting for expected regional land use and growth. As a result, this noise and vibration assessment has incorporated any expected cumulative and indirect traffic increases.

3.2.4.5. Mitigation Measures Approach

Noise and vibration impacts were identified, and mitigation measures for all noise vibration impacts were considered. General mitigation measures were evaluated qualitatively and recommended based on their likely efficacy, taking into account the FTA criteria. Noise and vibration as related to project construction was also reviewed, and various mitigation measures were reviewed and identified. More detailed mitigation planning will be developed in the NEPA documentation phase of the project in accordance with the FTA criteria.

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4. Highway 99 Corridor Environmental Consequences

4.1. Affected Environment

The affected environment for this evaluation is the Eugene-Springfield region within the API (Figure 4.1-1). Land uses in the Highway 99 Corridor include residential, commercial, and light industrial.

Both the Highway 99 Corridor Enhanced Corridor and EmX Alternatives begin at the Eugene Station in Downtown Eugene. Land use in that area is mainly commercial, with some intermixed multi- and single-family residences. The alignment for the Enhanced Corridor and EmX Alternatives differ between Eugene Station and Chambers Street. Where the Highway 99 Corridor Enhanced Corridor Alternative extends west to Chambers Street, land use becomes predominantly single-family residences. Both alternatives follow the same alignment from Chambers Street west to the corridor terminus. The main noise source for both alternatives in the east end of the corridor is traffic on major arterial roadways throughout the downtown area.

In the west end of the corridor, where the alignment extends northwest along Highway 99, land use is primarily commercial and light industrial south of Roosevelt Boulevard. North of Roosevelt Boulevard, land use on the east side of the alignment continues to be commercial and industrial. However, to the west, land use also includes single-family residences and hotels. Noise levels in this part of the corridor are dominated by traffic on Highway 99, as well as by nearby commercial and industrial activities.

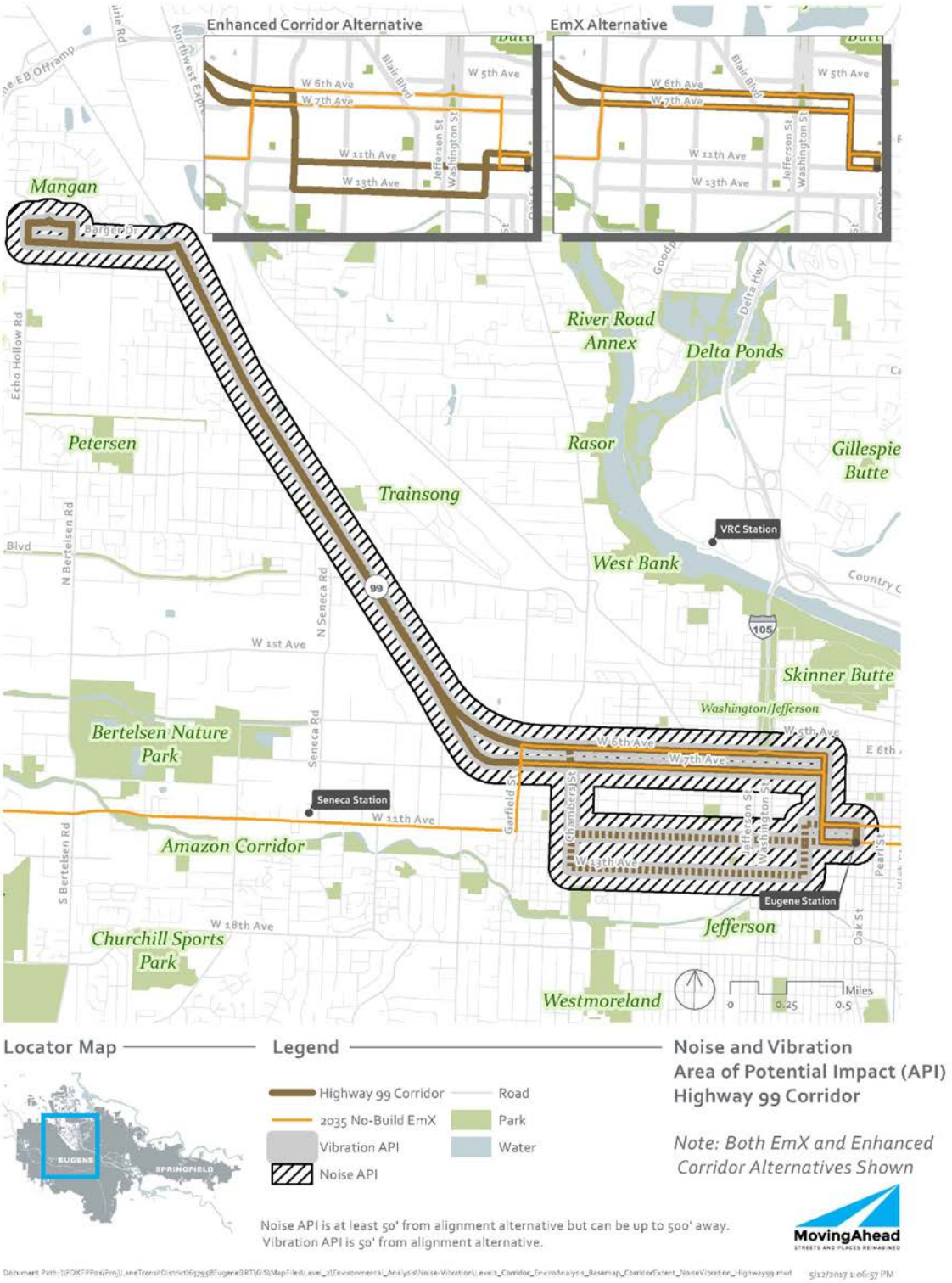
4.2. Long-Term Impacts for All Alternatives

The potential number of long-term noise and vibration impacts for each alternative is listed in Table 4.2-1. The number of impacts given for each alternative is the number of potentially impacted properties, not units. The number of units for a property can vary depending on whether the property includes a single- or multi-family home. After the preferred alternative is selected, detailed impact analyses will be based on the actual number of units affected. When multi-family properties are impacted, the number of units will be greater than the number of properties. As discussed in Section 3.1.1.1, the potential number of long-term noise impacts for each alternative would include impacts from bus operations, as well as those associated with the project related ancillary facilities, if any, associated with that alternative.

Table 4.2-1. Highway 99 Corridor Potential Noise and Vibration Impacts by Alternative

	Number of Properties Potentially Impacted	
Corridor	**Noise**	**Vibration**
No-Build Alternative	0	0
Enhanced Corridor Alternative	7	0
EmX Alternative	19	0

Figure 4.1-1. Noise and Vibration Area of Potential Impact



4.2.1. Noise Impacts

4.2.1.1. No-Build Alternative Impacts

Under the No-Build Alternative, no noise or vibration impacts are anticipated because there will be no project-related changes to the corridor.

4.2.1.2. Enhanced Alternative Impacts

There are seven multi-family properties with potential noise impacts under the Highway 99 Corridor Enhanced Corridor Alternative as based upon current guidance contained in the FTA Manual (FTA, 2006).

4.2.1.3. EmX Alternative Impacts

Under the Highway 99 Corridor EmX Alternative, potential noise impacts to 6 single-family properties and 13 multi-family properties are anticipated as based upon current guidance contained in the FTA Manual (FTA, 2006).

4.2.2. Vibration Impacts

All of the alternatives use rubber-tired vehicles (buses and EmX vehicles) on public rights of way. Vibration levels from rubber-tired vehicles are below the FTA criteria for structures that are greater than 15 to 20 feet from the travel lane. Therefore, no vibration impacts are predicted under any of the alternatives.

4.3. Indirect and Cumulative Effects

Regional traffic data were generated and used in this analysis, accounting for expected regional land use and growth. As a result, this noise and vibration assessment has incorporated any expected cumulative and indirect traffic increases in the long-term impacts.

4.4. Short-Term Construction-Related Impacts

Under the build alternatives, during construction of the proposed project improvements, noise and vibration levels in the project corridor may increase due to normal construction activities. However, daytime construction noise is exempt from provisions contained in the City of Eugene Municipal Code. Under the City of Eugene Municipal Code noise ordinance, project construction could be performed during the normal daytime hours of 7:00 a.m. to 7:00 p.m. No construction noise impacts are predicted for any alternative if construction is performed during the allowable hours.

If construction was planned outside of the allowable hours of 7:00 a.m. to 7:00 p.m., the project would be required to obtain a noise variance from local jurisdictions. As part of the variance process, a construction noise analysis would be performed; the construction specifications would contain limitations, if any, specific to the night work proposed and potential construction noise impacts.

4.5. Potential Mitigation Measures

Noise mitigation will be considered for impacted areas under both of the build alternatives in the Highway 99 Corridor. No vibration impacts are predicted and no vibration mitigation will be considered unless further analysis dictates otherwise. Mitigation for both noise and vibration impacts, if any, will be evaluated using the criteria contained in the FTA Manual (FTA, 2006). During final design, all impacts and

potential mitigation measures will be reviewed for verification. If it is discovered that the mitigation can be achieved by less costly means, or if a detailed analysis shows no impact, the mitigation measure may be eliminated.

The need for mitigation will be assessed based on the severity of the impact, existing and future noise levels, including a comparison to the No-Build Alternative, and the land use and potential for land use change in the future. Locations with impacts in the severe category will be those most likely to have noise mitigation measures applied. Sites with moderate impacts will be evaluated based on the existing and future noise levels and area land use. For noise, mitigation for both moderate and severe impacts will begin with source treatment, followed by treatments in the noise path. If source and path treatments are not sufficient to mitigate the impact, affected properties with severe impacts, and properties where the existing building does not already achieve sufficient exterior-to-interior noise reduction may be evaluated for sound insulation implementation.

4.5.1. Noise Source Mitigation

Noise source mitigation consists of using new modern vehicles with the appropriate mufflers and engine shrouds. LTD already employs a modern and well-maintained bus fleet, and no further source mitigation is necessary.

4.5.2. Noise Path Mitigation

Typical noise path mitigation includes use of barriers, such as earth berms, sound walls, and buffer zones. Constructing barriers between the bus roadways and the affected receivers would reduce noise levels by physically blocking the transmission of noise generated by the buses. Barriers can be constructed as walls or earth berms. Berms require more right-of-way than walls and are usually constructed with a 3-to-1 slope. For this project, berms generally would not be feasible because of topographical conditions and limited right-of-way.

A standard concrete sound wall is typically used for transit projects. Sound walls should be high enough to break the line of sight between the noise source and the receiver. The typical height for sound walls is 8 to 14 feet. Sound walls must also be long enough to prevent flanking of noise around the ends of the walls. Openings in sound walls for driveway connections or intersecting streets greatly reduce the effectiveness of these walls.

Buffer zones are undeveloped open spaces between the noise source and receiver. Buffer zones are created when an agency purchases or otherwise restricts land or development rights in addition to the normal right-of-way, so that future dwellings cannot be constructed close to the noise source. The build alternative corridors are generally in an urban area where land is at a premium, so creating buffer zones is not a feasible form of noise mitigation because doing so would require substantially more project-related displacements.

4.5.3. Noise Receiver Mitigation

For situations where noise path mitigation would be either unfeasible or ineffective, adding sound insulation to buildings will be considered for mitigation of project noise under special circumstances. Circumstances that warrant considering sound insulation could include no alternative mitigation measures, high future-build noise levels, and impacts to residences, schools, and hospitals in the FTA severe category. Sound insulation reduces the interior noise levels in sleeping and living quarters at residential properties or in noise sensitive areas at schools and other institutional properties to within

the guidelines set by the U.S. Department of Housing and Urban Development. Under these guidelines, interior noise levels for residential properties should not exceed 45 dBA Ldn, and a form of fresh air exchange must be maintained. The air exchange can be achieved by opening a window or using a ventilation system. Sound insulation is normally only used on older dwellings with single-paned windows, or in buildings with double-paned windows that are no longer effective because of leakage. Sound insulation would not reduce exterior noise levels. For schools and other institutional properties, a maximum interior noise level of 52 dBA during peak operational hours is used as the criterion.

4.5.4. Vibration Mitigation

No vibration impacts are expected as part of the project. Therefore, no mitigation is required.

4.6. Permits and Approvals

There are no noise- or vibration-related permits required for system operations. During construction, a noise variance may be necessary if construction is proposed outside the allowable hours of the local jurisdiction.

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5. River Road Corridor Environmental Consequences

5.1. Affected Environment

The affected environment for this evaluation is the Eugene-Springfield region within the API (Figure 5.1-1). Land uses in the River Road Corridor include residential, commercial, and light industrial.

Both build alternatives in the River Road Corridor begin at the Eugene Station in Downtown Eugene. Land use in that area is mainly commercial, with some intermixed multi- and single-family residences, and continues that way until Chambers Street. Along Chambers Street, there are also some light industrial uses. The main noise source in the southern end of the corridor for both alternatives is traffic on major arterial roadways throughout the downtown area. Nearby commercial and industrial activities also contribute to noise at this end of the corridor.

