# TABLE OF CONTENTS

1. Introduction .............................................................................................................................................. 1

2. Literature Review Findings – Non-Motorized Access and Transit Ridership ........................................... 4

3. Data Collection ...................................................................................................................................... 11

4. Data Preparation ................................................................................................................................... 13

5. Connectivity Analysis and Tools ......................................................................................................... 20

6. Regression Modeling .......................................................................................................................... 32

7. Existing Conditions Connectivity Analysis Results ............................................................................. 42

8. Future Projects Dataset ...................................................................................................................... 51

9. Future Projects Connectivity Analysis Results ............................................................................... 54

10. Project Prioritization ....................................................................................................................... 79

11. Market Analysis ................................................................................................................................ 91

12. Case Studies ....................................................................................................................................... 99

13. Model Limitations and Thoughts on Future Improvements ............................................................ 147

# APPENDICES

Appendix A: Connectivity User Guide
Appendix B. Project Type Rankings by Percent Change in Ridership
Appendix C: Project Type Rankings by Potential New Riders
Appendix D: Demographic and Ranking Tables
Appendix E: Project Type Prioritization by Aggregate Method
Appendix F: Example Plans for Future Projects
LIST OF TABLES

Table 1: Summary of Influential Access to Transit Factors ................................................................................. 4
Table 2: Regression Model Variables ........................................................................................................................ 11
Table 3: Bike/Level of Stress Calculation Matrix ................................................................................................... 18
Table 4: RDI Scoring Categories .............................................................................................................................. 22
Table 5: Bike Stress Scoring Categories ................................................................................................................... 24
Table 6: Intersection and Sidewalk/Walkway Density Scoring ........................................................................ 26
Table 7: Arterial Signalized Crossing Scoring ........................................................................................................ 28
Table 8: Regression Model Variables ........................................................................................................................ 34
Table 9: Base Model Coefficients ............................................................................................................................ 36
Table 10: Connectivity Coefficients .......................................................................................................................... 38
Table 11: Final Regression Results ............................................................................................................................. 40
Table 12: Top 15 and Bottom 15 Station Locations for Composite Connectivity Index Scores .......... 42
Table 13: Stop Locations with the Largest Change in RDI ...................................................................................... 54
Table 14: Stop Locations with the Largest Change in Signalized Arterial Crossing Index ................... 57
Table 15: Stop Locations with the Largest Change in the Sidewalk Density Score ................................ 59
Table 16: Stop Locations with the Largest Change in the Intersection Density Score .......................... 61
Table 17: Stop Locations with the Largest Reduction in the Bike Stress Average .................................. 63
Table 18: Top 15 locations in Walk Shed and Bike shed Area Increase .......................................................... 65
Table 19: Stations with the Largest Change in the Connectivity Composite Score ......................................... 68
Table 20: Top 40 Project Types with the Largest Percent Change in Daily Ridership ............................. 83
Table 21: Top 30 Project Types with the Largest Change in Net Daily Ridership .................................... 85
Table 22: Demographic and Transit Service Scoring Metric ................................................................................. 86
Table 23: Aggregate Stop-Area Project Rankings ................................................................................................. 88
Table 24: Demographic and Transit Service Scoring Metric

