

EXECUTIVE SUMMARY

1.1 – INTRODUCTION AND PREVIOUS STUDIES

148th Avenue is the primary north-south arterial in the Overlake area. Traffic on this roadway and within the Overlake area, has steadily increased since 1996, partly as a result of development in the Overlake area. Residents and businesses in the Overlake area are concerned about traffic congestion, increased traffic in their neighborhoods, and traffic that “cuts through” their streets because 148th Avenue is too congested. However, constituents don’t necessarily agree on solutions.

The Cities of Bellevue and Redmond completed the Bel-Red Overlake Transportation Study Update (BROTS Update) in 1999. Freeway, arterial, transit, pedestrian, bicycle, and transportation demand management needs were considered in the development of a 2012 multi modal transportation plan for the joint Overlake area. The intent of the BROTS Update was to:

- Evaluate future 2012 transportation needs based upon land use alternatives;
- Reassess the feasibility for planned improvements; and
- Focus on integrating roadway, transit, non-motorized, and demand management transportation solutions.

The BROTS Update developed a set of transportation facilities to support Redmond’s Overlake neighborhood Plan. The Overlake Neighborhood Plan assumes a land use intensity of 15.4 million square feet of development in Redmond, and 12.2 million square feet of development in the Bellevue BROTS area by the year 2012. The BROTS Update was intended to mitigate the impacts of growth and maintain established level of service standards.

The BROTS Update included a tentative project which would extend 152nd Avenue over SR 520 to provide an additional north-south corridor. Because of the significant costs associated with this project, the Bellevue and Redmond Councils agreed to further examine the merits of this project.

As part of the BROTS Interlocal Agreement dated September 30, 1999, Bellevue and Redmond agreed to explore a range of alternatives to address north-south corridor travel between and including 148th Avenue NE and 156th Avenue including examination of the 152nd extension over SR 520.

The BROTS North-South Corridor Study is a joint project with the City of Redmond. The study seeks to address congestion in the Overlake portion of 148th Avenue NE by comparing the benefits and impacts of developing a parallel crossing of SR 520 on 152nd Avenue NE with other alternatives in the area.

In addition to the BROTS North South Corridor Study, the Bellevue Transportation Department is undertaking several efforts to identify projects to manage traffic congestion and protect neighborhoods in east Bellevue. The *148th Avenue Mobility Improvement Package* was

completed in late 2002. This study boundary is directly adjacent and south of the BROTS North South Corridor Study area. The purpose of the 148th Avenue Mobility Improvement Package was to identify improvements along 148th Avenue in East Bellevue from Bel-Red Road to SE 24th Street to optimize the north-south travel function along the corridor, reduce congestion and travel time, and increase mobility along the corridor by selecting solutions that minimize impacts to adjacent neighborhoods and providing access to neighborhoods.

Project Vision and Purpose

At the onset of the project, the project team members held a chartering meeting to identify the project purpose and vision, identify key issues and project risks, develop a decision making process, and outline various team member roles and responsibilities. The project vision and purpose, as defined by the project team, are shown below.

Project Vision

Successful alternatives will:

- Enhance circulation and access in the Overlake area,
- Support projected levels of traffic growth,
- Protect neighborhoods from adverse traffic impacts,
- Maintain economic vitality of the Overlake neighborhood,
- Maintain air quality standards,
- Provide benefits commensurate to costs,
- Not preclude longer range projects that might come from regional plans, such as the Trans-Lake Washington Study, or the I-405 Corridor Program.

Project Purpose

The project purpose is:

- To identify projects for immediate implementation that will maintain traffic operations and person carrying capacity for 148th Avenue NE, north of Bel-Red Road
- To identify projects that will enhance north-south mobility, including 148th Avenue NE and 156th Avenue NE within the Overlake area
- To maintain or improve transit access and reliability in the Overlake neighborhood and along the 148th Avenue corridor.

In summary, the 148th Avenue Mobility Improvement Package identifies projects to manage near term congestion problems, to efficiently build consent among the public, to protect neighborhoods from impacts such as cut-through traffic, and to lay the groundwork for addressing future transportation needs. The study identifies projects that are designed to a

level sufficient for inclusion in the City's Capital Investment Program (CIP), and that have potential for partnership funding opportunities. The horizon year for the study is 2012.

Study Boundary

The study area is focused on the area between 148th Avenue to the west, and 156th Avenue to the east. The study boundary to the south is Bel-Red Road, and the northern boundary is at the NE 60th Street alignment.

The 148th Avenue Mobility Improvement Package, which is a complement study to the *BROTS North South Corridor Study*, examined solutions for congestion along 148th Avenue NE, south of Bel-Red Road to the I-90 Corridor.

A map showing the two separate study areas is shown in **Figure 1.1**.

1.2 – OVERVIEW OF STUDY METHODOLOGY

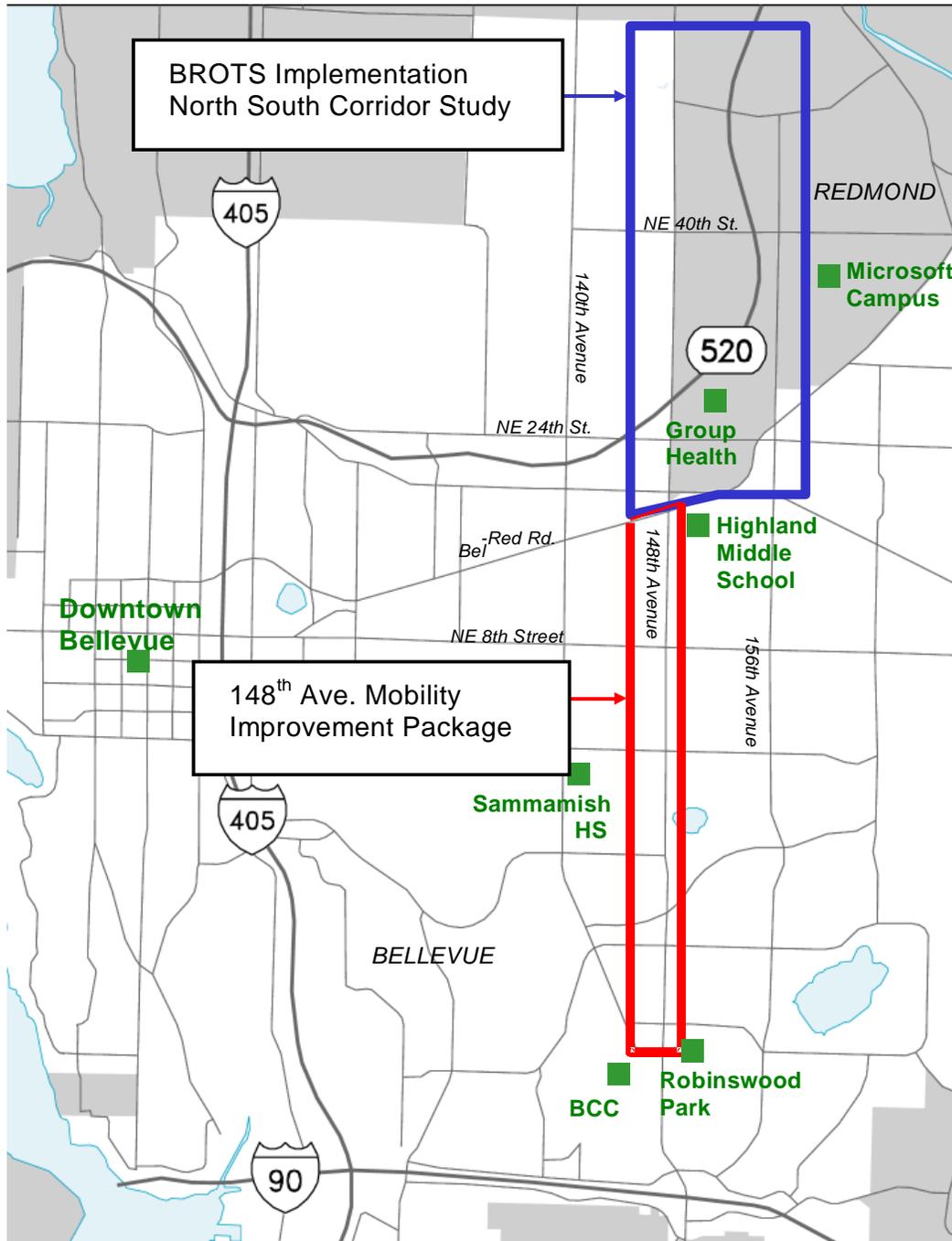
The Cities of Bellevue and Redmond hired David Evans & Associates, Inc. (DEA) to conduct the *BROTS North South Corridor Study*. DEA was primarily responsible for managing the project, conducting public outreach efforts, developing and analyzing the alternatives, and preparing the plans and cost estimates for the preferred recommendation. The City of Bellevue provided overall project management, assisted with public outreach tasks, assisted with traffic modeling output, and provided technical review. The City of Redmond actively participated on the project management team and assisted with public outreach and technical review.