As the alternatives extend north from the intersection of River Road and the Northwest Expressway, land use in both corridors is primarily single-family residential and multi-family residential. There is a commercial area located at the intersection of River Road and the Randy-Papé Beltline Highway; from that area to the Santa Clara Community Transit Center (intersection of Hunsaker Lane and River Road), land use is once again a mix of residential and commercial. Noise levels from the intersection of River Road and the Northwest Expressway to the Santa Clara Community Transit Center are dominated by traffic on River Road and the Randy-Papé Beltline, as well as nearby commercial and industrial activities.

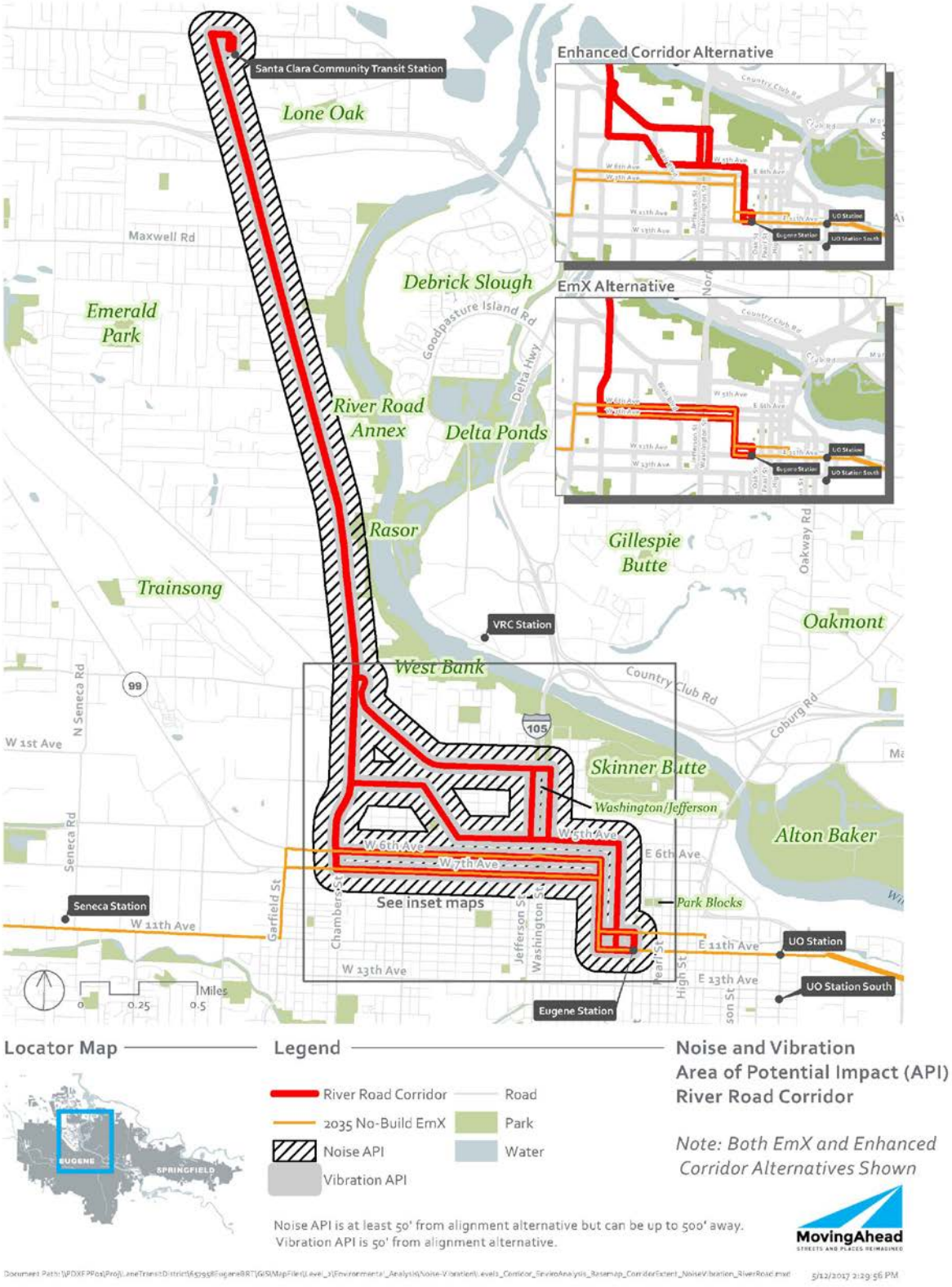
5.2. Long-Term Impacts for All Alternatives

The potential number of long-term noise and vibration impacts for each alternative is listed in Table 5.2-1. The number of impacts given for each alternative is the number of potentially impacted properties, not units. The number of units for a property can vary depending on whether the property includes a single- or multi-family home. After the preferred alternative is selected, detailed impact analyses will be based on the actual number of units affected. When multi-family properties are impacted, the number of units will be greater than the number of properties. As discussed in Section 3.1.1.1, the potential number of long-term noise impacts for each alternative would include impacts from bus operations, as well as those associated with the project-related ancillary facilities, if any, associated with that alternative.

Table 5.2-1. River Road Corridor Potential Noise and Vibration Impacts by Alternative

	Number of Properties Potentially Impacted	
Corridor	**Noise**	**Vibration**
No-Build Alternative	0	0
Enhanced Corridor Alternative	0	0
EmX Alternative	2	0

Figure 5.1-1. River Road Corridor API



5.2.1. Noise Impacts

5.2.1.1. No-Build Alternative Impacts

Under the No-Build Alternative, no noise or vibration impacts are anticipated because there will be no project-related changes to the corridor.

5.2.1.2. Enhanced Alternative Impacts

The River Road Corridor Enhanced Corridor Alternative is not predicted to have any noise impacts.

5.2.1.3. EmX Alternative Impacts

The River Road Corridor EmX Alternative is predicted to have potential noise impacts on two single-family properties as based upon current guidance contained in the FTA Manual (FTA, 2006).

5.2.2. Vibration Impacts

All of the alternatives use rubber-tired vehicles (buses and EmX vehicles) on public rights of way. Also, vibration levels from rubber-tired vehicles are below the FTA criteria for structures that are greater than 15 to 20 feet from the travel lane. Therefore, no vibration impacts are predicted under any of the alternatives.

5.3. Indirect and Cumulative Effects

Regional traffic data were generated and used in this analysis, accounting for expected regional land use and growth. As a result, this noise and vibration assessment has incorporated any expected cumulative and indirect traffic increases into long-term impacts.

5.4. Short-Term Construction-Related Impacts

Under the build alternatives, during construction of the proposed project improvements, noise and vibration levels in the project corridor may increase due to normal construction activities. However, daytime construction noise is exempt from provisions contained in the City of Eugene Municipal Code. Under the City of Eugene Municipal Code noise ordinance, project construction could be performed during the normal daytime hours of 7:00 a.m. to 7:00 p.m. No construction noise impacts are predicted for any alternative if construction is performed during the allowable hours.

If construction was planned outside of the allowable hours of 7:00 a.m. to 7:00 p.m., the project would be required to obtain a noise variance from local jurisdictions. As part of the variance process, a construction noise analysis would be performed; the construction specifications would contain limitations, if any, specific to the night work proposed and potential construction noise impacts.

5.5. Potential Mitigation Measures

Noise mitigation will be considered for impacted areas under the River Road Corridor EmX Alternative. No vibration impacts are predicted and no vibration mitigation will be considered unless further analysis dictates otherwise. Mitigation for both noise and vibration impacts, if any, will be evaluated using the criteria contained in the FTA Manual (FTA, 2006). During final design, all impacts and potential mitigation measures will be reviewed for verification. If it is discovered that the mitigation can be

achieved by less costly means, or if a detailed analysis shows no impact, then the mitigation measure may be eliminated.

The need for mitigation will be assessed based on the severity of the impact, existing and future noise levels, including a comparison to the No-Build Alternative, and the land use and potential for land use change in the future. Locations with impacts in the severe category will be those most likely to have noise mitigation measures applied. Sites with moderate impacts will be evaluated based on the existing and future noise levels, and area land use. For noise, mitigation for both moderate and severe impacts will begin with source treatment, followed by treatments in the noise path. If source and path treatments are not sufficient to mitigate the impact, affected properties with severe impacts, and properties where the existing building does not already achieve sufficient exterior-to-interior noise reduction may be evaluated for sound insulation implementation.

5.5.1. Noise Source Mitigation

Noise source mitigation consists of using new modern vehicles with the appropriate mufflers and engine shrouds. LTD already employs a modern and well-maintained bus fleet, and no further source mitigation is necessary.

5.5.2. Noise Path Mitigation

Typical noise path mitigation includes earth berms, sound walls, and buffer zones. Constructing barriers between the bus roadways and the affected receivers would reduce noise levels by physically blocking the transmission of noise generated by the buses. Barriers can be constructed as walls or earth berms. Berms require more right of way than walls and are usually constructed with a 3-to-1 slope. For this project, berms generally would not be feasible because of topographical conditions and limited right of way.

A standard concrete sound wall is typically used for transit projects. Sound walls should be high enough to break the line of sight between the noise source and the receiver. The typical height for sound walls is 8 to 14 feet. Sound walls must also be long enough to prevent flanking of noise around the ends of the walls. Openings in sound walls for driveway connections or intersecting streets greatly reduce the effectiveness of these walls.

Buffer zones are undeveloped open spaces between the noise source and receiver. Buffer zones are created when an agency purchases land or development rights in addition to the normal right of way, so that future dwellings cannot be constructed close to the noise source. The build alternative corridors are generally in an urban area where land is at a premium, so creating buffer zones is not a feasible form of noise mitigation because doing so would require substantially more project-related displacements.

5.5.3. Noise Receiver Mitigation

For situations where noise path mitigation would be either unfeasible or ineffective, adding sound insulation to buildings will be considered for mitigation of project noise under special circumstances. Circumstances that warrant considering sound insulation could include no alternative mitigation measures, high future-build noise levels, and impacts to residences, schools, and hospitals in the FTA severe category. Sound insulation reduces the interior noise levels in sleeping and living quarters at residential properties and in noise-sensitive areas at schools and other institutional properties to within the guidelines set by the U.S. Department of Housing and Urban Development. Under these guidelines, interior noise levels for residential properties should not exceed 45 dBA Ldn, and a form of fresh air

exchange must be maintained. The air exchange can be achieved by opening a window or using a ventilation system. Sound insulation is normally only used on older dwellings with single-paned windows, or in buildings with double-paned windows that are no longer effective because of leakage. Sound insulation would not reduce exterior noise levels. For schools and other institutional properties, a maximum interior noise level of 52 dBA during peak operational hours is used as the criterion.

5.5.4. Vibration Mitigation

No vibration impacts are expected as part of the project. Therefore, no mitigation is required.

5.6. Permits and Approvals

There are no noise or vibration related permits required for system operations. During construction, a noise variance may be necessary if construction is proposed outside the allowable hours of the local jurisdiction.

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6. 30th Avenue to Lane Community College Corridor Environmental Consequences

6.1. Affected Environment

The affected environment for this evaluation is the Eugene-Springfield region within the API (Figure 6.1-1). Land uses in the 30th Avenue to LCC College Corridor include residential, commercial, schools, and parks.

The 30th Avenue to LCC Corridor Enhanced Corridor and EmX Alternatives are located within the same roadway footprint and alignment. Both alternatives begin at the Eugene Station in Downtown Eugene. Land use in that area is mainly commercial, with some intermixed multi- and single-family residences. The main noise source for both alternatives in the northern end of the corridor is traffic on major arterial roadways throughout the downtown area.

As the 30th Avenue to LCC Corridor build alternatives extend south from E. 20th Avenue, land use in both corridors is primarily single-family residential. In addition, key land uses on the common corridor consist of the LCC, Amazon Park, and woodland areas located in Lane County. The corridor contains the Civic Stadium site, which is currently undergoing redevelopment. Noise levels south of the downtown area in both corridors are dominated by traffic on Amazon Parkway and E. 30th Avenue.