Table 25: Station Areas with High Potential for Marketing Efforts

Table 26: Station Areas with High Potential for Infrastructure Investment

Table 27: Station Areas with High Potential Return from Zoning Changes

Table 28: 2035 Employment and Population in Case Study Locations

Table 29: Daily Ridership Estimates

Table 30: Daily Ridership Estimates Based on Sound Transit Model Forecasts

Table 31: Case Study Project Evaluation

Table 32: Case Study Project Evaluation
LIST OF FIGURES

Figure 1: Study Area ........................................................................................................................................................... 3
Figure 2: Issaquah (left) and Burien (right) Sidewalk GIS Files ................................................................................... 14
Figure 3: Examples of Network Gaps and Discontinuities .......................................................................................... 16
Figure 4: Example Attributes of a Minor Arterial (left) and an Off-street Path (right) from the final ....................... 19
Figure 5: Example Connectivity Surfaces ..................................................................................................................... 21
Figure 6: Examples of Route Directness in Northgate Transit Center and Capitol Hill ........................................ 23
Figure 7: Example of Bike Stress routing and the Bike Stress Index ......................................................................... 25
Figure 8: Examples of Sidewalk/Walkway Density and Intersection Density ........................................................... 27
Figure 9: Examples of Signalized Arterial Index .......................................................................................................... 29
Figure 10: Examples of 15-Minute Travel Sheds Areas in Seattle and Redmond ................................................... 31
Figure 11. Connectivity Modeling Process .................................................................................................................. 32
Figure 12. Scatter plot of Actual vs. Prediction for Daily Boardings ........................................................................ 41
Figure 13: Composite Connectivity Scores - West Seattle and Downtown Seattle .................................................. 44
Figure 14: Composite Connectivity Scores - Othello and Mt. Baker LRT Stations .................................................... 45
Figure 15: Composite Connectivity Scores - Northgate Transit Center and Overlake Village ........................... 46
Figure 16: Composite Connectivity Scores - Edmonds Sounder Station and Tukwila International Boulevard Light Rail Station ........................................................................................................... 48
Figure 17: Composite Connectivity Scores - Kent-Des Moines Rd and in Federal Way Transit Center ......................... 49
Figure 18: Gaps in Seattle Bike Plan and the Existing Street Network (left) and Discrepancies between the Network and the Bellevue Bike Plan GIS Data (right) .............................................................................. 52
Figure 19: Existing and Future RDI Scores for Overlake Village ................................................................................. 56
Figure 20: Existing and Future Signalized Arterial Crossing Score for North Seattle ................................................ 58
Figure 21: Existing and Future Sidewalk Density Scores for Tukwila Urban Center ....................................................... 60
Figure 22: Existing and Future Intersection Density Scores for SeaTac ................................................................. 62
Figure 23: Existing and Future Bike Stress Scores for Overlake Village ................................................................. 64
Figure 24: Existing and Future 15-minute Walk Shed for the Northgate Transit Center Area ................... 66
Figure 25: Existing and Future 15-minute Bike Sheds for the Northgate Transit Center Area ............ 67
Figure 26: Existing and Future Connectivity in SeaTac ......................................................................................... 70
Figure 27: Existing and Future Connectivity in Burien ......................................................................................... 72
Figure 28: Existing and Future Connectivity in West Seattle .................................................................................... 74
Figure 29: Existing and Future Connectivity in Lynnwood ................................................................................... 76
Figure 30: Existing and Future Connectivity in Overlake Village ....................................................................... 78
Figure 31: Station Areas with High Marketing Potential ....................................................................................... 94
Figure 32: Station Areas with High Investment Potential ....................................................................................... 96
Figure 33: Station Areas with High Zoning Potential ............................................................................................ 98
Figure 34: Northgate Transit Center RDI and Signalized Arterial Crossing Index .................................... 101
Figure 35: Northgate Transit Center Bike Stress and Bike Shed ........................................................................ 102
Figure 36: Northgate Transit Center Arterial Sidewalk/Walkway Density and Intersection Density .......... 103
Figure 37: Northgate Transit Center Composite Connectivity Scores ............................................................... 104
Figure 38: Pedestrian Underpass of I-5 and Unsignalized Crossing of Roosevelt Ave .................................... 105
Figure 39: Bicyclist along Northgate Way and Urban Form near Transit Center .............................................. 106
Figure 40: Overlake Village RDI and Signalized Arterial Crossing Index ......................................................... 107
Figure 41: Overlake Village Bike Stress and Bike Shed ....................................................................................... 108
Figure 42: Overlake Village Arterial Sidewalk/Walkway Density and Intersection Density .................. 109
Figure 43: Overlake Village Composite Connectivity Scores .............................................................................. 110
Figure 44: Narrow Sidewalk along 148th Ave and Wide Sidewalks with Signalized Crossings along 156th Ave ....................................................................................................................................................... 111
Figure 45: Bicyclist along NE 24th St and New Bike Lanes along 152nd Ave ............... 111
Figure 46: Mt. Baker LRT Station RDI and Signalized Arterial Crossing Index .......... 113
Figure 47: Mt. Baker LRT Station Bike Stress and Bike shed ....................................... 114
Figure 48: Mt. Baker Arterial Sidewalk/Walkway Density and Intersection Density .... 115
Figure 49: Mt. Baker LRT Station Composite Connectivity Scores ................................ 116
Figure 50: Pedestrians along MLK Jr. Way and Poor Sidewalk Quality ......................... 117
Figure 51: Bicyclist along Rainier Avenue and Steep Terrain West of the Station ...... 117
Figure 52: Federal Way Transit Center RDI and Signalized Arterial Crossing Index .... 119
Figure 53: Federal Way Transit Center Bike Stress and Bike shed ................................. 120
Figure 54: Federal Way Transit Center Arterial Sidewalk/Walkway Density and Intersection Density .................................................................................................................. 121
Figure 55: Federal Way TC Composite Connectivity Score ........................................... 122
Figure 56: Buffered Sidewalks with Strip Commercial and Flashing Pedestrian Crossing .... 123
Figure 57: Bike Lane on S 316th Street and Bike Parking at the Transit Center .............. 124
Figure 58: Northgate Transit Center New Transportation Projects ............................... 128
Figure 59: Overlake Village New Transportation Projects .............................................. 129
Figure 60: Mt. Baker Transit Center New Transportation Projects ................................. 130
Figure 61: Federal Way Transit Center New Transportation Projects ............................ 131
Figure 62: Northgate Transit Center Future Connectivity Map and 15-minute Travel Sheds .... 136
Figure 63: Overlake Village Future Connectivity Map and 15-minute Travel Sheds ......... 137
Figure 64: Mt. Baker LRT Station Future Connectivity Map and 15-minute Travel Sheds .... 138
Figure 65: Federal Way Transit Center Future Connectivity Map and 15-minute Travel Sheds .... 139
1. INTRODUCTION