The project Scope consists of the following major tasks:

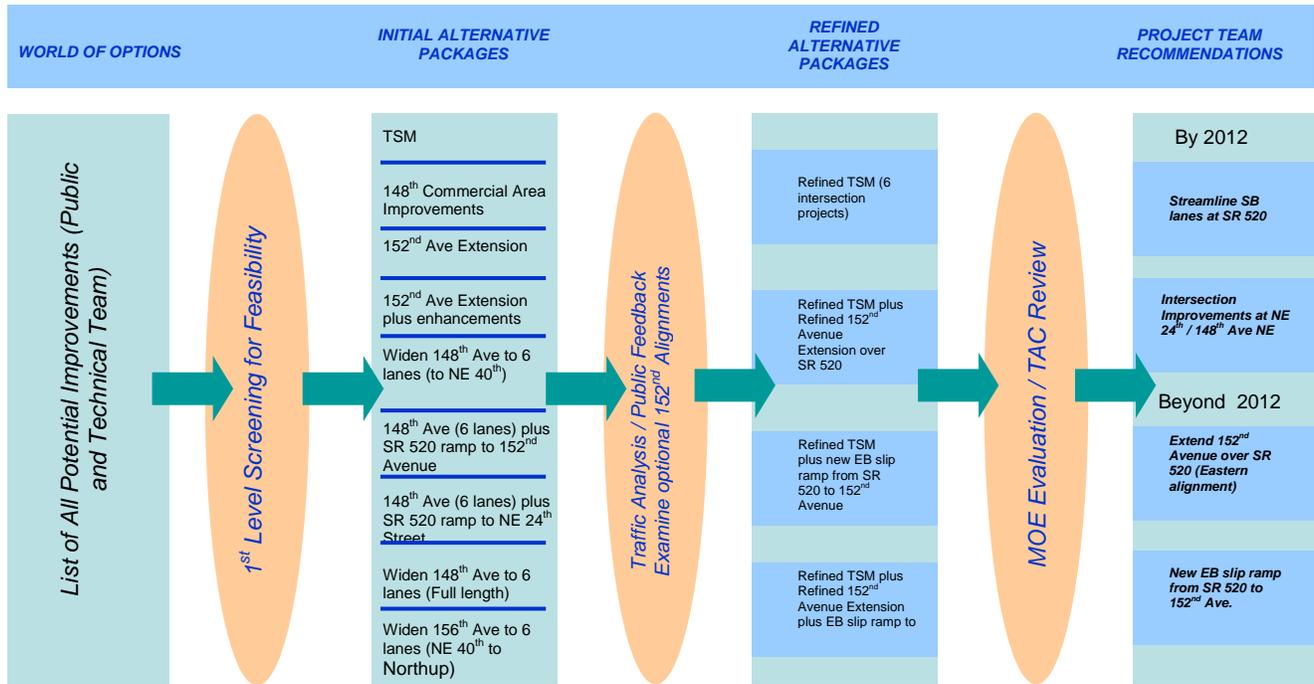
- Project Management and Public Outreach
- Existing and Future Baseline Conditions
- Identification of All Feasible Improvements
- Development of Initial Alternatives (Near Term and Long Term)
- Initial Alternatives Evaluation
- Development of Refined Alternatives
- Refined Alternatives Evaluation
- Recommended Improvements and Conceptual Designs
- Implementation and Financing Plan
- Draft and Final Reports

A process chart shown in Figure 1.2 shows the overall project process.

Figure 1.1
BROTS North-South Corridor Study
148th Avenue Mobility Improvement Package
Project Boundaries



**Figure 1.2
BROTS North South Corridor Study Process Chart**



1.3 - PROJECT MANAGEMENT AND PUBLIC OUTREACH

The project management team consisted of the Cities of Bellevue project manager, the City of Redmond project manager, the consultant project manager. The project management team conducted ongoing meetings to manage the project scope, schedule, budget and other items that had a direct impact to the project.

A Technical Advisory Committee (TAC) was formed, consisting of professionals and technical staff from the Cities of Bellevue and Redmond, and professional staff from King County Department of Transportation, Washington State Department of Transportation (WSDOT), and Sound Transit. The role of the TAC was to act as an advisory committee for the project. The TAC provided input into the development of alternatives, evaluation of alternatives, and recommendations. The TAC met at seven times during the course of the study.

A Staff Review Group was formed, in addition to the TAC. This group acted as additional support to the TAC, and had the responsibility for providing technical data and traffic modeling output, reviewing various components of the project as needed, such as reviewing technical

data, cost information, and traffic analysis. Occasionally, members from this group attended TAC meetings, however, they generally met with the project managers on an individual basis.

In addition, the study included a significant public outreach effort. An important element of the study was to identify key issues and concerns regarding the corridor from the public, as well as potential corridor improvements. The public outreach effort consisted of the following elements:

Interviews with key stakeholders – The consultant team interviewed 17 key stakeholders that represented constituencies that would be affected by the project, including neighborhood representatives, school districts, communities of faith, emergency services and major employers. These meetings were held at the onset of the project to engage the public, identify key community issues, and solicit ideas for potential improvements.

Meetings with Community Councils and Neighborhoods – The project management team provided updates on the project to the East Bellevue Community Council, and the Bellevue Neighborhood Network North at various times throughout the course of the project. These groups provided valuable feedback to the project management team.

Open Houses – Three open houses were held throughout the course of the study. The first open house was used to identify key issues from stakeholders and residents, and potential improvements. Alternative packages were presented to the public for feedback at the second open house. The recommended projects were presented to the public at the final open house. All three open houses were done in conjunction with the *148th Avenue Mobility Improvement Package* study.

Newsletters and other Media – During the course of the study, a newsletter was sent to households located within and near the study area, and placed at other public facilities throughout the City. The newsletter provided an update on the project and the preliminary alternatives. Articles about the study and its progress were written in various newspapers, including the Eastside Journal, the City of Bellevue “It’s Your City” newsletter, and neighborhood projects newsletters. Additionally, a project webpage was maintained on both the Bellevue and Redmond city websites. The webpage included current project status, upcoming public events, analysis results, recommended projects and contact information.

Commissions and Councils – Updates on the project were presented to the Bellevue Transportation Commission throughout the course of the study. In addition, both the City of Bellevue and Redmond provided an update on the final recommended improvements to both city Councils.

Based on the initial input from stakeholders and the community, a number of key issues were identified. These included:

- The corridor has good proximity to employment, retail, and access to I-90 and SR 520
- Congestion is getting worse
- Neighborhood protection is very important
- Better transit service is needed, including more routes, better frequency
- The worst areas are 148th Avenue at NE 24th and SR 520
- There are good pedestrian facilities along the corridor
- The worst congestion is southbound in the afternoon peak period
- There are too many kinds of traffic using the corridor – local, retail and commuter traffic

1.4 - EXISTING CONDITIONS AND FUTURE BASELINE CONDITIONS

The first scope item conducted was a documentation of the Existing and Future Baseline Conditions. The Existing and Future Baseline conditions report provides a summary and inventory of the existing and future (2012) land use characteristics, roadway facilities, transit facilities and conditions, non-motorized facilities, and traffic conditions. Locations of where significant delay to through and cross street traffic were identified. In addition, deficiencies to pedestrian and bicycle access were noted.

1.5 - IDENTIFICATION OF POSSIBLE IMPROVEMENTS

Initial Alternatives were developed for the study area considering the following information: input from stakeholder interviews with key community members, a review of current and anticipated traffic operations for year 2012 (baseline conditions) with comments received at the first open house meeting in October 2001.

These contributing pieces provided a view of the current and expected traffic needs for the area and from these pieces the project team created a list of possible treatments. The first step involved a feasibility screening process to confirm which possible treatments looked to be able to provide a benefit and could be constructed.

The purpose of this first level screening was to confirm whether improvements should be carried forward for additional analysis, or whether they should be referred on to other projects or sources. In addition, some of the suggested improvements were fatally flawed based on measures used to screen them. Three measures were used to screen the suggested improvements, including:

1. Would the improvement meet the project purpose?

- Would the concept improve or meet the project objective?
- For this project, the answer would be an assessment of whether the concept could provide improved mobility, travel or transportation access through the corridor. It could be in terms of vehicle throughput as well as person throughput.

2. Required Permits and Approvals

- Would the concept likely receive required permits and approvals (interjurisdictional support and permitting agency approvals)?
- Is the concept compatible with other on-going studies?
- Can the concept meet design standards and/or be approved (geometric feasibility)?

3. Cost Effectiveness

- Is the scale of the concept consistent with the improved travel, reliability and access benefit that it provides?

Improvements were either deemed as fatally flawed, referred on to other studies, or accepted and packaged into alternatives for further evaluation.