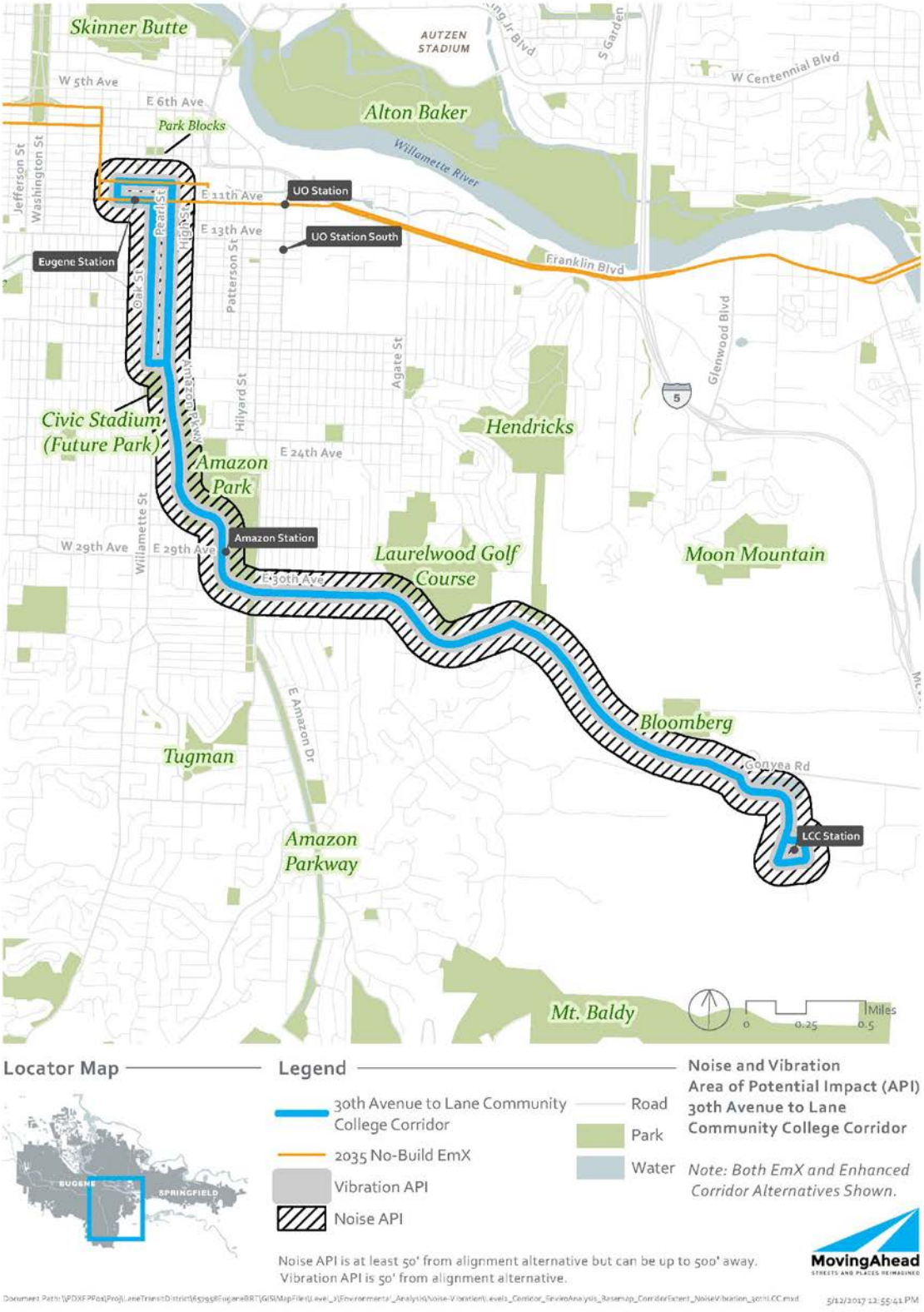
6.2. Long-Term Impacts for All Alternatives

The potential number of long-term noise and vibration impacts for each alternative is listed in Table 6.2-1. The number of impacts given for each alternative is the number of potentially impacted properties, not units. The number of units for a property can vary depending on whether the property includes a single- or multi-family home. After the preferred alternative is selected, detailed impact analyses will be based on the actual number of units affected. When multi-family properties are impacted, the number of units will be greater than the number of properties. As discussed in Section 3.1.1.1, the potential number of long-term noise impacts for each alternative would include impacts from bus operations, as well as those associated with the project-related ancillary facilities, if any, associated with that alternative.

Table 6.2-1. 30th Ave to LCC Corridor Potential Noise and Vibration Impacts by Alternative

	Number of Properties Potentially Impacted	
Corridor	**Noise**	**Vibration**
No-Build Alternative	0	0
Enhanced Corridor Alternative	0	0
EmX Alternative	9	0

Figure 6.1-1. 30th Avenue to LLC Corridor API



6.2.1. Noise Impacts

6.2.1.1. No-Build Alternative Impacts

Under the No-Build Alternative, no noise or vibration impacts are anticipated because there will be no project-related changes to the corridor.

6.2.1.2. Enhanced Alternative Impacts

The 30th Avenue to LCC Corridor Enhanced Corridor Alternative is not predicted to have any noise impacts.

6.2.1.3. EmX Alternative Impacts

The 30th Avenue to LCC Corridor EmX Alternative is predicted to have nine potential noise impacts as based upon current guidance contained in the FTA Manual (FTA, 2006). Three of the potential impacts are expected at single-family properties and four are expected at multi-family properties. In addition, one hotel and one church are predicted to have potential noise impacts.

This corridor may require incorporation of FHWA noise prediction and impact assessment procedures. The area of greatest potential for the use of such measures is at 20th Avenue, where a new roadway will be constructed between Oak and Pearl Streets.

6.2.2. Vibration Impacts

All of the alternatives use rubber-tired vehicles (buses and EmX vehicles) on public rights of way. Also, vibration levels from rubber-tired vehicles are below the FTA criteria for structures that are greater than 15 to 20 feet from the travel lane. Therefore, no vibration impacts are predicted under any of the alternatives.

6.3. Indirect and Cumulative Effects

Regional traffic data were generated and used in this analysis, accounting for expected regional land use and growth. As a result, this noise and vibration assessment has incorporated any expected cumulative and indirect traffic increases in the long-term impacts.

6.4. Short-Term Construction-Related Impacts

Under the build alternatives, during construction of the proposed project improvements, noise and vibration levels in the project corridor may increase due to normal construction activities. However, daytime construction noise is exempt from provisions contained in the City of Eugene Municipal Code. Under the City of Eugene Municipal Code and Lane County noise ordinances, project construction could be performed during the normal daytime hours of 7:00 a.m. to 7:00 p.m. For the portions of the corridor located in unincorporated Lane County, construction noise during normal construction operations is exempt from the County noise control ordinance. No construction noise impacts are predicted for any alternative, provided that construction is performed during the allowable hours outlined in the City of Eugene Municipal Code or the County noise control ordinance.

If construction was planned outside the hours of 7:00 a.m. to 7:00 p.m., the project would be required to obtain a noise variance from local jurisdictions. As part of the variance process, a construction noise

analysis would be performed. The construction specifications would contain limitations, if any, specific to the night work proposed and potential construction noise impacts.

6.5. Potential Mitigation Measures

Noise mitigation will be considered for impacted areas under the 30th Avenue to LCC EmX Alternative. No vibration impacts are predicted and no vibration mitigation will be considered unless further analysis dictates otherwise. Mitigation for both noise and vibration impacts, if any, will be evaluated using the criteria contained in the FTA Manual (FTA, 2006). During final design, all impacts and potential mitigation measures will be reviewed for verification. If it is discovered that the mitigation can be achieved by less costly means, or if a detailed analysis shows no impact, the mitigation measure may be eliminated.

The need for mitigation will be assessed based on the severity of the impact; existing and future noise levels, including a comparison to the No-Build Alternative; and the land use and potential for land use change in the future. Locations with impacts in the severe category will be those most likely to have noise mitigation measures applied. Sites with moderate impacts will be evaluated based on the existing and future noise levels and area land use. For noise, mitigation for both moderate and severe impacts will begin with source treatment, followed by treatments in the noise path. If source and path treatments are not sufficient to mitigate the impact, then affected properties with severe impacts, and properties where the existing building does not already achieve sufficient exterior-to-interior noise reduction, may be evaluated for sound insulation implementation.

6.5.1. Noise Source Mitigation

Noise source mitigation consists of using new modern vehicles with the appropriate mufflers and engine shrouds. LTD already employs a modern and well-maintained bus fleet, and no further source mitigation is necessary.

6.5.2. Noise Path Mitigation

Typical noise path mitigation includes earth berms, sound walls, and buffer zones. Constructing barriers between the bus roadways and the affected receivers would reduce noise levels by physically blocking the transmission of noise generated by the buses. Barriers can be constructed as walls or earth berms. Berms require more right of way than walls and are usually constructed with a 3-to-1 slope. For this project, berms generally would not be feasible because of topographical conditions and limited right of way.

A standard concrete sound wall is typically used for transit projects. Sound walls should be high enough to break the line of sight between the noise source and the receiver. The typical height for sound walls is 8 to 14 feet. Sound walls must also be long enough to prevent flanking of noise around the ends of the walls. Openings in sound walls for driveway connections or intersecting streets greatly reduce the effectiveness of these walls.

Buffer zones are undeveloped open spaces between the noise source and receiver. Buffer zones are created when an agency purchases land or development rights in addition to the normal right of way, so that future dwellings cannot be constructed close to the noise source. The build alternative corridors are generally in an urban area where land is at a premium, so creating buffer zones is not a feasible form of noise mitigation because doing so would require substantially more project-related displacements.

6.5.3. Noise Receiver Mitigation

For situations where noise path mitigation would be either unfeasible or ineffective, adding sound insulation to buildings will be considered for mitigation of project noise under special circumstances. Circumstances that warrant considering sound insulation could include no alternative mitigation measures, high future-build noise levels, and impacts to residences, schools, and hospitals in the FTA severe category. Sound insulation reduces the interior noise levels in sleeping and living quarters at residential properties or in noise-sensitive areas at schools and other institutional properties to within the guidelines set by the U.S. Department of Housing and Urban Development. Under these guidelines, interior noise levels for residential properties should not exceed 45 dBA Ldn, and a form of fresh air exchange must be maintained. The air exchange can be achieved by opening a window or using a ventilation system. Sound insulation is normally only used on older dwellings with single-paned windows, or in buildings with double-paned windows that are no longer effective because of leakage. Sound insulation would not reduce exterior noise levels. For schools and other institutional properties, a maximum interior noise level of 52 dBA during peak operational hours is used as the criterion.

6.5.4. Vibration Mitigation

No vibration impacts are expected as part of the project. Therefore, no mitigation is required.

6.6. Permits and Approvals

There are no noise- or vibration-related permits required for system operations. During construction, a noise variance may be necessary if construction is proposed outside the allowable hours of the local jurisdiction.

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7. Coburg Road Corridor Environmental Consequences

7.1. Affected Environment

The affected environment for this evaluation is the Eugene-Springfield region within the API (Figure 7.1-1). Land uses in the Coburg Road Corridor include residential and commercial.

The Coburg Road Corridor Enhanced Corridor Alternative and EmX Alternative alignments follow the same alignment from the south side of the Ferry Street Bridge to the corridor terminus at Gateway Station. The alternatives follow different alignments in the Downtown Eugene area. Both alternatives begin at the Eugene Station in Downtown Eugene. Land use in that area is mainly commercial, with some intermixed multi- and single-family residences. The main noise source for both alternatives in the southern end of the corridor is traffic on major arterial roadways throughout the downtown area.

Key land uses throughout the Coburg Road Corridor under both alternatives include the Oakway Center, at the intersection of Oakway and Coburg roads, and the shopping center at the intersection of Willakenzie and Coburg roads. The recently completed Veterans Affairs Hospital and Crescent Village Mixed-Use development are also located within the north end of both corridors. North of Harlow Road there are many multi- and single-family residences within both corridors. Noise levels north of the downtown area and the Ferry Street Bridge in these corridors are dominated by traffic on Coburg Road and nearby commercial activities. Traffic on I-105, the Randy-Papé Beltline, and I-5 also affect noise levels where the alternatives pass near those roadways.

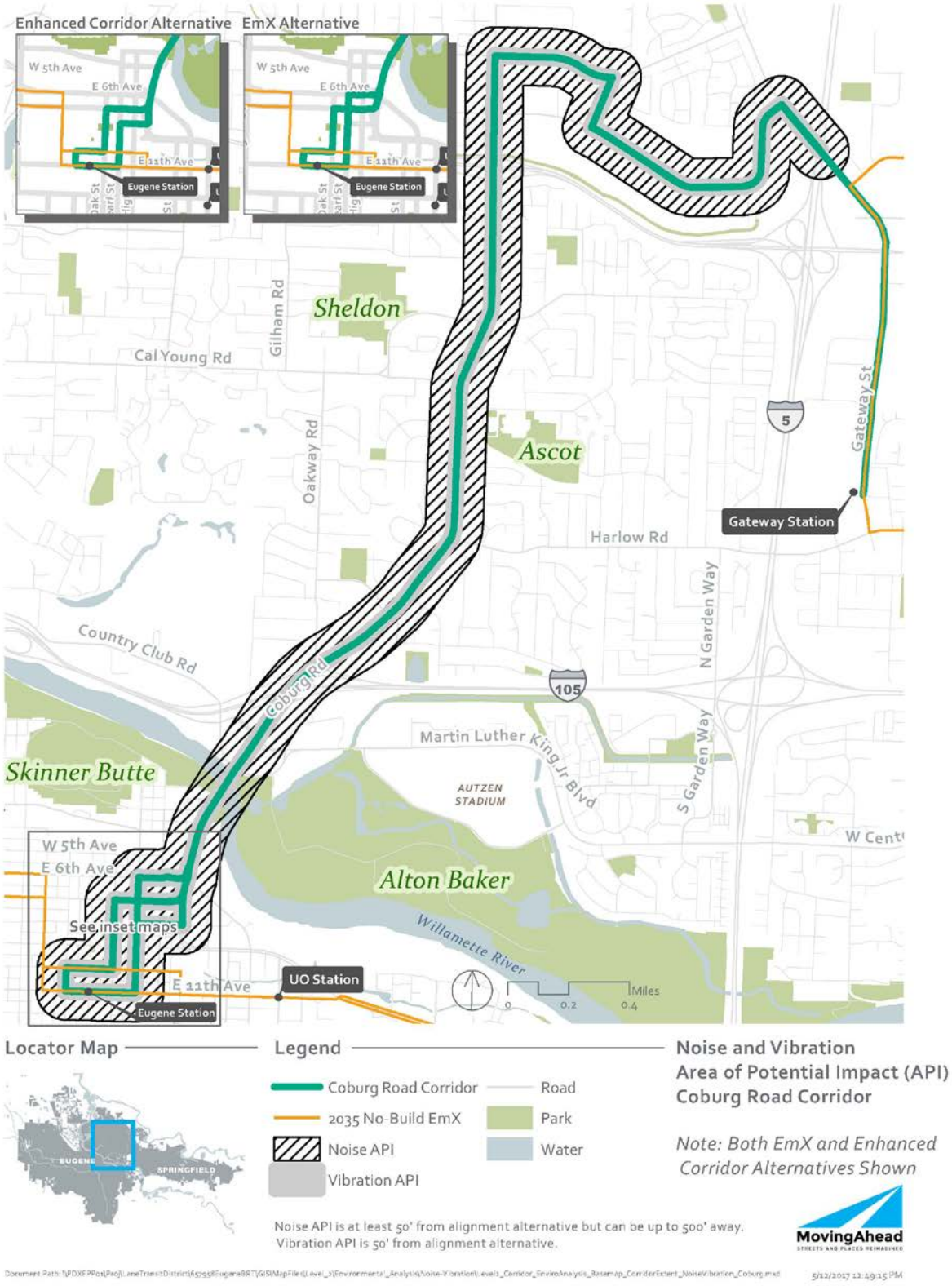
7.2. Long-Term Impacts for All Alternatives