Increasing the availability of transportation options is a primary goal of Transportation 2040, the Puget Sound region’s long-range transportation blueprint. Transit plays a key role in providing for local and regional mobility, but in many areas, transit access is limited by a lack of non-motorized infrastructure. There has been an increasing amount of research on how non-motorized access can improve walking/biking mode share, but research on non-motorized access to transit is still a relatively new field.

This study works to fill this gap in the research using data and modeling techniques developed specifically for the Puget Sound region. The timing for this work is right, with continued advancement in non-motorized connectivity research, improved non-motorized data from local jurisdictions, and better analysis techniques being incorporated into common GIS software. The intent of this study is to develop a suite of GIS tools to analyze and visualize non-motorized transit access and to develop a model to understand how non-motorized connectivity affects transit ridership. Using these tools, King County Metro (KC) and Sound Transit (ST) can assess non-motorized access projects, prioritize transit service and investments, and partner with local agencies on obtaining grant and other funds to support transit access projects. The tools and research described in this report are part of an ongoing evaluation of non-motorized transit access by both agencies. This report was informed by earlier access studies and may be incorporated into future evaluations.

The non-motorized transit access study involved a major collaboration with local jurisdictions to collect GIS pedestrian, bicycle, and roadway data from more than 20 local jurisdictions. Using this data, the model team developed a set of GIS analysis tools to summarize connectivity data such as route directness, bike stress, intersection/sidewalk density, and arterial crossing density at more than 500 transit stops across a three-county study area. These connectivity variables were then used to develop a model that can measure the potential change in transit ridership when non-motorized connectivity to transit stops improves.

Also included in this report are several examples of potential uses of the connectivity tools and ridership model. The applications described in the report include:

- A framework for transit agencies to prioritize non-motorized projects included in local jurisdiction active transportation plans
• An evaluation of “market areas” where areas with high/low non-motorized connectivity, transit supportive land use densities, and transit supportive demographics are presented

• A set of detailed case study applications where the model was used to evaluate existing and 2035 conditions at four transit stop areas in the region. Through these case studies, the team evaluated specific non-motorized access projects and identified some strategies to enhance the non-motorized evaluation with additional station area planning.

The project study area consists of approximately 400 square miles of KC and ST coverage area, shown in **Figure 1**.
Figure 1
Study Area