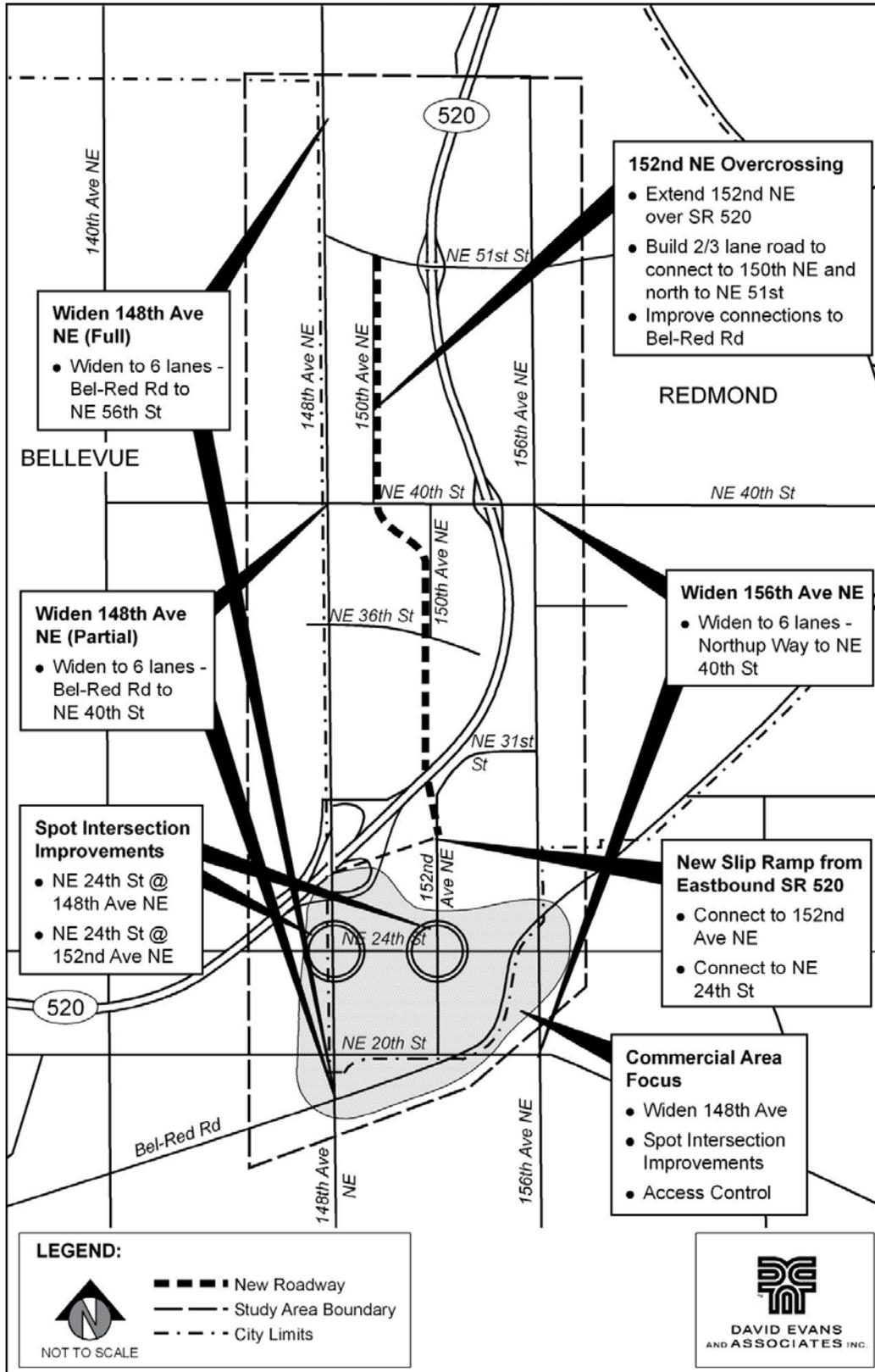
1.6 - DEVELOPMENT OF INITIAL ALTERNATIVES

A second step in the development of the alternatives involved traffic modeling of individual traffic improvements to confirm the potential for improvement. Using those treatments that have a potential for improving traffic operations in the area, a total of 15 alternative packages were identified for review by the Technical Advisory Committee. Treatments ranged from intersection improvements to bus/access lanes on arterials to road widening options. Six alternative packages were excluded from further review due to low expectations of composite traffic performance to address the key concerns for the corridor, i.e. congestion along 148th Avenue NE, especially in the vicinity of the NE 24th Street intersection.

Eventually, nine alternative packages of improvements were evaluated for traffic operations and conceptual cost estimates for review at the second open house. The alternative packages range from a collection of four intersection projects on 148th Avenue NE with focus on traffic signal synchronization and coordination (the Transportation Systems Management Alternative 1) to a large-scale road widening project (4/5 lanes to 6/7 lanes) along 148th Avenue NE from Bel-Red Road to NE 56th Street (approximately 2 ¼ miles). Descriptions of the project elements for each alternative are presented below along with key features and possible constraints.

The alternative options, shown in **Figure 1.3** included:

**Figure 1.3
Initial Alternatives**



Alternative 1 – Transportation Systems Management (TSM)

Intersection lane additions and revisions at four key intersections along 148th Avenue NE: Bel-Red Road, NE 20th Street, NE 24th Street and the SR 520 Eastbound off-ramp to southbound 148th Avenue NE.

- Realignment of southbound through lanes at the SR 520 ramp intersection and relocation of southbound STOP bar
- Lengthen the westbound right lane on NE 24th
- Convert the northbound right lane on 148th NE to a shared through/right lane at NE 24th
- Revise lanes for double westbound left turns on NE 24th
- Add right-turn lane for westbound traffic on NE 20th
- Add dual left-turn lane for eastbound traffic on Bel-Red Road - in addition to the planned BROTS project at the intersection.
- Interconnect cable and facilities to accommodate signal coordination along 148th Avenue NE.
- Signal timing changes.

Estimated Cost: \$2-3 Million (Not including Right of way)

Alternative 2 – 148th Commercial Area Improvements

This alternative builds on Alternative 1 – TSM, with the following additional elements:

- Widen 148th Avenue NE to three lanes in each direction, converting right lane to through/right lanes, from SR 520 to Bel-Red Road (does not include widening over SR 520).
- Add southbound right turn lane at NE 20th Street
- Add eastbound right turn lane on NE 20th Street
- Dual left turn lanes for eastbound traffic on NE 24th Street at Bel-Red Road
- Add eastbound right turn lane on NE 24th Street at 156th Avenue NE
- Dual left turn lanes for both directions on Bel-Red Road at 156th Avenue NE
- Extension of 152nd Avenue NE onto NE 21st Street to Bel-Red Road with new signal
- Add northbound left turn lane on Bel-Red Road at NE 21st Street

Estimated Cost: \$6-7 Million (Not including Right of way)

Alternative 3 – 152nd Avenue NE Overcrossing

This alternative consists of three projects identified and approved as BROTS projects 40.2, 47.2 and 56.1. This alternative includes only these three BROTS projects and does not include TSM improvements (Alternative 1).

- Extend 152nd Avenue NE across SR 520 with a 60-foot structure (48-foot roadway for three lanes, bike lanes plus two six-foot sidewalks)
- Connect with 150th Avenue NE, complete sidewalk along 150th Avenue NE
- Build connecting roadway, 2/3 lanes wide (40 feet with curb, gutter and sidewalk) to 150th Avenue NE at NE 40th Street
- Signal modification at NE 40th Street and 150th Avenue NE
- Signal modification at NE 51st Street and 150th Avenue NE

Estimated Cost: \$31-33 Million (Not including Right of way or building impacts)

Alternative 4 – 152nd Avenue NE Overcrossing with Enhancements

This alternative includes Alternative 3 along with TSM improvements from Alternative 1 plus roadway connections to Bel-Red Road.

- Three BROTS projects along 152nd Avenue NE
- Four intersection improvements along 148th Avenue NE identified in Alternative 1 – TSM
- Extend 152nd Avenue NE to Bel-Red Road via NE 21st Street with new signal at Bel-Red Road
- Add left turn lane northbound on Bel-Red Road to NE 21st Street

Estimated Cost: \$33-36 Million (Not including Right of way or building impacts)

Alternative 5 – 148th Avenue NE Widening to Six Lanes, Bel-Red Road to NE 40th Street

This alternative consists of widening to three northbound and southbound lanes along 148th Avenue NE from Bel-Red Road to NE 40th Street, using the existing right turn lanes as the third through lane where possible. Southbound widening would begin approximately 300 feet north of the NE 40th Street intersection and end as an exclusive right turn lane to Bel-Red Road. Northbound widening would begin approximately 300 feet south of the Bel-Red Road intersection and end as an exclusive right turn lane to NE 40th Street. Other improvements include:

- Bridge widening over SR 520 for a third lane in each direction. The proposed northbound lane between loop ramps would remain.
- Alternative 1 – TSM side-street improvements along 148th Avenue NE at Bel-Red Road, at NE 20th Street and at NE 24th Street.
- Exclusive right turn lanes on 148th Avenue NE accessing Fred Meyer and Sears would be converted to the third through lane in each direction.
- Left-turning movements from the center turn lane would be restricted and replaced with U-turn routes, similar to design of 148th Avenue NE/SE south of Bel-Red Road.

Estimated Cost: \$15-18 Million (Not including Right of way)

Alternative 6 – 148th Avenue NE Widening (Bel-Red Rd to NE 40th) plus New SR 520 ramp to 152nd Avenue NE

This alternative builds on Alternative 5 with a new eastbound off-ramp from the existing off-ramp to 152nd Avenue NE.

- New ramp would diverge from existing eastbound to southbound off-ramp, drop under 148th Avenue NE in short (150 feet) tunnel, then rise to meet grade at 152nd Avenue NE at new traffic signal
- One-lane one-direction ramp (30-foot wide)
- Cut and cover structure for new ramp under 148th Avenue NE
- Alternative would streamline transit access to Overlake Park-and-Ride lot and streamline emergency access to Group Health Hospital

Estimated Cost: \$24-27 Million (Not including Right of way)

Alternative 7 – 148th Avenue NE Widening (Bel-Red Rd to NE 40th) plus New SR 520 ramp to NE 24th Street

This alternative builds on Alternative 5 with the addition of a direct eastbound off-ramp from SR 520 to NE 24th Street.