The potential number of long-term noise and vibration impacts for each alternative is listed in Table 7.2-1. The number of impacts given for each alternative is the number of potentially impacted properties, not units. The number of units for a property can vary depending on whether the property includes a single- or multi-family home. After the preferred alternative is selected, detailed impact analyses will be based on the actual number of units affected. When multi-family properties are impacted, the number of units will be greater than the number of properties. As discussed in Section 3.1.1.1, the potential number of long-term noise impacts for each alternative would include impacts from bus operations, as well as those associated with the project-related ancillary facilities, if any, associated with that alternative.

Table 7.2-1. Coburg Road Corridor Potential Noise and Vibration Impacts by Alternative

	Number of Properties Potentially Impacted	
Corridor	**Noise**	**Vibration**
No-Build Alternative	0	0
Enhanced Corridor Alternative	0	0
EmX Alternative	46	0

Figure 7.1-1. Coburg Road Corridor API



7.2.1. Noise Impacts

7.2.1.1. No-Build Alternative Impacts

Under the No-Build Alternative, no noise or vibration impacts are anticipated because there will be no project-related changes to the corridor.

7.2.1.2. Enhanced Alternative Impacts

The Coburg Road Corridor Enhanced Corridor Alternative is not predicted to have any noise impacts.

7.2.1.3. EmX Alternative Impacts

The Coburg Road Corridor EmX Alternative is predicted to have 46 potential noise impacts as based upon current guidance contained in the FTA Manual (FTA, 2006). Thirty-nine of the potential impacts are expected at single-family properties and three are expected at multi-family properties. In addition, one hotel, two churches, and one school are predicted to have potential noise impacts.

7.2.2. Vibration Impacts

All of the alternatives use rubber-tired vehicles (buses and EmX vehicles) on public rights of way. Also, vibration levels from rubber-tired vehicles are below the FTA criteria for structures that are greater than 15 to 20 feet from the travel lane. Therefore, no vibration impacts are predicted under any of the alternatives.

7.3. Indirect and Cumulative Effects

Regional traffic data were generated and used in this analysis, accounting for expected regional land use and growth. As a result, this noise and vibration assessment has incorporated any expected cumulative and indirect traffic increases in the long-term impacts.

7.4. Short-Term Construction-Related Impacts

Under the build alternatives, during construction of the proposed project improvements, noise and vibration levels in the project corridor may increase due to normal construction activities. However, daytime construction noise is exempt from provisions contained in the City of Eugene Municipal Code. Under the City of Eugene Municipal Code noise ordinance, project construction could be performed during the normal daytime hours of 7:00 a.m. to 7:00 p.m. Similarly, under the City of Springfield Municipal Code noise ordinance, project construction could be performed during the normal daytime hours of 7:00 a.m. to 6:00 p.m. without having to obtain a variance or other exemption. No construction noise impacts are predicted for any alternative if construction is performed during the allowable hours.

If construction was planned outside of hours of 7:00 a.m. to 7:00 p.m., the project would be required to obtain a noise variance from local jurisdictions. As part of the variance process, a construction noise analysis would be performed. The construction specifications would contain limitations, if any, specific to the night work proposed and potential construction noise impacts.

7.5. Potential Mitigation Measures

Noise mitigation will be considered for impacted areas under the Coburg Road Corridor EmX Alternative. No vibration impacts are predicted and no vibration mitigation will be considered unless further analysis

dictates otherwise. Mitigation for both noise and vibration impacts, if any, will be evaluated using the criteria contained in the FTA Manual (FTA, 2006). During final design, all impacts and potential mitigation measures will be reviewed for verification. If it is discovered that the mitigation can be achieved by less costly means, or a detailed analysis shows no impact, then the mitigation measure may be eliminated.

The need for mitigation will be assessed based on the severity of the impact; existing and future noise levels, including a comparison to the No-Build Alternative; and the land use and potential for land use change in the future. Locations with impacts in the severe category will be those most likely to have noise mitigation measures applied. Sites with moderate impacts will be evaluated based on the existing and future noise levels and area land use. For noise, mitigation for both moderate and severe impacts will begin with source treatment, followed by treatments in the noise path. If source and path treatments are not sufficient to mitigate the impact, affected properties with severe impacts, and properties where the existing building does not already achieve sufficient exterior-to-interior noise reduction, may be evaluated for sound insulation implementation.

7.5.1. Noise Source Mitigation

Noise source mitigation consists of using new modern vehicles with the appropriate mufflers and engine shrouds. LTD already employs a modern and well-maintained bus fleet, and no further source mitigation is necessary.

7.5.2. Noise Path Mitigation

Typical noise path mitigation includes earth berms, sound walls, and buffer zones. Constructing barriers between the bus roadways and the affected receivers would reduce noise levels by physically blocking the transmission of noise generated by the buses. Barriers can be constructed as walls or earth berms. Berms require more right of way than walls and are usually constructed with a 3-to-1 slope. For this project, berms generally would not be feasible because of topographical conditions and limited right of way.

A standard concrete sound wall is typically used for transit projects. Sound walls should be high enough to break the line of sight between the noise source and the receiver. The typical height for sound walls is 8 to 14 feet. Sound walls must also be long enough to prevent flanking of noise around the ends of the walls. Openings in sound walls for driveway connections or intersecting streets greatly reduce the effectiveness of these walls.

Buffer zones are undeveloped open spaces between the noise source and receiver. Buffer zones are created when an agency purchases land or development rights in addition to the normal right of way, so that future dwellings cannot be constructed close to the noise source. The build alternative corridors are generally in an urban area where land is at a premium, so creating buffer zones is not a feasible form of noise mitigation because doing so would require substantially more project-related displacements.

7.5.3. Noise Receiver Mitigation

For situations where noise path mitigation would be either unfeasible or ineffective, adding sound insulation to buildings will be considered for mitigation of project noise under special circumstances. Circumstances that warrant considering sound insulation could include no alternative mitigation measures, high future-build noise levels, and impacts to residences, schools, and hospitals in the FTA severe category. Sound insulation reduces the interior noise levels in sleeping and living quarters at

residential properties or in noise-sensitive areas at schools and other institutional properties to within the guidelines set by the U.S. Department of Housing and Urban Development. Under these guidelines, interior noise levels for residential properties should not exceed 45 dBA Ldn, and a form of fresh air exchange must be maintained. The air exchange can be achieved by opening a window or using a ventilation system. Sound insulation is normally only used on older dwellings with single-paned windows, or in buildings with double-paned windows that are no longer effective because of leakage. Sound insulation would not reduce exterior noise levels. For schools and other institutional properties, a maximum interior noise level of 52 dBA during peak operational hours is used as the criterion.

7.5.4. Vibration Mitigation

No vibration impacts are expected as part of the project. Therefore, no mitigation is required.

7.6. Permits and Approvals

There are no noise- or vibration-related permits required for system operations. During construction, a noise variance may be necessary if construction is proposed outside the allowable hours of the local jurisdiction.

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8. Martin Luther King, Jr. Boulevard Corridor Environmental Consequences

8.1. Affected Environment

The affected environment for this evaluation is the Eugene-Springfield region within the API (Figure 8.1-1). Land uses in the Martin Luther King, Jr. Boulevard Corridor include government buildings, recreational facilities and parking areas, residential, and commercial.

The Martin Luther King, Jr. Boulevard Corridor Enhanced Corridor Alternative begins at the Eugene Station in Downtown Eugene. Land use in that area is mainly commercial and government buildings (Lane County Circuit Court, City of Eugene, etc.). The main noise source in this portion of the corridor is traffic on major arterial roadways throughout the downtown area.

Key land uses in other portions of the Martin Luther King, Jr. Boulevard Corridor are the University of Oregon's Autzen Stadium, University of Oregon student housing (Duck Village), Papé Field, PK Baseball Park, Lane County Juvenile Court, and Alton Baker Park. Residential land uses predominate near I-5 at the far eastern edge of the corridor. Noise levels in the corridor north and east of the downtown area are dominated by traffic on Coburg Road and Martin King, Jr. Boulevard. Commercial activities and sport activities also contribute to noise levels in these areas. Traffic on I-105 and I-5 also affect noise levels where the Martin Luther King, Jr. Boulevard Corridor Enhanced Corridor Alternative passes near those roadways.

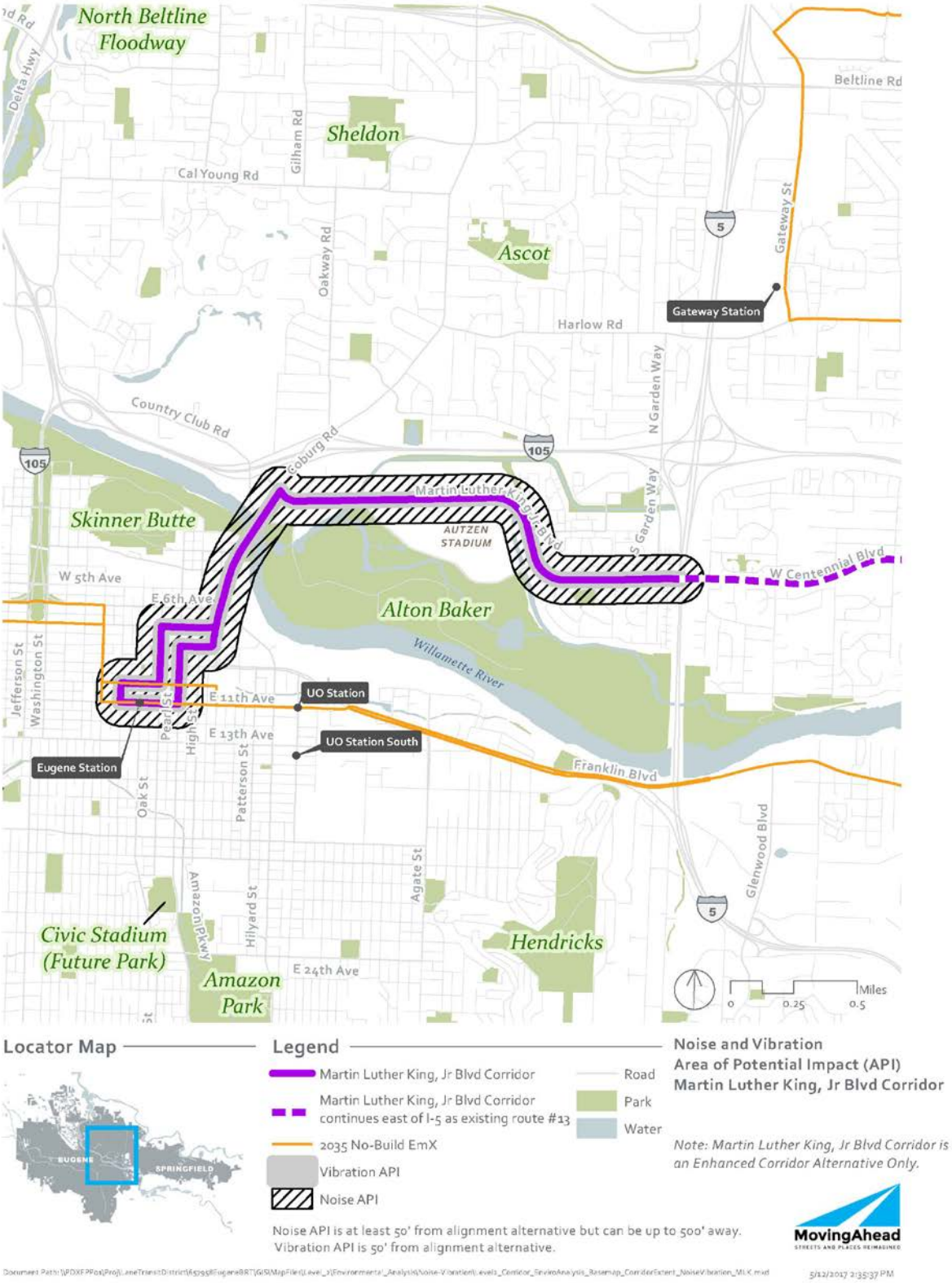
8.2. Long-Term Impacts for All Alternatives

The potential number of long-term noise and vibration impacts for each alternative is listed in Table 8.2-1. The number of impacts given for each alternative is the number of potentially impacted properties, not units. The number of units for a property can vary depending on whether the property includes a single- or multi-family home. After the preferred alternative is selected, detailed impact analyses will be based on the actual number of units affected. When multi-unit properties, such as a hotel, are impacted, the number of units will be greater than the number of properties. As discussed in Section 3.1.1.1, the potential number of long-term noise impacts for each alternative would include impacts from bus operations, as well as those associated with the project-related ancillary facilities, if any, associated with that alternative.