- New ramp would diverge from SR 520 approximately 1000 feet west of the current diverge point for the 148th Avenue interchange. The ramp would follow the grade of the adjacent land, dropping to join NE 24th Street with a second eastbound lane.
- Retaining/structural walls for the ramp descent to NE 24th Street
- New ramp would block access to existing business park on NE 24th Street – this would require development of new site access for the property.

Estimated Cost: \$22-25 Million (Not including Right of way)

Alternative 8 – 148th Avenue NE Widening to Six Lanes, Bel-Red Road to NE 56th Street

This alternative consists of widening to three northbound and southbound lanes along 148th Avenue NE from Bel-Red Road to NE 56th Street, using the existing right turn lanes as the third through lane where possible. Southbound widening would begin approximately 300 feet north of the NE 56th Street intersection and end as an exclusive right lane turning to Bel-Red Road. Northbound widening would begin approximately 300 feet south of Bel-Red Road intersection and end as an exclusive right turn lane to NE 56th Street. Other improvement elements include:

- Bridge widening over SR 520 for a third lane in each direction. The proposed northbound lane between loop ramps would remain.
- Alternative 1 – TSM side-street improvements along 148th Avenue NE at Bel-Red Road, at NE 20th Street and at NE 24th Street.

- Exclusive right turn lanes on 148th Avenue NE accessing Fred Meyer and Sears would be converted to the third through lane in each direction.
- Left-turning movements from two-way left turn lane would be restricted and replaced with U-turn routes, similar to design of 148th Avenue NE/SE south of Bel-Red Road.

Estimated Cost: \$21-24 Million (Not including Right of way)

Alternative 9 – 156th Avenue NE Widening to Six Lanes, Northup Way to NE 40th Street

This alternative would build upon the TSM improvements of Alternative 1 with widening of 156th Avenue NE to three lanes in each direction. A planned BROTS project includes widening for the third southbound lane from Bel-Red Road to Northup Way.

- Convert right turn lanes to third through lane along 156th Avenue NE
- Begin widening southbound approximately 300 feet north of the NE 40th Street intersection and end at Bel-Red Road with southbound right/through lane, by feeding into BROTS project to add third southbound lane to Northup Way.
- Begin widening northbound approximately 300 feet south of Northup Way intersection and end with an exclusive right lane at NE 40th Street.

Estimated Cost: \$8-10 Million (Not including Right of way)

Initial Alternatives Evaluation

The nine alternative packages were analyzed for traffic operations using a micro-simulation model (VISSIM traffic model). The alternatives and their analysis were presented to the public at the second public open house held in May 2002. The results from the feedback showed that the public generally opposed significant widening to 148th Avenue, but approved of smaller intersection projects along 148th Avenue between Bel-Red Road and SR 520. The public also favored the option of extending 152nd Avenue over SR 520 and exploration of a new ramp from SR 520 to either 152nd Avenue or NE 24th Street.

1.7 – 152nd AVENUE EXTENSION OVER SR 520 ANALYSIS

During the progression of the study, it became more apparent that the original route for the 152nd Avenue NE roadway connection across SR 520 had significant costs for construction, right of way and building impacts than previously thought. This route was also determined to have significant potential travel time and traffic operational benefits in the study area. Therefore, the potential for traffic improvements and community connection made the alternative attractive for consideration in the North-South Corridor Study. Two additional routes were identified for exploration as alternatives for the 152nd corridor crossing. The City of Redmond requested that these two additional routes be analyzed and compared with the original nine alternatives to determine relative traffic benefits and costs.

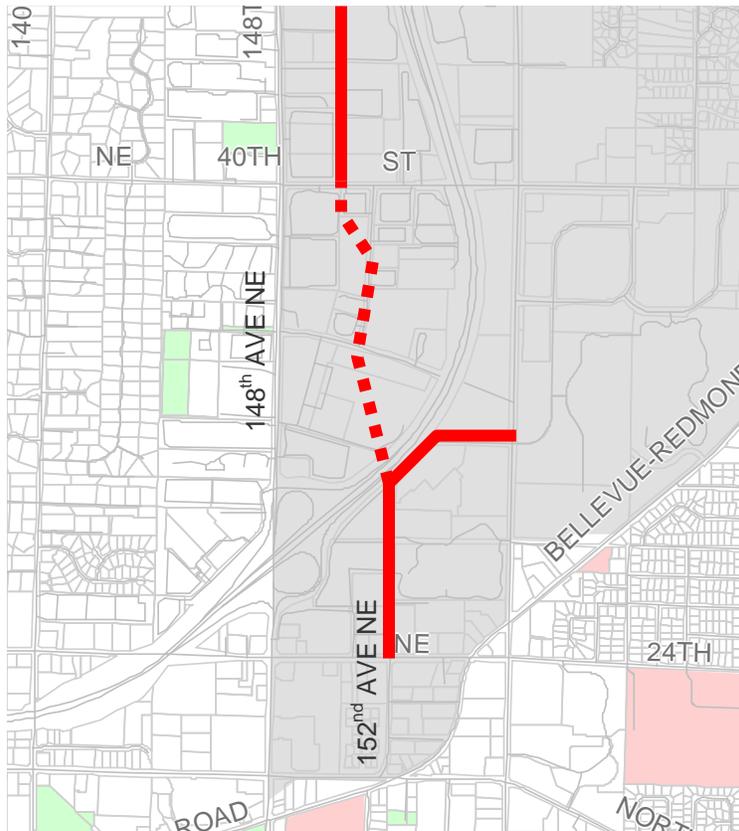
The primary goal of the analysis was to answer the question “Is there a viable and cost-effective (or lower cost) route for the 152nd Avenue overcrossing that can provide comparable travel time benefits to Alternative 4 in the BROTS North-South Corridor Study analysis?” The analysis also considered costs and traffic benefits.

The three alignment scenarios are described below and shown in Figures 1.4 to 1.6.

**Original 152nd Avenue NE Overcrossing Alignment
(Identified in 1999 BROTS Update)**

This route would extend 152nd Avenue NE to cross SR 520 where it would curve to a connection with 150th Avenue NE at NE 36th Street. It would follow 150th Avenue NE to a point midway between NE 36th Street and NE 40th Street where it would make an S-curve to a connection with 150th Avenue NE at NE 40th Street. Both legs of 150th Avenue NE that intersect NE 40th Street are currently signalized. With this proposal the eastern-most signal could be eliminated. The

**Figure 1.4
Original 152nd Avenue Extension Alignment**

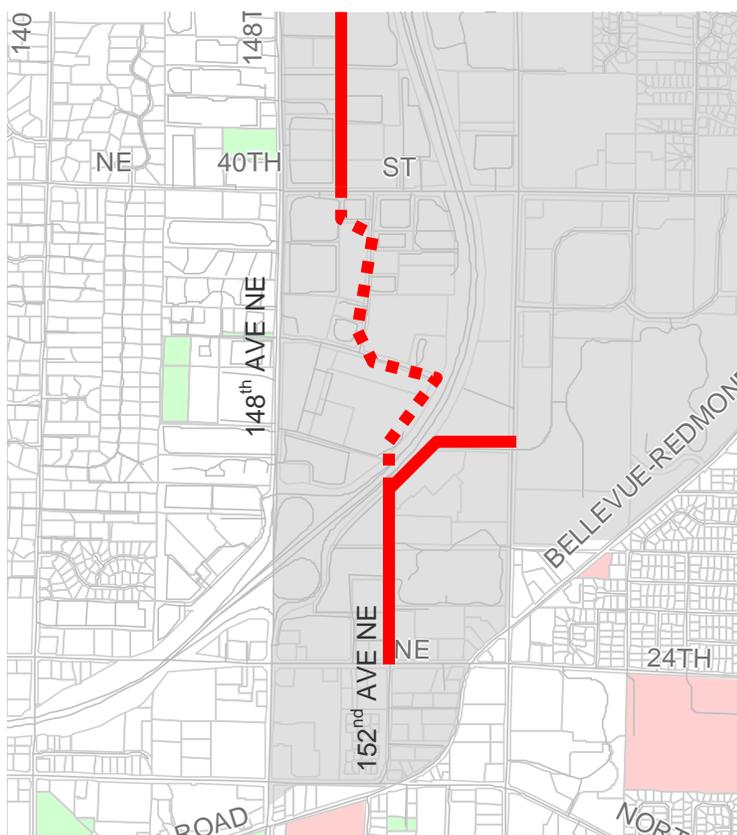


existing 150th Avenue NE roadway north of NE 40th Street would remain as is. This alternative is approximately 3700 feet in length.

152nd Avenue NE Overcrossing (520 West Side Alignment)

This route would connect 152nd Avenue NE on the south side of SR 520 with a straight route over SR 520 to the Allied Signal (Honeywell) parking lot just west of SR 520 alignment. The route would continue north adjacent to SR 520 to NE 36th Street, then head west along NE 36th Street and turn onto 150th Avenue NE, following the same north section alignment as for the BROTS Alternative 4. This alternative is approximately 4200 feet in length.

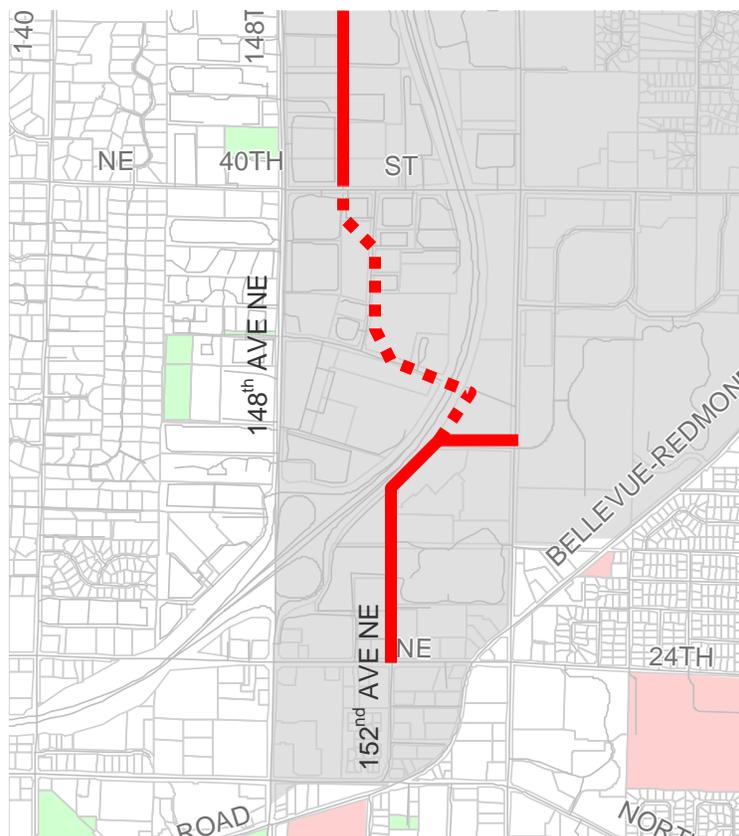
Figure 1.5
152nd Avenue Extension (West Side Alignment)



152nd Avenue NE Overcrossing (520 East Side Alignment)

This route would connect 152nd Avenue NE on the south side of SR 520 to a crossing over SR 520 in the NE 36th Street alignment via a roadway connection along the east side of SR 520. This alignment would require a new roadway parallel to SR 520 between NE 31st Street and NE 36th Streets, along the current private roadway behind the Microsoft buildings north of NE 31st Street. The new roadway would be adjacent to SR 520 on the east side of the WSDOT right of way. This would follow existing roadway from 152nd Avenue NE to NE 31st Street, and follow the existing private roadway from NE 31st Street to NE 36th Street and include a new bridge over SR 520 at NE 36th Street. The East Side Alignment would be along NE 36th Street and would connect to the same location at 150th Avenue NE, with the same north section alignment as for the BROTS alternative. This alignment is approximately 3800 feet in length.

**Figure 1.6
152nd Avenue Extension (East Side Alignment)**



Summary Findings

Figure 1.7 presents a summary of the benefits and costs associated with the three alternative alignments for the 152nd Avenue NE roadway extension over SR 520. While there appear to be traffic benefits with each of the three alternatives, there would be significant differences in cost and property impacts. Based on the magnitude of these property impacts, it appears that the original alignment is fatally flawed due to the alignment through a building on the Honeywell (Allied Signal) campus.

Traffic benefits can be expected with each of the three alternative alignments, ranging from an estimated reduction in peak hour system delay of 521 to 654 hours, a reduction in system delay between 21% and 26 % of the baseline system delay. The estimated conceptual construction costs for the three alternative alignments range from \$17.0 million for the East Side alignment to \$24.4 million for the Original Alignment – where the majority of the construction cost would lie in the structure or bridge over SR 520. The East Side alignment has the lowest cost and least apparent impact on the roadway network and on right of way and property access. The West Side alignment would have comparable construction costs to the Original Alignment without the impacts to buildings. The East Side alignment would have lowest construction costs with least impact to adjacent properties and access.

**Figure 1.7
Summary of Benefits and Costs for Three Alignment Alternatives**

Alternative Alignment	Straight Shot	West Side of SR 520	East Side of SR 520
Traffic Benefits System Delay 148th Travel Time (SB)	Decrease by 26% Decrease by 43%	Decrease by 26% Decrease by 43%	Decrease by 21% Decrease by 35%
Conceptual Construction Cost Right of Way Costs, (fee simple)¹ Building Costs² Total Estimated Cost	\$24.4 million \$5 million \$25 million \$54.4 million	\$23.7 million \$4.6 million - \$28.3 million	\$17.5 million \$4.0 million - \$21.5 million
Required Right-of- Way	142,000 SF	131,600 SF	111,500 SF
Property Impacts	Removal of Clean Room building (\$25M) Parking loss, Landscaping and driveway adjustments	Parking loss, Landscaping and driveway adjustments	Parking loss, Landscaping and driveway adjustments

Note 1: Right of way costs are estimated based on fee simple values of \$35 per SF for commercial property, \$18 per SF for multi-family residential, and \$35 per SF for future parking lot (currently undeveloped and in permitting), without any mitigation for other impacts.

Note 2: Building costs for Original Alignment reflect information provided by Allied Signal staff, \$25,000,000 for building construction.

Recommended Alignment

The results of the analysis were presented to Bellevue and Redmond staff, and the Bellevue Transportation Commission. Based upon staff input and Commission input, the project team recommended that the East Side alignment be used with further alternatives development. The results of the analysis were also provided to the Microsoft Corporation. The Microsoft Corporation reviewed the technical work, and does not support any of the alignments. The opposition to the East Side alignment is primarily related to the fact that the bridge and adjoining roadway would adversely affect the Augusta property located on the north side of NE 31st Street, east of SR 520.

1.8 – DEVELOPMENT OF REFINED ALTERNATIVES

After the second open house and the 152nd extension analysis, the Technical Advisory Committee reviewed the technical analysis and public input for the nine alternatives. The analysis showed that the TSM alternative provided significant benefits at a considerably low cost compared with the other alternatives. For the TSM alternative, the VISSIM output showed that the southbound travel time on 148th Avenue NE dropped by 34 percent (from 23 minutes to 15 minutes during the PM peak hour), from NE 51st to Bel-Red Road when compared to the Baseline scenario (No Action – Includes current BROTS projects). This travel time was favorable when compared to the results of the other alternatives.

In addition, Bellevue traffic modeling staff conducted additional analysis for the two slip ramp alternatives, and determined that the slip ramp to 152nd Avenue provided a much more significant improvement to operations along 148th Avenue, when compared to the slip ramp to NE 24th Street.

Based on the traffic modeling results and public input, the Committee developed four refined alternatives for further review. The four refined alternatives are described below. The benefits and impacts are also shown, which are based on traffic output conducted by the City of Bellevue, using the BKR (Bellevue Kirkland Redmond) traffic model. This model was used so that the alternatives could be tested against the concurrency thresholds for the BROTS study area (Redmond TMD 5). A map showing the locations summary of all of the alternative packages is shown in **figure 1.8** **Figure 1.9** provides a summary of the performance characteristics for the alternatives.

Alternative 1 – Refined Transportation Systems Management (TSM)

This alternative refined the original TSM alternative, and includes lane additions and revisions at four key intersections along 148th Avenue NE and two key intersections along Bel-Red Road. These projects are in addition to the existing BROTS projects in the vicinity, including: BROTS 68.0 (northbound third lane at SR 520 ramp); BROTS 50.2 (Dual eastbound and westbound left turn lanes on NE 20th at 148th); BROTS 51.2 (Dual westbound left turn lanes and eastbound right turn lane on Bel-Red Rd. at 148th Ave. NE); BROTS 22.3 (southbound right turn on 156th

Ave. NE at Bel-Red Rd.); BROTS 63.0 (added southbound through lane on 156th Ave. NE south of Bel-Red Rd.); and BROTS 53.1 (northbound left turn lane and southbound right turn lane on Bel-Red Rd. at NE 24th St.) The additional improvements include:

- Realignment of southbound through lanes at the SR 520 ramp intersection and relocation of southbound STOP bar
- Add second northbound right turn lane to SR 520
- Lengthen the westbound right lane on NE 24th at 148th Avenue NE
- Revise lanes for dual westbound left turn lanes on NE 24th Street at 148th Avenue NE
- Add westbound right-turn lane on NE 20th at 148th Avenue NE
- Provide dual northbound left turn lanes on 148th Avenue NE at NE 20th Street
- Add southbound right turn lane on 148th Avenue at NE 20th Street
- Provide dual eastbound left turn lanes on Bel-Red Road at 148th Avenue NE
- Provide dual eastbound and westbound left turn lanes on NE 24th Street at Bel-Red Road
- Provide dual eastbound and westbound left turn lanes on Bel-Red Road at 156th Avenue NE

Benefits and Impacts

- Concurrency: Areawide LOS of .946 for TMD 5 (Circular 212 1 hour pm peak)
- Network delay: summary volume/capacity (v/c) reduced by 2%
- Corridor Operations: 148th Avenue summary v/c reduced by 2%
- Side Street Delay: NE 24th Street summary v/c reduced by 10%
- Key Intersection: Reduces v/c at NE 24th and 148th Ave NE by 10%
- Transit Speed/Reliability: Freeway to Overlake Village Transit Center travel time reduced by 5%
- Business Impact: Requires purchase of several buildings; parking and building impacts
- Non-Motorized impacts: Bike lanes added on Bel-Red Rd; pedestrian environment worsens due to widened crossings
- Cost: \$17.4 to 21.6 million

Alternative 2 – Refined Transportation Systems Management (TSM) plus Slip Ramp to 152nd Avenue

This alternative builds off of the Refined TSM Alternative (Alt. 1) by adding an eastbound slip ramp from SR 520 directly to 152nd Avenue. The ramp would divert off of the existing eastbound ramp, but would tunnel underneath 148th Avenue NE, and meet 152nd Avenue at the vicinity of the entrance to the Overlake Village Transit Center.