Table 8.2-1. Martin Luther King, Jr. Blvd Corridor Potential Noise and Vibration Impacts by Alternative

	Number of Properties Potentially Impacted	
Corridor	**Noise**	**Vibration**
No-Build Alternative	0	0
Enhanced Corridor Alternative	1	0

Figure 8.1-1. Martin Luther King, Jr. Boulevard Corridor API



8.2.1. Noise Impacts

8.2.1.1. No-Build Alternative Impacts

Under the No-Build Alternative, no noise or vibration impacts are anticipated because there will be no project-related changes to the corridor.

8.2.1.2. Enhanced Alternative Impacts

The Martin Luther King, Jr. Boulevard Corridor Enhanced Corridor Alternative is predicted to have one potential noise impact at a hotel as based upon current guidance contained in the FTA Manual (FTA, 2006).

8.2.2. Vibration Impacts

All of the alternatives use rubber-tired vehicles (buses and EmX vehicles) on public rights of way. Also, vibration levels from rubber-tired vehicles are below the FTA criteria for structures that are greater than 15 to 20 feet from the travel lane. Therefore, no vibration impacts are predicted under any of the alternatives.

8.3. Indirect and Cumulative Effects

Regional traffic data were generated and used in this analysis, accounting for expected regional land use and growth. As a result, this noise and vibration assessment has incorporated any expected cumulative and indirect traffic increases in the long-term impacts.

8.4. Short-Term Construction-Related Impacts

Under the build alternatives, during construction of the proposed project improvements, noise and vibration levels in the project corridor may increase due to normal construction activities. However, daytime construction noise is exempt from provisions contained in the City of Eugene Municipal Code. Under the City of Eugene Municipal Code noise ordinance, project construction could be performed during the normal daytime hours of 7:00 a.m. to 7:00 p.m. Similarly, under the City of Springfield Municipal Code noise ordinance, project construction could be performed during the normal daytime hours of 7:00 a.m. to 6:00 p.m. without having to obtain a variance or other exemption. No construction noise impacts are predicted for any alternative if construction is performed during the allowable hours.

If construction was planned outside the hours of 7:00 a.m. to 7:00 p.m., the project would be required to obtain a noise variance from local jurisdictions. As part of the variance process, a construction noise analysis would be performed. The construction specifications would contain limitations, if any, specific to the night work proposed and potential construction noise impacts.

8.5. Potential Mitigation Measures

Noise mitigation will be considered for impacted areas under the Martin Luther King, Jr. Boulevard Corridor Enhanced Corridor Alternative. No vibration impacts are predicted and no vibration mitigation will be considered unless further analysis dictates otherwise. Mitigation for both noise and vibration impacts, if any, will be evaluated using the criteria contained in the FTA Manual (FTA, 2006). During final design, all impacts and potential mitigation measures will be reviewed for verification. If it is discovered

that the mitigation can be achieved by less costly means, or a detailed analysis shows no impact, then the mitigation measure may be eliminated.

The need for mitigation will be assessed based on the severity of the impact, existing and future noise levels, including a comparison to the No-Build Alternative, and the land use and potential for land use change in the future. Locations with impacts in the severe category will be those most likely to have noise mitigation measures applied. Sites with moderate impacts will be evaluated based on the existing and future noise levels and area land use. For noise, mitigation for both moderate and severe impacts will begin with source treatment, followed by treatments in the noise path. If source and path treatments are not sufficient to mitigate the impact, then affected properties with severe impacts, and properties where the existing building does not already achieve sufficient exterior-to-interior noise reduction, may be evaluated for sound insulation implementation.

8.5.1. Noise Source Mitigation

Noise source mitigation consists of using new modern vehicles with the appropriate mufflers and engine shrouds. Lane Transit District already employs a modern and well maintained bus fleet, and no further source mitigation is necessary.

8.5.2. Noise Path Mitigation

Typical noise path mitigation includes earth berms, sound walls, and buffer zones. Constructing barriers between the bus roadways and the affected receivers would reduce noise levels by physically blocking the transmission of noise generated by the buses. Barriers can be constructed as walls or earth berms. Berms require more right of way than walls and are usually constructed with a 3-to-1 slope. For this project, berms generally would not be feasible because of topographical conditions and limited right of way.

A standard concrete sound wall is typically used for transit projects. Sound walls should be high enough to break the line of sight between the noise source and the receiver. The typical height for sound walls is 8 to 14 feet. Sound walls must also be long enough to prevent flanking of noise around the ends of the walls. Openings in sound walls for driveway connections or intersecting streets greatly reduce the effectiveness of these walls.

Buffer zones are undeveloped open spaces between the noise source and receiver. Buffer zones are created when an agency purchases land or development rights in addition to the normal right of way, so that future dwellings cannot be constructed close to the noise source. The build alternative corridors are generally in an urban area where land is at a premium, so creating buffer zones is not a feasible form of noise mitigation because doing so would require substantially more project-related displacements.

8.5.3. Noise Receiver Mitigation

For situations where noise path mitigation would be either unfeasible or ineffective, adding sound insulation to buildings will be considered for mitigation of project noise under special circumstances. Circumstances that warrant considering sound insulation could include no alternative mitigation measures, high future-build noise levels, and impacts to residences, schools, and hospitals in the FTA severe category. Sound insulation reduces the interior noise levels in sleeping and living quarters at residential properties or in noise-sensitive areas at schools and other institutional properties to within the guidelines set by the U.S. Department of Housing and Urban Development. Under these guidelines, interior noise levels for residential properties should not exceed 45 dBA Ldn, and a form of fresh air

exchange must be maintained. The air exchange can be achieved by opening a window or using a ventilation system. Sound insulation is normally only used on older dwellings with single-paned windows, or in buildings with double-paned windows that are no longer effective because of leakage. Sound insulation would not reduce exterior noise levels. For schools and other institutional properties, a maximum interior noise level of 52 dBA during peak operational hours is used as the criterion.

8.5.4. Vibration Mitigation

No vibration impacts are expected as part of the project. Therefore, no mitigation is required.

8.6. Permits and Approvals

There are no noise- or vibration-related permits required for system operations. During construction, a noise variance may be necessary if construction is proposed outside the allowable hours of the local jurisdiction.

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Appendix A: Glossary and Naming Conventions

This appendix includes a detailed list of acronyms, abbreviations, and technical terms used throughout this report. It also includes naming conventions used in the MovingAhead Project.

Acronyms and Abbreviations

Table A-1. Acronyms and Abbreviations

Acronyms and Abbreviations	Definitions
/H-RCP	Historic Structures or Sites Combine Zone
/WP	Waterside Protection
/WQ	Water Quality
°C	degree(s) Celsius
µg/L	microgram(s) per liter
µg/m^3	microgram(s) per cubic meter
AA	Alternatives Analysis
AAC	all aluminum conductor
AASHTO	American Association of State Highway and Transportation Officials
AAI	All Appropriate Inquiry
ACS	American Community Survey
ADA	Americans with Disabilities Act
AEO	Annual Energy Outlook
APE	Area of Potential Effect
API	Area of Potential Impact
approx.	Approximately
ARTS	All Roads Transportation Safety Program
ATR	Automated Traffic Recording
BAT	business access and transit
BEST	Better Eugene Springfield Transit
BFE	Base Flood Elevation
BMP	best management practice
BPA	Bonneville Power Administration
BRT	bus rapid transit
Btu	British thermal unit
c	Circa
CAA	Clean Air Act
CAFE	Corporate Average Fuel Economy
CEQ	Council on Environmental Quality

Table A-1. Acronyms and Abbreviations

Acronyms and Abbreviations	Definitions
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERCLIS	Comprehensive Environmental Response Compensation and Liability Information System
CFR	Code of Federal Regulations
CFU	Colony-Forming Unit
CH2M	CH2M HILL, Inc.
CIG	Capital Investment Grant
CIP	Capital Improvements Program
City	City of Eugene
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COGP	County Opportunity Grant Program
Corps	U.S. Army Corps of Engineers
CRL	Confirmed Release List
CSZ	Cascadia Subduction Zone
CTR	commute trip reduction
CWA	Clean Water Act
CY	cubic yard
dB	Decibel
dBA	A-weighted decibel
DBE	Disadvantaged Business Enterprise
DEIS	Draft Environmental Impact Statement. Also referred to as Draft EIS.
DEQ	Oregon Department of Environmental Quality
DKS	DKS Associates
DLS	Donation Land Claim
DOE	Determination of Eligibility
DOGAMI	Oregon Department of Geology and Mineral Industries
Draft EIS	Draft Environmental Impact Statement. Also referred to as DEIS.
Draft Envision Eugene	*Draft Envision Eugene Community Vision* (Envision Eugene, 2016, July)
Draft Eugene 2035 TSP	*Draft Eugene 2035 Transportation System Plan* (Central Lane MPO, 2016, May)
DSL	Oregon Department of State Lands
DU	dwelling unit
EA	Environmental Assessment or each
EC	City of Eugene Code
EC	eligible contributing

Table A-1. Acronyms and Abbreviations

Acronyms and Abbreviations	Definitions
EC	Enhanced Corridor Alternative (in some tables)
ECLA	*Eugene Comprehensive Lands Assessment* (ECONorthwest, 2010, June)
ECSI	Environmental Cleanup Site Information database (Oregon DEQ, 2016)
EFH	essential fish habitat
EIS	Environmental Impact Statement
EJ	Environmental Justice
EmX	Emerald Express, Lane Transit District's Bus Rapid Transit System
EmX	EmX Alternative (in some tables)
EOA	Equity and Opportunity Assessment
EPA	U. S. Environmental Protection Agency
ES	eligible significant
ES NR	eligible significant NRHP
ESA	Endangered Species Act or Environmental Site Assessment
ESH	essential indigenous anadromous salmonid habitat
ESU	Evolutionarily Significant Unit
EWEB	Eugene Water & Electric Board
FAST Act	Fixing America's Surface Transportation Act
FEIS	Final Environmental Impact Statement. Also referred to as Final EIS.
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act of 1974
Final EIS	Final Environmental Impact Statement. Also referred to as FEIS.
FOE	Finding of Effect
FPPA	Farmland Protection Policy Act, 7 U.S.C. 4201-4209 and 7 CFR 658
FRA	Federal Railroad Administration
ft	foot (feet)
ft^2	square foot (feet)
FTA	Federal Transit Administration
FTN	Frequent Transit Network
FY	fiscal year
GAN	Grant Anticipation Note
GARVEE	Grant Anticipation Revenue Vehicle
GHG	greenhouse gas
GIS	geographic information system
GLO	General Land Office
Heritage	Heritage Research Associates, Inc.