Benefits and Impacts

- Concurrency: Areawide LOS of .938 for TMD 5 (Circular 212 1 hour pm peak)
- Network delay: summary volume/capacity (v/c) reduced by 2%
- Corridor Operations: 148th Avenue summary v/c reduced by 4%
- Side Street Delay: NE 24th Street summary v/c reduced by 12%
- Key Intersection: Reduces v/c at NE 24th and 148th Ave NE by 27%
- Transit Speed/Reliability: Freeway to Overlake Village Transit Center travel time more direct with new ramp. Old route is reduced by 10%
- Business Impact: Requires purchase of several buildings; parking and building impacts
- Non-Motorized impacts: Bike lanes added on Bel-Red Rd; pedestrian environment worsens due to widened crossings
- Cost: \$35 to 40 million

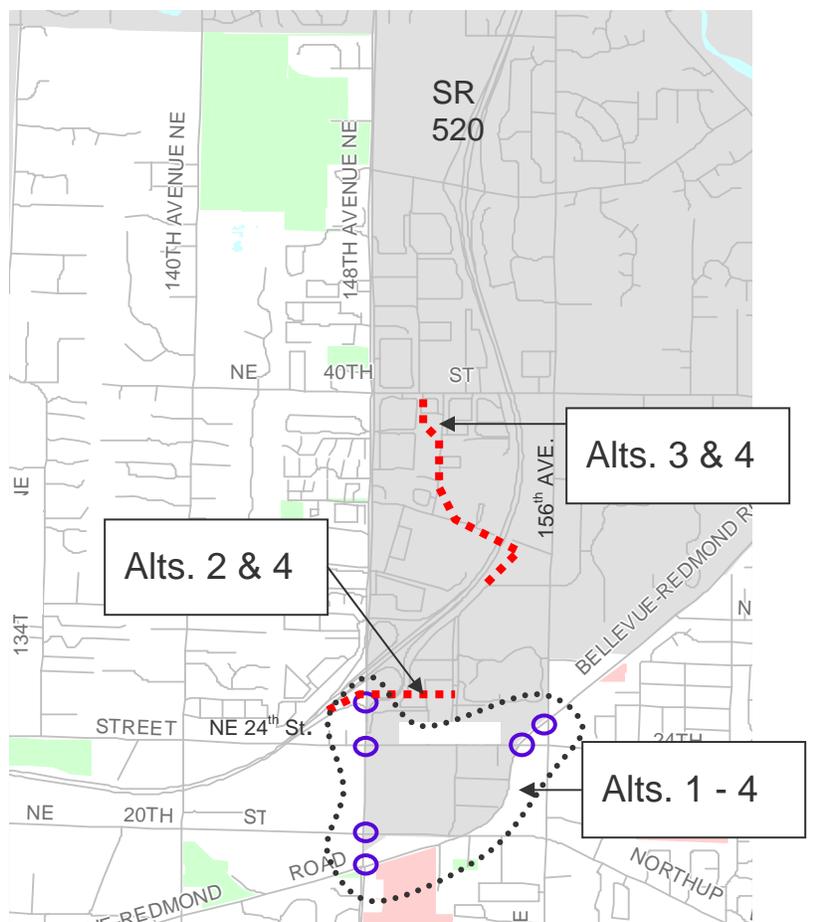
Alternative 3 – Refined Transportation Systems Management (TSM) plus 152nd Avenue Extension over SR 520

This alternative builds off of the Refined TSM Alternative (Alt. 1) by adding a 152nd Avenue extension over SR 520. The route would use the alignment recommended by the Cities of Redmond and Bellevue staff, which followed the east side of SR 520, crossing at NE 36th Street.

Benefits and Impacts

- Concurrency: Areawide LOS of .921 for TMD 5 (Circular 212 1 hour pm peak)
- Network delay: summary volume/capacity (v/c) reduced by 3%
- Corridor Operations: 148th Avenue summary v/c reduced by 1%
- Side Street Delay: NE 24th Street summary v/c reduced by 7%
- Key Intersection: Reduces v/c at NE 24th and 148th Ave NE by 19%
- Transit Speed/Reliability: Freeway to Overlake Village Transit Center travel time more direct with new ramp. Old route is reduced by 8%
- Business Impact: Requires purchase of several buildings; parking and building impacts
- Non-Motorized impacts: Bike lanes added on Bel-Red Rd and possibly new 152nd Avenue extension; pedestrian environment worsens at intersection improvements, but is improved across SR 520 with new connection.
- Cost: \$35 to 44 million

Figure 1.8
Summary of Refined Alternatives



Alternative 4 – Refined Transportation Systems Management (TSM) plus 152nd Avenue Extension over SR 520, plus Slip Ramp to 152nd Avenue

This alternative builds off of the Refined TSM Alternative (Alt. 1) by combining Alternatives 2 and 3. It includes both the 152nd Avenue extension, and the eastbound slip ramp to 152ⁿ Avenue.

Benefits and Impacts

- Concurrency: Areawide LOS of .936 for TMD 5 (Circular 212 1 hour pm peak)
- Network delay: summary volume/capacity (v/c) reduced by 1.4%
- Corridor Operations: 148th Avenue summary v/c reduced by 2%
- Side Street Delay: NE 24th Street summary v/c reduced by 5%

- Key Intersection: Reduces v/c at NE 24th and 148th Ave NE by 29%
- Transit Speed/Reliability: Freeway to Overlake Village Transit Center travel time more direct with new ramp. Old route is reduced by 6%
- Business Impact: Requires purchase of several buildings; parking and building impacts
- Non-Motorized impacts: Bike lanes added on Bel-Red Rd and possibly new 152nd Avenue extension; pedestrian environment worsens at intersection improvements, but is improved across SR 520 with new connection.
- Cost: \$53 to 62 million

**Figure 1.9
Refined Alternatives – Summary of Performance Measures**

Benefit / Impact	Baseline Scenario	Alt. 1 Refined TSM	Alt. 2 TSM + Slip Ramp	Alt. 3 TSM + 152nd Ext.	Alt. 4 TSM + Slip Ramp + 152nd Ext.
Areawide LOS (TMD 5)	0.946	0.932	0.938	0.921	0.936
Network Delay Reduced Summary v/c	NA	-2%	-2%	-3%	-1.40%
Corridor Operations 148th reduced summary v/c	NA	-2%	-4%	-1%	-2%
Side Street Delay NE 24th Reduced summary v/c	NA	-10%	-12%	-7%	-5%
Key Intersection 148th/NE 24th reduced summary v/c	NA	-10%	-27%	-19%	-29%
Transit Speed (old route)	NA	-5%	-10%	-8%	-6%
Cost		\$17 - 22 m	\$35 - 40 m	\$35 - 44 m	\$53 - 62 m

Refined Alternatives Evaluation

The four alternative packages went through an evaluation using established criteria, to determine their effectiveness and feasibility. The purpose of the analysis was to provide a framework for comparison of the alternatives. The results of the analysis were used to help the TAC select the preferred alternative. The evaluation criteria included various measures of effectiveness, feasibility, and other impacts. Each alternative was evaluated in either a quantitative or qualitative manner (depending on the criteria). The Measure of Effectiveness results are shown in **Figure 1.10**.

**Figure 1.10
Evaluation of Alternatives (Measures of Effectiveness Rating)**

		ALTERNATIVES			
		Refined TSM Alternative with six projects	Refined TSM plus preferred 152nd NE Overcrossing	Refined TSM plus SR 520 slip ramp to 152nd NE	Refined TSM plus preferred 152nd NE Overcrossing and SR 520 slip ramp to 152nd NE
MEASURES OF EFFECTIVENESS					
Network Delay		2	3	2	2
Side Street Delay		5	4	5	3
Corridor Operations		2	2	3	2
Transit/HOV Speed and Reliability		4	4	5	5
Person Throughput		2	3	3	4
Overall Effectiveness		3	3.2	3.6	3.2
Rating Scale	1	2	3	4	5
	Least Effective/ Efficient (Most Impact)	←			→
					Most Effective/ Efficient (Least Impact)
MEASURES OF FEASIBILITY					
Safety		3	4	3	4
Enviornmental - Noise		4	2	2	2
Environmental - Water		2	2	2	2
Air Quality		5	5	5	5
Relative Cost		3	1	2	1
Neighborhood Impacts		4	5	4	5
Business Impacts		2	2	1	1
Overall Feasibility		3.3	3.0	2.7	2.9
OTHER IMPACTS					
Pedestrian Enviornment		3	4	3	4
Bicycle Environment		4	5	4	5
Aesthetics / Vegetation		2	2	2	2
R-O-W Acquisition		2	1	1	1
Geometrics		3	3	2	2
Impacts to Other Projects (CIP)		4	4	4	4
Political Feasibility		5	4	4	4
Overall Other Impacts		3.3	3.3	2.9	3.1
TOTAL IMPACTS		9.6	9.5	9.2	9.2
Rating Scale	1	2	3	4	5

1.9 - RECOMMENDED IMPROVEMENTS

Based on the Measures of Effectiveness evaluation, the TAC made recommendations for near term and long term improvements.

As shown in Figure 1.9, all of the alternatives, including the baseline scenario (No Action), were able to meet concurrency by the year 2012. However, the TAC believed that some improvements were still needed within the 2012 year horizon in order to address the queuing and overall congestion problems, especially in the vicinity of NE 24th Street at 148th Avenue. However, the TAC was also opposed to building a significant number of intersection widening projects throughout the study area (TSM Alternative) that would degrade the pedestrian environment and reduce the ability to develop mixed uses and transit oriented developments within the Overlake area in the future.

Short Term Recommended Improvements (By the year 2012)

The TAC recommended that two of the TSM Alternative projects are worthy of building within the near term (By the year 2012). These include the streamlining project at 148th Avenue NE at SR 520, and the intersection improvements at NE 24th Street at 148th Avenue. The TAC believed that these two projects are the most critical for improving the congestion that is currently occurring at that vicinity. These projects would help to solve problems that exist today. The short term improvements are shown in **Figure 1.11**. Detailed conceptual drawings are shown in **Figures 1.12** and **1.13**

- 148th Avenue NE at SR 520 Eastbound to Southbound Ramp – Streamline the southbound lanes on 148th Avenue to reduce friction and improve the southbound flow. This project must be coordinated with the planned BROTS project 68.0 to widen 148th Avenue NE over SR 520 for an additional northbound lane between loop ramps.
 - Benefit: Project would reduce lane-blockages at the ramp intersection and provide better guidance for southbound traffic approaching the NE 24th Street intersection.
 - Estimated cost is \$325,000 (2003 dollars)

- NE 24th Street at 148th Avenue NE – Lengthen the westbound right turn lane on NE 24th Street (to NB 148th Avenue) and provide dual westbound left turn lanes (to SB 148th Avenue). In addition, widen NE 24th Street to allow for wide curb lanes for bicyclists.
 - Benefits: Project would peak period intersection operation at the key bottleneck location in the study area.
 - Impacts: Added lane may impact businesses in the northeast and southeast quadrants of the intersection.
 - Estimated Cost is \$4.0 million – 4.4 million (2003 dollars)

Longer Term Recommended Improvements (Beyond the year 2012)

The TAC recommended that two additional projects be considered beyond the year 2012. These include the both the 152nd Avenue extension, and the SR 520 slip ramp to 152nd Avenue NE.

The TAC recognized that the 152nd Avenue extension would be a significant long term improvement to the Overlake area, primarily because it provides greater connectivity across SR 520 for both motorized and non-motorized transportation. In addition, it could provide a benefit for transit shuttles to connect the Microsoft campus better.

The eastbound slip ramp to 152nd Avenue provides a considerable benefit to the intersection of NE 24th Street at 148th Avenue NE. The ramp would carry vehicles directly to the Group Health Hospital area and thereby reduce the number of vehicles making the southbound to eastbound turning movement at that intersection. In addition, it provides a significant reduction in travel time for buses coming off of SR 520 headed to the Overlake Village Transit Center. The long term improvements are shown in **Figure 1.11**. Detailed conceptual drawings are shown in **Figures 1.14** and **1.15**

- 152nd Avenue NE Extension over SR 520 – Extend 152nd Avenue NE to the north, and follow the eastern edge of SR 520, crossing SR 520 at NE 36th Street. Continue westward, and link with 150th Avenue to the north.
 - Benefits: Project would add roadway connection with options for travel within the study area. Project would provide new bicycle and pedestrian connection across SR 520 between office park developments. The new overcrossing is expected to reduce traffic on 148th Avenue NE and 156th Avenue NE and area-wide v/c is reduced by 3%.
 - Estimated cost is \$18 million – 22 million (2003 dollars).

- New slip ramp from SR 520 – Add an eastbound slip-ramp from SR 520 to 152nd Avenue NE. The ramp would traverse east, and tunnel under 148th Avenue NE and continue toward 152nd Avenue NE in the vicinity of the Overlake Park & Ride/Transit Center.
 - Benefits: Project would significantly reduce traffic at the NE 24th Street and 148th Avenue NE intersection and operation would improve to LOS E. New ramp would provide direct connection to the Overlake Village Transit Center and to Group Health Hospital.
 - Impacts: Building impacts and circulation impacts would result from the project.
 - Estimated cost is \$18 million (2003 dollars)