Table A-1. Acronyms and Abbreviations

Acronyms and Abbreviations	Definitions
HGM	Hydro-geomorphic
HMTA	Hazardous Materials Transport Act of 1975, with amendments in 1990 and 1994
HOV	high-occupancy vehicle
HPNW	Historic Preservation Northwest
I-5	Interstate 5
I-105	Interstate 105
IOF	Immediate Opportunity Fund
ISA	International Society of Arboriculture
ISTEA	Intermodal Surface Transportation Efficiency Act
kV	kilovolt(s)
LaneACT	Lane Area Commission on Transportation
LCC	Lane Community College
LCDC	Land Conservation and Development Commission
LCOG	Lane Council of Governments
Ldn	day-night sound level
LE	Listed Endangered
LEP	limited English proficiency
L_{eq}	equivalent sound level
LF	lineal foot (feet)
LGAC	Local Government Affairs Council
LGGP	Local Government Grant Program
LID	Local Improvement District
L_{max}	maximum sound level
L_{min}	minimum sound level
LNG	liquefied natural gas
LOS	level of service
LPA	Locally Preferred Alternative
LRAPA	Lane Regional Air Protection Agency
LRFP	LTD's Long-Range Financial Plan
LRT	Light Rail Transit
LRTP	LTD's Long-Range Transit Plan
LT	Listed Threatened
LTD	Lane Transit District
LUST	leaking underground storage tank
LWCF	Land and Water Conservation Fund
m	meter(s)

Table A-1. Acronyms and Abbreviations

Acronyms and Abbreviations	Definitions
MAP-21	Moving Ahead for Progress in the 21st Century
MBTA	Migratory Bird Treaty Act
Metro Plan	*Metro Plan, Eugene-Springfield Metropolitan Area General Plan* (LCOG et al., 1987, as updated on 2015, December 31)
mg/kg	milligram(s) per kilogram
MI	mile(s)
mL	milliliter(s)
MMA	Michael Minor and Associates, Inc.
MOA	Memorandum of Agreement
MOE	Measure of Effectiveness
MPC	Metropolitan Policy Committee
mpg	miles per gallon
mph	miles per hour
MPO	Metropolitan Planning Organization
MTIP	*Metropolitan Transportation Improvement Program Federal FY 2015 to Federal FY 2018* (Central Lane MPO, adopted 2014, October, as amended)
Mw	Earthquake moment magnitude
N/A	not applicable
NA	not applicable; no data available
NAAQS	National Ambient Air Quality Standards
NAC	Noise Abatement Criteria
NAVD88	North American Vertical Datum of 1988
ND	nodal development
NEPA	National Environmental Policy Act of 1969, as amended, 42 U.S.C. 4321-4347
NFA	no further action
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_2	nitrous dioxide
NO_x	nitrous oxides
NPDES	National Pollutant Discharge Elimination System
NPMS	National Pipeline Mapping System
NPS	Department of Interior's National Park Service
NR	Natural Resource
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NS	no standard established

Table A-1. Acronyms and Abbreviations

Acronyms and Abbreviations	Definitions
NW Natural	Northwest Natural
O_3	Ozone
O&M	operations and maintenance
OAR	Oregon Administrative Rule
OARRA	Oregon Archaeological Records Remote Access
ODA	Oregon Department of Agriculture
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
ODOE	Oregon Department of Energy
ODOT	Oregon Department of Transportation
OHP	Oregon Highway Plan
OPA	Oil Pollution Act of 1990
OPRD	Oregon Parks and Recreation Department
OR	Oregon
ORBIC	Oregon Biodiversity Information Center
ORS	Oregon Revised Statutes
OTIB	Oregon Transportation Infrastructure Bank
Pb	Lead
PCB	polychlorinated biphenyl
PEM	Palustrine Emergent Wetland
PM	particulate matter
PM_{10}	particulate matter – 10 microns in diameter
$PM_{2.5}$	particulate matter – 2.5 microns in diameter
PMT	Project Management Team
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
PROS	Parks, Recreation, and Open Space
PUC	Public Utilities Commission
Qls	landslide and debris avalanche deposits
Qtg	terrace and fan deposits
Qty	Quantity
RCRA	Resource Conservation and Recovery Act of 1976
RFFA	reasonably foreseeable future action
ROW	right of way
RRFB	Rectangular Rapid Flash Beacon

Table A-1. Acronyms and Abbreviations

Acronyms and Abbreviations	Definitions
RTP	*Central Lane Metropolitan Planning Organization Regional Transportation Plan* (LCOG, adopted 2007, November; 2011, December). (The RTP includes the Financially Constrained Roadway Projects List)
SARA	Superfund Amendments and Reauthorization Act of 1986
SARA III	Emergency Planning and Community Right to Know Act of 1986; part of the SARA amendments
SC	sensitive critical
SCC	Standard Cost Categories
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SDC	Systems Development Charge
SDWA	Safe Drinking Water Act
sec	second(s)
Section 4(f)	Section 4(f) of the Department of Transportation Act of 1966
Section 6(f)	Section 6(f) of the LWCF Act of 1965
Section 106	Section 106 of the National Historic Preservation Act of 1966 (36 CFR 800.5)
SF	square foot (feet)
SHPO	Oregon State Historic Preservation Office
SIP	State Implementation Plan
SMU	Species Management Unit
SO_2	sulfur dioxide
SOC	species of concern
SSGA	Small Starts Construction Grant Agreement
STA	Special Transportation Area
STIP	Statewide Transportation Improvement Program
SV	Sensitive Vulnerable
SY	square yard(s)
TAP	Transportation Alternatives Program
TAZ	transportation analysis zone
TCE	Temporary Construction Easement
TD	transit-oriented development
TDM	Transportation Demand Management
TEA-21	Transportation Equity Act for the 21st Century
Teoe	siliciclastic marine sedimentary rocks
TESCP	Temporary Erosion and Sediment Control Plan
TIF	Tax Increment Financing
TIP	Transportation Improvement Program
TMDL	total maximum daily load

Table A-1. Acronyms and Abbreviations

Acronyms and Abbreviations	Definitions
TOD	transit-oriented development
TPAU	Department of Transportation – Transportation Planning Analysis Unit
TPR	Transportation Planning Rule
TransPlan	*Eugene-Springfield Transportation System Plan* (City of Eugene et al., adopted 2002, July)
TRB	Transportation Research Board
TSI	Transportation System Improvement
TSM	Transportation System Management
TSP	Transportation System Plan
UGB	Urban Growth Boundary
UMTA	Urban Mass Transit Administration
Uniform Act	Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, 42 U.S.C. 4601 et. seq., 49 CFR Part 24
URA	Urban Renewal Area
U.S.C.	United States Code
USDOT	U.S. Department of Transportation
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
v/c	volume-to-capacity
VHT	vehicle hours traveled
VMT	vehicle miles traveled
VOC	volatile organic compound
WEEE	West Eugene EmX Extension
WEG	wind erodibility group
YOE	year of expenditure

Terms

Table A-2. Terms

Terms	Definitions
Accessibility	The extent to which facilities are barrier-free and useable for all persons with or without disabilities.
Action	An "action," a federal term, is the construction or reconstruction, including associated activities, of a transportation facility. For the purposes of this Handbook, the terms "project," "proposal," and "action" are used interchangeably unless otherwise specified. An action may be categorized as a "categorical exclusion" or a "major federal action."
Agricultural/Forest/Natural Resource	AG, EFU-25, EFU-30, EFU-40, F-1, F-2, and NR
Alignment	Alignment is the street or corridor that the transit project would be located within.
Alternative Fuels	Low-polluting fuels which are used to propel a vehicle instead of high-sulfur diesel or gasoline. Examples include methanol, ethanol, propane or compressed natural gas, liquid natural gas, low-sulfur or "clean" diesel and electricity.
Alternatives Analysis (AA)	The process of evaluating the costs, benefits, and impacts of a range of transportation alternatives designed to address mobility problems and other locally-defined objectives in a defined transportation corridor, and for determining which particular investment strategy should be advanced for more focused study and development. The Alternatives Analysis (AA) process provides a foundation for effective decision making.
Area of Potential Effect	A term used in Section 106 to describe the area in which historic resources may be affected by a federal undertaking.
Area of Potential Impact	An Assessment's Area of Potential Impact for the project is defined separately for each discipline.
Auxiliary Lanes	Lanes designed to improve safety and reduce congestion by accommodating cars and trucks entering or exiting the highway or roadway, and reducing conflicting weaving and merging movements.
Base Fare	The price charged to one adult for one transit ride; excludes transfer charges, and reduced fares.
Base Period	The period between the morning and evening peak periods when transit service is generally scheduled on a constant interval. Also known as "off-peak period."
Boarding	Boarding is a term used in transit to account for passengers of public transit systems. One person getting on a transit vehicle equals one boarding. In many cases, individuals will have to transfer to an additional transit vehicle to reach their destination and may well use transit for the return trip. Therefore, a single rider may account for several transit boardings in one day.
Bus Phase	An exclusive traffic signal phase for buses and/or BRT vehicles.
Bus Rapid Transit (BRT)	A transit mode that combines the quality of rail transit and the flexibility of buses. It can operate on bus lanes, high-occupancy vehicle (HOV) lanes, expressways, or ordinary streets. The vehicles are designed to allow rapid passenger loading and unloading, with more doors than ordinary buses.

Table A-2. Terms

Terms	Definitions
Business Access and Transit (BAT) Lane	In general, a BAT lane is a concrete lane, separated from general-purpose lanes by a paint stripe and signage. A BAT lane provides Bus Rapid Transit (BRT) priority operations, but general-purpose traffic is allowed to travel within the lane to make a turn into or out of a driveway or at an intersecting street. However, only the BRT vehicle is allowed to use the lane to cross an intersecting street.
Busway	Exclusive freeway lane for buses and carpools.
Capital Improvements Program (CIP)	A CIP is a short-range plan, usually 4 to 10 years, which identifies capital projects and equipment purchases, provides a planning schedule, and identifies options for funding projects in the program.
Categorical Exclusion (CE)	A CE means a category of actions that do not individually or cumulatively have a significant effect on the human environment and for which, therefore, neither an environmental assessment nor an environmental impact statement is required.
Chambers Special Area Zone	S-C
Charter Tree	A tree defined by the Eugene Charter (City of Eugene, 2002, updated 2008) as "…(a living, standing, woody plant having a trunk 25 inches in circumference at a point 4-½ feet above mean ground level at the base of the trunk) of at least fifty years of age within publicly owned rights of way for streets, roads, freeways, throughways, and thoroughfares and within those portions of the city which were in the incorporated boundaries of the city as of January 1, 1915, shall be designated historic street trees and recognized as objects of high historic value and significance in the history of the city and deserving of maintenance and protection." These trees have special historic importance to the City and require special processes be followed if their removal is proposed, including a public vote on the project proposing the removal.
Charter Tree Boundary	Defined by the Eugene Charter (City of Eugene, 2002, updated 2008) as "…those portions of the city which were in the incorporated boundaries of the city as of January 1, 1915." Trees within this boundary may, if they meet certain criteria, be granted the special title and protective status of a Charter Tree, defined above.
City of Eugene Zoning Classifications	Industrial (I-2 and I-3), Commercial (C-3), Mixed-Use (C-1, C-2, GO, S-C, S-CN, S-DR, S-DW, S-E, S-F, S-HB, S-JW, S-RN, S-W, and S-WS), Single-Family Residential (R-1), Multi-Family Residential (R-2 and R-3), Institution (PL and PRO), Agricultural/Forest/Natural Resource (AG, EFU-25, EFU-30, EFU-40, F-1, F-2, and NR), Office (E-1 and E-2), Special Area Zone (Non-Mixed Use) (S-H and S-RP), Downtown Westside Special Area Zone (S-DW), Chambers Special Area Zone (S-C)
Clean Air Act Amendments of 1990	The comprehensive federal legislation that establishes criteria for attaining and maintaining the federal standards for allowable concentrations and exposure limits for various air pollutants; the act also provides emission standards for specific vehicles and fuels.
Collector Streets	Collector streets provide a balance of both access and circulation within and between residential and commercial/industrial areas. Collectors differ from arterials in that they provide more of a citywide circulation function, do not require as extensive control of access, and are located in residential neighborhoods, distributing trips from the neighborhood and local street system.
Commercial	C-3

Table A-2. Terms

Terms	Definitions
Commuter Rail	Commuter rail is a transit mode that is a multiple car electric or diesel propelled train. It is typically used for local, longer-distance travel between a central city and adjacent suburbs, and can operate alongside existing freight or passenger rail lines or in exclusive rights of way.
Compressed Natural Gas (CNG)	An alternative fuel; compressed natural gas stored under high pressure. CNG vapor is lighter than air.
Conformity	The ongoing process that ensures the planning for highway and transit systems, as a whole and over the long term, is consistent with the state air quality plans for attaining and maintaining health-based air quality standards; conformity is determined by metropolitan planning organizations (MPOs) and the U.S. Department of Transportation (USDOT), and is based on whether transportation plans and programs meet the provisions of a State Implementation Plan.
Congestion Mitigation and Air Quality (CMAQ)	Federal funds available for either transit or highway projects that contribute significantly to reducing automobile emissions, which cause air pollution.
Cooperating Agency	Regulations that implement the National Environmental Policy Act define a cooperating agency as any federal agency, other than a lead agency, which has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major federal action significantly affecting the quality of the human environment.
Coordination Plan	Required under Moving Ahead for Progress in the 21st Century (MAP-21), the coordination plan contains procedures aimed at achieving consensus among all parties in the initial phase of environmental review and to pre-empt disagreements that can create delays later on in a project.
Corridor	A broad geographical band that follows a general directional flow connecting major sources of trips that may contain a number of streets, highways, and transit route alignments.
Corridor Transit Service Characteristics	The amount of transit service provided in each corridor, measured by daily vehicle hours traveled, daily vehicle miles traveled, and daily place-miles of service.
Demand Responsive	Non-fixed-route service utilizing vans or buses with passengers boarding and alighting at pre-arranged times at any location within the system's service area. Also called “Dial-a-Ride.”
Diesel Multiple Unit (DMU)	Each unit carries passengers and can be self-powered by a diesel motor; no engine unit is required.
Documented Categorical Exclusion (DCE)	A DCE means a group of actions that may also qualify as Categorical Exclusions (CEs) if it can be demonstrated that the context in which the action is taken warrants a CE exclusion; i.e., that no significant environmental impact will occur. Thus, these actions are referred to as DCEs. Such actions require some National Environmental Policy Act documentation, but not an Environmental Assessment or a full-scale Environmental Impact Statement. DCEs documentation must demonstrate that, in the context(s) in which these actions are to be performed, they will have no significant environmental impact or that such impacts will be mitigated.
Downtown Westside Special Area Zone	S-DW