Figure 1.11
BROTS North South Corridor Study – TAC Recommendations

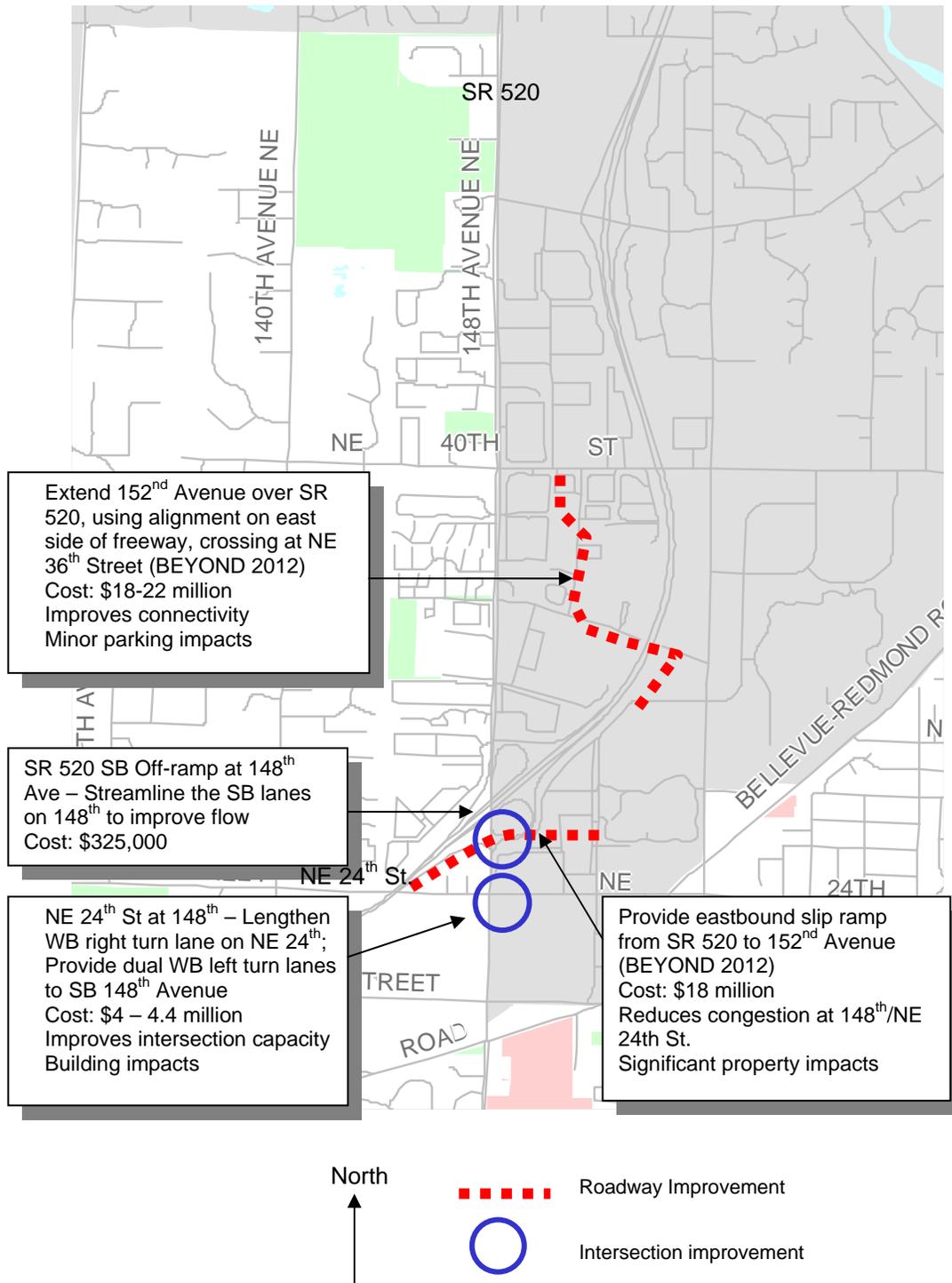


Figure 1.12
Streamline Improvement at 148th Avenue NE / SR 520

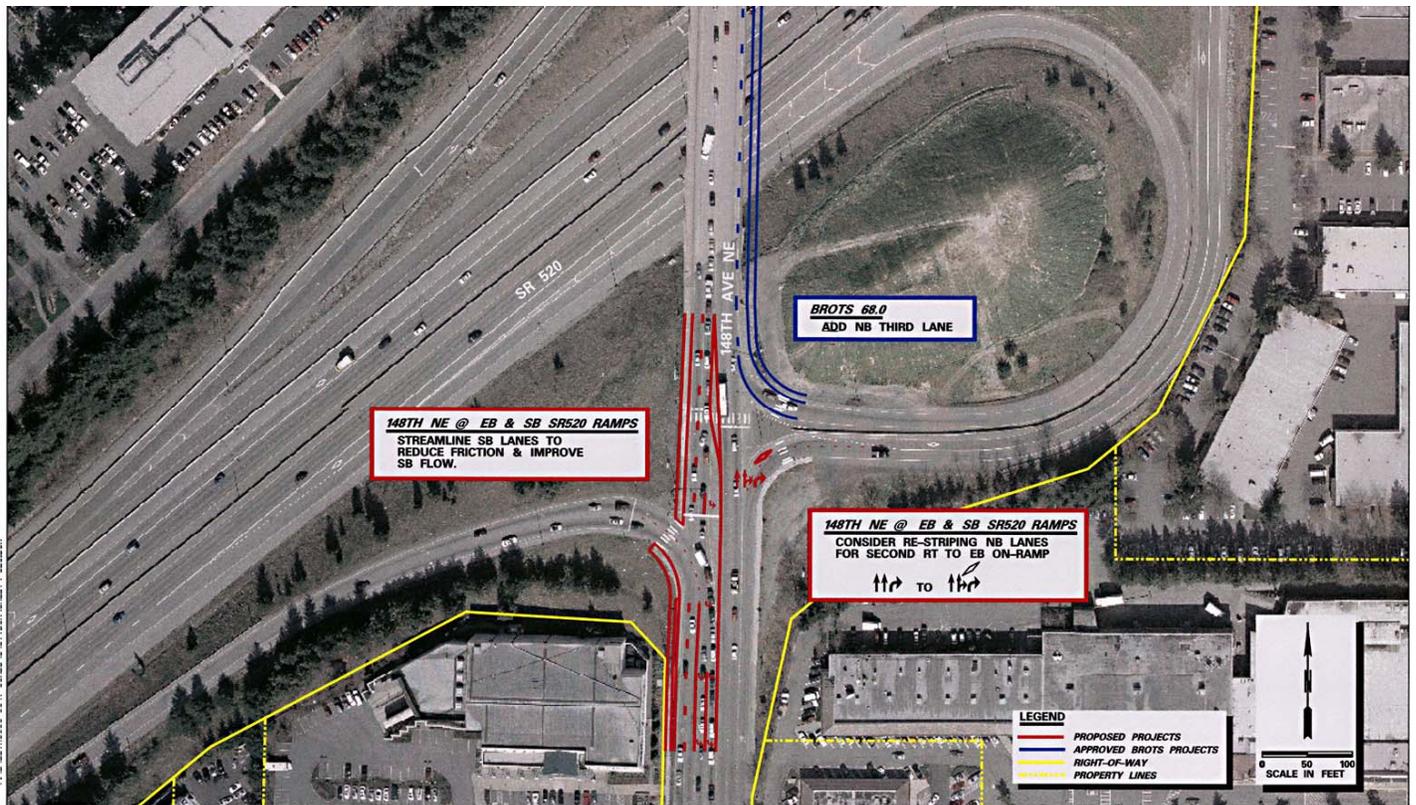


Figure 1.13
Intersection Improvement at 148th Avenue NE / NE 24th Street

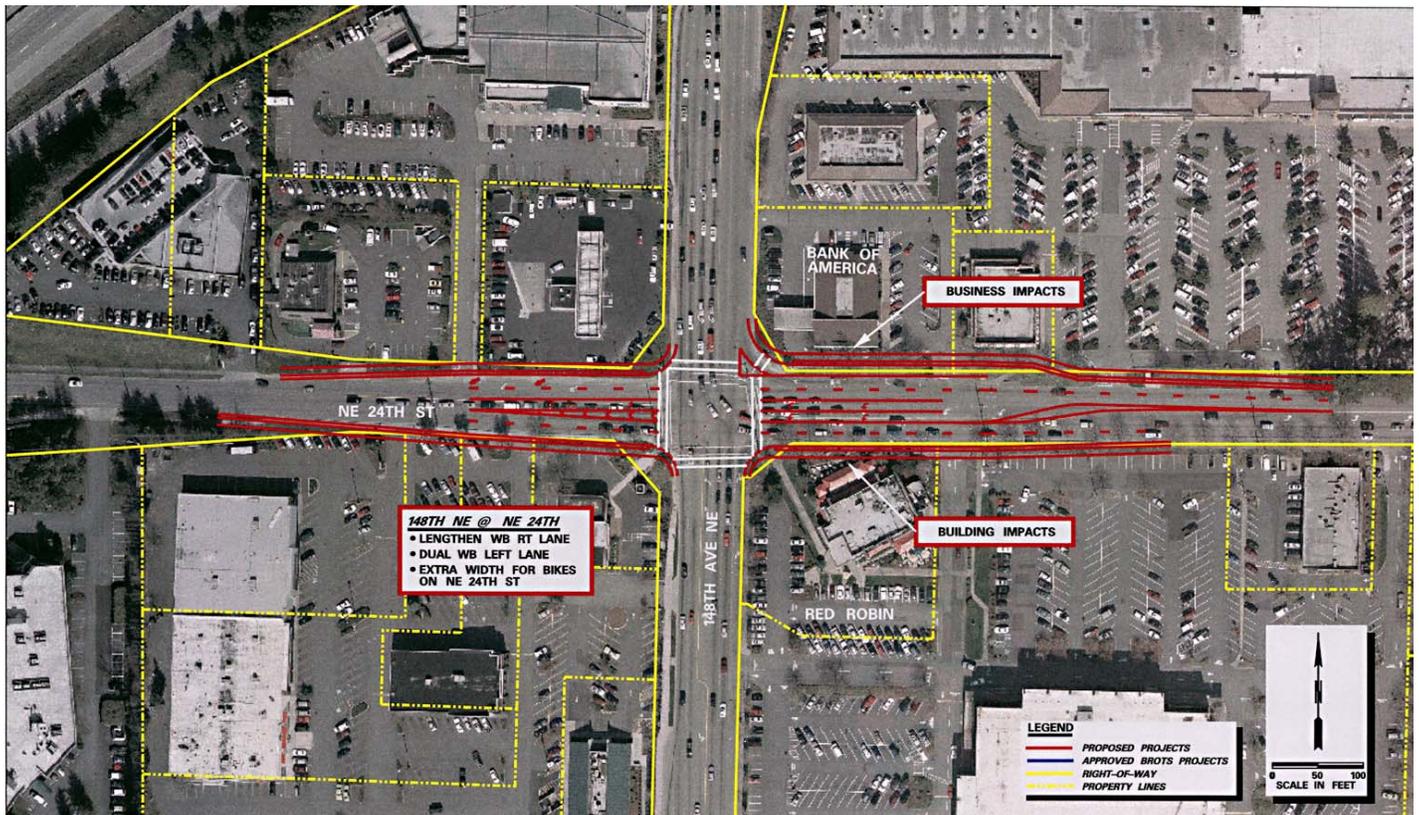
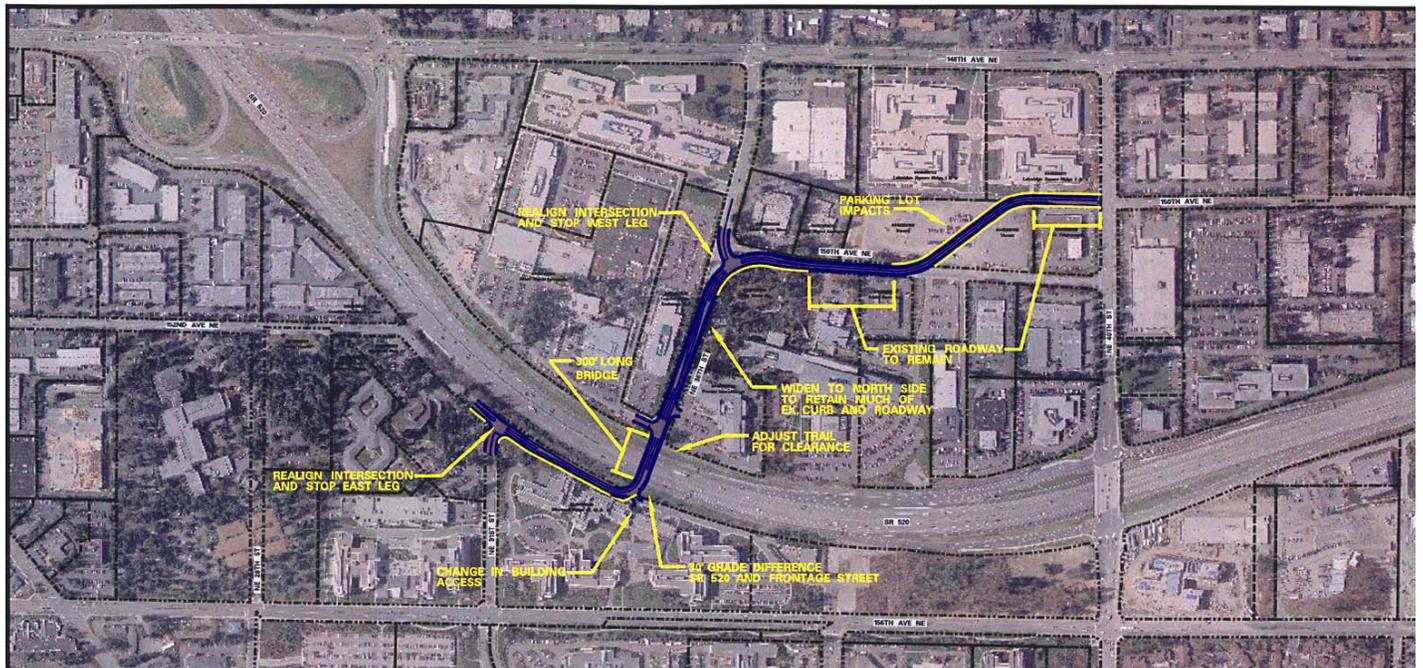


Figure 1.14
152nd Avenue Extension over SR 520



NORTH →

Figure 1.15
Eastbound Slip Ramp to 152nd Avenue