Table A-2. Terms

Terms	Definitions
Draft Environmental Impact Statement (DEIS)	The DEIS is the document that details the results of the detailed analysis of all of the projects alternatives. The DEIS contains all information learned about the impacts of a project and alternatives.
Earmark	A federal budgetary term that refers to the specific designation by Congress that part of a more general lump-sum appropriation be used for a particular project; the earmark can be designated as a minimum and/or maximum dollar amount.
Effects	Effects include ecological, aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions that may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial. Effects include: (1) direct effects that are caused by the action and occur at the same time and place, and (2) indirect effects that are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use; population density or growth rate; and related effects on air and water and other natural systems, including ecosystems (40 CFR 1508.8).
Electrical Multiple Unit (EMU)	The EMU is heavier than a light rail vehicle, but it is powered in the same way by an overhead electrical system.
EmX	Lane Transit District's Bus Rapid Transit System, pronounced "MX," short for Emerald Express.
Environmental Assessment (EA)	A report subject to the requirements of the National Environmental Policy Act (NEPA) demonstrating that an Environmental Impact Statement (EIS) is not needed for a specific set of actions. The EA can lead to a Finding of No Significant Impact (FONSI).
Environmental Impact Statement (EIS)	A comprehensive study of likely environmental impacts resulting from major federally-assisted projects; EISsare required by the National Environmental Policy Act.
Environmental Justice	A formal federal policy on environmental justice was established in February 1994 with Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations." There are three fundamental environmental justice principles: • To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations. • To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process. • To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.
Envision Eugene	The City of Eugene's Comprehensive Plan (latest draft or as adopted). Envision Eugene includes a determination of the best way to accommodate the community's projected needs over the next 20 years.

Table A-2. Terms

Terms	Definitions
Evaluation Criteria	Evaluation criteria are the factors used to determine how well each of the proposed multimodal alternatives would meet the project's Goals and Objectives. The Evaluation Criteria require a mix of quantitative data and qualitative assessment. The resulting data are used to measure the effectiveness of proposed multimodal alternatives and to assist in comparing and contrasting each of the alternatives to select a preferred alternative.
Exclusive Right of Way	A roadway or other facility that can only be used by buses or other transit vehicles.
Fatal Flaw Screening	The purpose of a Fatal Flaw Screening is to identify alternatives that will not work for one reason or another (e.g., environmental, economic, community). By using a Fatal Flaw Screening process to eliminate alternatives that are not likely to be viable, a project can avoid wasting time or money studying options that are not viable and focus on alternatives and solutions that have the greatest probability of meeting the community's needs (e.g., environmentally acceptable, economically efficient, implementable).
Finding of No Significant Impact (FONSI)	A document prepared by a federal agency showing why a proposed action would not have a significant impact on the environment and thus would not require preparation of an Environmental Impact Statement (EIS). A FONSI is based on the results of an Environmental Assessment (EA).
Fixed Guideway System	A system of vehicles that can operate only on its own guideway constructed for that purpose (e.g., rapid rail, light rail). Federal usage in funding legislation also includes exclusive right of way bus operations, trolley coaches, and ferryboats as "fixed guideway" transit.
Fixed Route	Service provided on a repetitive, fixed-schedule basis along a specific route with vehicles stopping to pick up and deliver passengers at set stops and stations; each fixed-route trip serves the same origins and destinations, unlike demand responsive and taxicabs.
Geographic Information System (GIS)	A data management software tool that enables data to be displayed geographically (i.e., as maps).
Goals and Objectives	Goals and objectives define the project's desired outcome and reflect community values. Goals and objectives build from the project's Purpose and Need Statement. • Goals are overarching principles that guide decision making. Goals are broad statements. • Objectives define strategies or implementation steps to attain the goals. Unlike goals, objectives are specific and measurable.
Guideway	A transit right of way separated from general purpose vehicles.
Headway	Time interval between vehicles passing the same point while moving in the same direction on a particular route.

Table A-2. Terms

Terms	Definitions
Heritage Tree	The C*ity of Eugene Urban Forest Management Plan* (City of Eugene Public Works Department Maintenance Division, 1992) defines "Heritage Trees" as: "Any tree of exceptional value to our community based on its size (relative to species), history, location, or species, or any combination of these criteria." Such a tree cannot be removed "except when otherwise necessary for the public health, safety, or welfare."
Hydrology	Refers to the flow of water including its volume, where it drains, and how quickly it flows.
Impacts	A term to describe the positive or negative effects upon the natural or built environments as a result of an action (i.e., project).
In-vehicle Travel Time	The amount of time it takes for a transit vehicle to travel between an origin and a destination.
In-vehicle Walk and Wait Travel Time	The amount of in-vehicle travel time plus time spent walking to transit, initial wait time, transfer wait time (if any), and time walking from transit to the destination.
Independent Utility	A project or section of a larger project that would be a usable and reasonable expenditure even if no other projects or sections of a larger project were built and/or improved.
Industrial	I-2 and I-3
Institution	PL and PRO
Intergovernmental Agreement	A legal pact authorized by state law between two or more units of government, in which the parties contract for, or agree on, the performance of a specific activity through either mutual or delegated provision.
Intermodal	Those issues or activities that involve or affect more than one mode of transportation, including transportation connections, choices, cooperation, and coordination of various modes. Also known as "multimodal."
Jefferson Westside Special Area Zone	S-JW
Joint Development	Ventures undertaken by the public and private sectors for development of land around transit stations or stops.
Key Transit Corridors	Key Transit Corridors are mapped in Envision Eugene and are anticipated to be significant transit corridors for the City and the region
Kiss & Ride	A place where commuters are driven and dropped off at a station to board a public transportation vehicle.
Land and Water Conservation Fund (LWCF) Act of 1965	16 U.S.C. 4601-4 et seq. The Land and Water Conservation Fund (LWCF) State Assistance Program was established by the LWCF Act of 1965 to stimulate a nationwide action program to assist in preserving, developing, and providing assurance to all citizens of the United States (of present and future generations) such quality and quantity of outdoor recreation resources as may be available, necessary, and desirable for individual active participation. The program provides matching grants to states and through states to local units of government, for the acquisition and development of public outdoor recreation sites and facilities.
Landscape Tree	A living, standing, woody plant having a trunk that exists on private property.

Table A-2. Terms

Terms	Definitions
Lane Regional Air Protection Agency (LRAPA)	LRAPA is responsible for achieving and maintain clean air in Lane County using a combination of regulatory and non-regulatory methods
Layover Time	Time built into a schedule between arrival at the end of a route and the departure for the return trip, used for the recovery of delays and preparation for the return trip.
Lead Agency	The organization that contracts and administers a study. For transit projects, FTA would typically fill this role. The lead agency has the final say about the project's purpose and need, range of alternatives to be considered, and other procedural matters.
Level of Detail	The amount of data collected, and the scale, scope, extent, and degree to which item-by-item particulars and refinements of specific points are necessary or desirable in carrying out a study.
Level of Service (LOS)	LOS is a measure used by traffic engineers to determine the effectiveness of elements of transportation infrastructure. LOS is most commonly used to analyze highways, but the concept has also been applied to intersections, transit, and water supply.
Light Rail Transit (LRT)	Steel wheel/steel rail transit constructed on city streets, semi-private right of way, or exclusive private right of way. Formerly known as "streetcar" or "trolley car" service, LRT's major advantage is operation in mixed street traffic at grade. LRT vehicles can be coupled into trains, which require only one operator and often are used to provide express service.
Limited (or Controlled) Access	Restricted entry to a transportation facility based upon facility congestion levels or operational condition. For example, a limited access roadway normally would not allow direct entry or exit to private driveways or fields from said roadway.
Liquefaction	A phenomenon associated with earthquakes in which sandy to silty, water saturated soils behave like fluids. As seismic waves pass through saturated soil, the structure of the soil distorts, and spaces between soil particles collapse, causing ground failure.
Liquefied Natural Gas (LNG)	An alternative fuel; a natural gas cooled to below its boiling point of 260 degrees Fahrenheit so that it becomes a liquid; stored in a vacuum bottle-type container at very low temperatures and under moderate pressure. LNG vapor is lighter than air.
Local Streets	Local streets have the sole function of providing direct access to adjacent land. Local streets are deliberately designed to discourage through-traffic movements.
Locally Preferred Alternative (LPA)	The LPA is the alternative selected through the Alternatives Analysis process completed prior to or concurrent with National Environmental Policy Act analysis. This term is also used to describe the proposed action that is being considered for New Starts or Small Starts funds.
Low-Income Persons	Those whose median household income is at or below the Department of Health and Human Services poverty guidelines. For a four-person household with two related children, the poverty threshold is $24,300 (year 2016 dollars).

Table A-2. Terms

Terms	Definitions
Maintenance area	An air quality designation for a geographic area in which levels of a criteria air pollutant meet the health-based primary standard (national ambient air quality standard, or NAAQS) for the pollutant. An area may have on acceptable level for one criteria air pollutant, but may have unacceptable levels for others. Maintenance/attainment areas are defined using federal pollutant limits set by EPA.
Maintenance facility	A facility along a corridor used to clean, inspect, repair and maintain bus vehicles, as well as to store them when they are not in use.
Major Arterial	Major arterial streets should serve to interconnect the roadway system of a city. These streets link major commercial, residential, industrial, and institutional areas. Major arterial streets are typically spaced about one mile apart to assure accessibility and reduce the incidence of traffic using collectors or local streets for through traffic in lieu of a well-placed arterial street. Access control, such as raised center medians, is a key feature of an arterial route. Arterials are typically multiple miles in length.
Major Investment Study (MIS)	An alternatives analysis study process for proposed transportation investments in which a wide range of alternatives is examined to produce a smaller set of alternatives that best meet project transportation needs. The purpose of the study is to provide a framework for developing a package of potential solutions that can then be further analyzed during an Environmental Impact Statement process.
Metro Plan Designations	Commercial, Commercial/Mixed Use, Government and Education, Heavy Industrial, High Density Residential/Mixed-Use, High Density Residential, Light-Medium Industrial, Low Density Residential, Medium Density Residential, Medium Density Residential/Mixed-Use, Mixed-Use, Parks and Open Space, Major Retail Center, Campus Industrial, University Research
Metropolitan Planning Organization (MPO)	The organization designated by local elected officials as being responsible for carrying out the urban transportation and other planning processes for an area.
Minimum Operable Segment	A stand-alone portion of the alternative alignment that has independent utility, allowed by FTA to be considered as interim termini for a project. A minimum operable segment (MOS) provides flexibility to initiate a project with available funding while pursuing additional funding to complete the remainder of the project.
Minor Arterial	A minor arterial street system should interconnect with and augment the urban major arterial system and provide service to trips of moderate length at a somewhat lower level of travel mobility than major arterials. This system also distributes travel to geographic areas smaller than those identified with the higher system. The minor arterial street system includes facilities that allow more access and offer a lower traffic mobility. Such facilities may carry local bus routes and provide for community trips, but ideally should not be located through residential neighborhoods.

Table A-2. Terms

Terms	Definitions
Minority	A person who is one or more of the following: • Black: a person having origins in any of the black racial groups of Africa • Hispanic or Latino: a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race • Asian American: a person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent • American Indian and Alaskan Native: a person having origins in any of the original people of North America, South America (including Central America), and who maintains cultural identification through tribal affiliation or community recognition • Native Hawaiian and Other Pacific Islander: a person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands
Mitigation	A means to avoid, minimize, rectify, or reduce an impact, and in some cases, to compensate for an impact.
Mixed-Use	C-1, C-2, GO, S-C, S-CN, S-DR, S-DW, S-E, S-F, S-HB, S-JW, S-RN, S-W, and S-WS
Modal Split	A term that describes how many people use different forms of transportation. Frequently used to describe the percentage of people using private automobiles as opposed to the percentage using public transportation, walking, or biking. Modal split can also be used to describe travelers using other modes of transportation. In freight transportation, modal split may be measured in mass.
Mode	A particular form or method of travel distinguished by vehicle type, operation technology, and right-of-way separation from other traffic.
Moving Ahead for Progress in the 21st Century (MAP-21)	Moving Ahead for Progress in the 21st Century (MAP-21) was signed by President Obama on July 6, 2012, reauthorizing surface transportation programs through FY 2014. It includes new and revised program guidance and regulations with planning requirements related to public participation, publication, and environmental considerations.
MovingAhead Project	The City of Eugene and LTD are working with regional partners and the community to determine which improvements are needed on some of our most important transportation corridors for people using transit, and facilities for people walking and biking. MovingAhead will prioritize transit, walking, and biking projects along these corridors so that they can be funded and built in the near-term. The project will focus on creating active, vibrant places that serve the community and accommodate future growth. During Phase 1, currently underway, the community will weigh in on preferred transportation solutions for each corridor and help prioritize corridors for implementation. When thinking about these important streets, LTD and the City of Eugene refer to them as corridors because several streets may work as a system to serve transportation needs.
Multi-Family Residential	R-2 and R-3
Multimodal	Multimodal refers to various modes. For the MovingAhead project, multimodal refers to Corridors that support various transportation modes including vehicles, buses, walking and cycling.

Table A-2. Terms

Terms	Definitions
National Environmental Policy Act of 1969 (NEPA)	A comprehensive federal law requiring analysis of the environmental impacts of federal actions such as the approval of grants; also requiring preparation of an Environmental Impact Statement for every major federal action significantly affecting the quality of the human environment.
New Starts	Federal funding granted under Section 3(i) of the Federal Transit Act. These discretionary funds are made available for construction of a new fixed guideway system or extension of any existing fixed guideway system, based on cost-effectiveness, alternatives analysis results, and the degree of local financial commitment.
No Action or No-Build Alternative	An alternative that is used as the basis to measure the impacts and benefits of the other alternative(s) in an environmental assessment or other National Environmental Policy Act action. The No-Build Alternative consists of the existing conditions, plus any improvements that have been identified in the Statewide Transportation Improvement Program.
Nonattainment Area	Any geographic region of the United States that the U.S. Environmental Protection Agency (EPA) has designated as not attaining the federal air quality standards for one or more air pollutants, such as ozone and carbon monoxide.
Notice of Intent	A federal announcement, printed in the *Federal Register*, advising interested parties that an Environmental Impact Statement will be prepared and circulated for a given project
Off-Peak Period	Non-rush periods of the day when travel activity is generally lower and less transit service is scheduled. Also called "base period."
Office	E-1 and E-2
Oregon Statewide Comprehensive Outdoor Recreation Plan (SCORP)	The 2013-2017 Oregon Statewide Comprehensive Outdoor Recreation Plan (SCORP), entitled *Ensuring Oregon's Outdoor Legacy* (OPRD, No Date), constitutes Oregon's basic 5-year plan for outdoor recreation. The plan guides the use of LWCF funds that come into the state; provides guidance for other OPRD-administered grant programs; and provides recommendations to guide federal, state, and local units of government, as well as the private sector, in making policy and planning decisions.
Park and Ride	Designated parking areas for automobile drivers who then board transit vehicles from these locations.
Participating Agency	A federal or non-federal agency that may have an interest in the project. These agencies are identified and contacted early-on in the project with an invitation to participate in the process. This is a broader category than "cooperating agency" (see Cooperating Agency).
Passenger Miles	The total number of miles traveled by passengers on transit vehicles; determined by multiplying the number of unlinked passenger trips times the average length of their trips.
Peak Hour	The hour of the day in which the maximum demand for transportation service is experienced (refers to private automobiles and transit vehicles).
Peak Period	Morning and afternoon time periods when transit riding is heaviest.

Table A-2. Terms

Terms	Definitions
Peak/Base Ratio	The number of vehicles operated in passenger service during the peak period divided by the number operated during the base period.
Place-miles	Place-miles refers to the total carrying capacity (seated and standing) of each bus and is calculated by multiplying vehicle capacity of each bus by the number of service miles traveled each day. Place-miles highlight differences among alternatives caused by a different mix of vehicles and levels of service.
Preferred Alternative	An alternative that includes a major capital improvement project to address the problem under investigation. As part of the decision making process, the Preferred Alternative is compared against the No Action or No-Build Alternative from the standpoints of transportation performance, environmental consequences, cost-effectiveness, and funding considerations.
Purpose and Need	The project Purpose and Need provides a framework for developing and screening alternatives. The purpose is a broad statement of the project's transportation objectives. The need is a detailed explanation of existing conditions that need to be changed or problems that need to be fixed.
Queuing	Occurs when traffic lanes cannot fit all the vehicles trying to use them, or if the line at an intersection extends into an upstream intersection.
Record of Decision (ROD)	A decision made by FTA as to whether the project sponsor receives federal funding for a project. The Record of Decision follows the Draft EIS and Final EIS.
Regulatory Agency	An agency empowered to issue or deny permits.
Resource Agency	A federal or state agency or commission that has jurisdictional responsibilities for the management of a resource such as plants, animals, water, or historic sites.
Revenue Hours	Hours of transit service available for carrying paying riders.
Ridership	The number of people using a public transportation system in a given time period.
Ridesharing	A form of transportation, other than public transit, in which more than one person shares the use of the vehicle, such as a van or car, to make a trip. Also known as "carpooling" or "vanpooling."
Right of Way	Publicly owned land that can be acquired and used for transportation purposes.
Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFETEA-LU)	SAFETEA-LU was passed by Congress July 29, 2005, and signed by the President August 10, 2005. Includes new and revised program guidance and regulations (approximately 15 rulemakings) with planning requirements related to public participation, publication, and environmental considerations. SAFETEA-LU covers FY 2005 through FY 2009 with a total authorization of $45.3 billion.
Scoping	A formal coordination process used to determine the scope of the project and the major issues likely to be related to the proposed action (i.e., project).
Screening Criteria	Criteria used to compare alternatives.
Section 4(f) of the Department of Transportation Act of 1966	23 U.S.C. 138 and 49 U.S.C. 303. Parks are subject to evaluation in the context of Section 4(f) of the Department of Transportation Act of 1966, which governs the use of publicly-owned/open to the public park and recreation lands, government-owned wildlife lands, and historic resources.

Table A-2. Terms

Terms	Definitions
Section 4(f) resources	(i) any publicly owned land in a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance, or (ii) any land from a historic site of national, state, or local significance
Section 6(f) of the LWCF Act of 1965	The LWCF's most important tool for ensuring long-term stewardship is its "conversion protection" requirement. Section 6(f)(3) strongly discourages conversions of state and local park, and recreational facilities to other uses. Conversion of property acquired or developed with assistance under the program requires approval of the Department of Interior's National Park Service (NPS) and substitution of other recreational properties of at least equal fair market value, and of reasonably equivalent usefulness and location.
Section 106	Section 106 of the National Historic Preservation Act of 1966 requires that federal agencies take into account the effect of government-funded construction projects on property that is included in, or eligible for inclusion in, the NRHP.
Shuttle	A public or private vehicle that travels back and forth over a particular route, especially a short route or one that provides connections between transportation systems, employment centers, etc.
Single-Family Residential	R-1
Special Area Zone (Non-Mixed Use)	S-H and S-RP
Springfield 2030	Currently underway, this update to the City of Springfield's Comprehensive Plan will guide and support attainment of the community's livability and economic prosperity goals and redevelopment priorities.
Springfield Transportation System Plan (TSP)	The City of Springfield's Transportation System Plan looks at how the transportation system is currently used and how it should change to meet the long-term (20-year) needs of the City of Springfield's residents, businesses, and visitors. The Plan, which identifies improvements for all modes of transportation, will serve as the City of Springfield's portion of the Regional Transportation System Plan prepared by Lane Council of Governments (LCOG). It was prepared in coordination with Oregon Department of Transportation, LCOG, and the Oregon Department of Land Conservation and Development. The TSP was adopted March 11, 2014.
State Implementation Plan (SIP)	A state plan mandated by the Clean Air Act Amendments of 1990 that contains procedures to monitor, control, maintain, and enforce compliance with national standards for air quality.
Strategy	An intended action or series of actions which when implemented achieves the stated goal.
Street Tree	A living, standing, woody plant having a trunk that exists in the public right of way.
Study Area	The area within which evaluation of impacts is conducted. The study area for particular resources will vary based on the decisions being made and the type of resource(s) being evaluated.
Throughput	The number of users being served at any time by the transportation system.

Table A-2. Terms

Terms	Definitions
Title VI	This Title declares it to be the policy of the United States that discrimination on the ground of race, color, or national origin shall not occur in connection with programs and activities receiving federal financial assistance and authorizes and directs the appropriate federal departments and agencies to take action to carry out this policy.
Transit Oriented Development (TOD) or Nodal Development	A strategy to build transit ridership, while discouraging sprawl, improving air quality and helping to coordinate a new type of community for residents. TODs are compact, mixed-use developments situated at or around transit stops. Sometimes referred to as Transit Oriented Communities, or Transit Villages.
Transit System	An organization (public or private) providing local or regional multi-occupancy-vehicle passenger service. Organizations that provide service under contract to another agency are generally not counted as separate systems.
Transitway	A Bus Rapid Transit (BRT) priority lane generally with a concrete lane, with or without concrete tracks with grass-strip divider, and a curb separation, traversable by general-purpose vehicles at signalized intersections.
Transportation Demand Management (TDM)	Strategies to attempt to reduce peak period automobile trips by encouraging the use of high occupancy modes through commuter assistance, parking incentives, and work policies that alter the demand for travel in a defined area in terms of the total volume of traffic, the use of alternative modes of travel, and the distribution of travel over different times of the day.
Transportation Improvement Program (TIP)	A program of intermodal transportation projects, to be implemented over several years, growing out of the planning process and designed to improve transportation in a community. This program is required as a condition of a locality receiving federal transit and highway grants.
Travel Shed	Synonymous with "corridor" (see Corridor). A subarea in which multiple transportation facilities are experiencing congestion, safety, or other problems.
urban plaza	An urban plaza is a place that can be used for socializing, relaxation, and/or events.
v/c ratio	Used as a principal measure of congestion. The "v" represents the volume or the number of vehicles that are using the roadway at any particular period. The "c" represents the capacity of a roadway at its adopted level of service (LOS). If the volume exceeds the capacity of the roadway (volume divided by capacity exceeds 1.00), congestion exists.
Vehicle Hours of Delay	Cumulative delay experiences by transit vehicles during high traffic periods.
Water Quality	Refers to the characteristics of the water, such as its temperature and oxygen levels, how clear it is, and whether it contains pollutants.
Whiteaker Special Area Zone	S-W

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Appendix B: Construction Activities and Methods

General Construction Methods

The following section describes how construction of the Locally Preferred Alternative (LPA) would likely be staged and sequenced. This description is based on Lane Transit District's (LTD's) experience with the Franklin, Gateway, and West Eugene EmX Corridors. The final plan for construction methods, sequencing, and staging will be determined in coordination with the contractor and permitting authorities.

Utility work will generally be completed before the transportation infrastructure is constructed. Utility work, often conducted by local utility companies, occurs separately from project-related construction. After completing required utility relocation and other preparatory site work, the contractor will begin with construction of new transit lanes, bike lanes, sidewalks, and any other "flatwork." The contractor will modify existing signals or construct new traffic signals as part of this work. In some cases, the contractor may construct the signal footings but install signal arms after initial work is complete. Flatwork for stations, including curbs, ramps, and station footings, will be completed as the work progresses along the alignment. Streets and street segments will be restored to normal operations after this work is complete. The contractor is expected to progress approximately two blocks every 2 weeks, with additional time required – up to 2 weeks – for each enhanced stop or EmX station. Additional time will be required at intersections that require new or substantially modified traffic signals. The construction sequencing will be determined through coordination between the contractor and local residents, businesses, and property owners regarding construction scheduling preferences. It is expected that, for each major segment, the work would start at one end of the segment and progress to the other end of the segment. All flatwork is expected to be completed in two construction seasons.

Stations will be fabricated during the second construction season and installed during the subsequent (final) construction season, along with landscaping, fare machines, real-time passenger information, enhanced stop or EmX station amenities, and other similar items.

The contractor and LTD will coordinate closely with the Oregon Department of Transportation (ODOT) and with the City of Eugene (as appropriate to the jurisdiction) on traffic control. Depending on the segment, ODOT or the City will review and approve traffic plans for construction.

On streets with multiple lanes in each direction (or multiple lanes in one direction for one-way streets), at least one lane of traffic will be open at all times. Flaggers will coordinate travel at intersections and other points of congestion, as necessary. On streets with a single lane, it may be necessary to close one direction of traffic for certain periods. In those situations, flaggers will be used to manage the traffic flow safely. The contractor and LTD will also coordinate with businesses to ensure that the project maintains access for patrons and deliveries.

Coordination with Businesses and Residents

LTD's Franklin, Gateway, and West Eugene EmX projects demonstrated LTD's commitment to communicating with impacted businesses, residences, and travelers, both before and during construction. As with those projects, LTD will contact all businesses and residents along the alignment well before construction begins to solicit local concerns, issues, and scheduling preferences. Businesses and residents will also be able to communicate with the contractor and LTD during construction. LTD's construction liaison will provide e-mail updates and serve as an ongoing point of contact to address

concerns and to provide information to affected businesses, residents, and other interested persons. LTD will provide a 24-hour hotline to quickly address construction concerns from businesses and residences.

LTD will also work to enhance activity at businesses affected by construction. This can be done through attractive signage, direct communications with the public (e.g., direct mail and advertising), and community events (e.g., street fairs). These techniques succeeded in keeping business areas active during previous EmX projects.