APPENDIX O2

Design Deviations

I-405, SR520 to SR522 Stage 1 (Kirkland Stage 1)

Draft RFP

March 22, 2005

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Design Deviation #1

NB I-405 Superelevation Transition Location

I-405, SR520 to SR522 Stage 1

MP 18.10 to 20.08

PIN – 84056A

December 9, 2004

Washington State Department of Transportation
Urban Corridors Office

Denise Cieri
Project Manager

Deviation Preparation:

Date: December 9, 2004

By: WENDY TAYLOR, P.E

Wendy Taylor, P.E.

WENDY M. TAYLOR
STATE OF WASHINGTON
35558
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES 04/14/05

Deviation Recommended for Approval

Date: 12/9, 2004

By: _____

Kim Henry, P.E.
I-405 Chief Engineer

Deviation Approval:

Date: 1/6, 2005

By: _____

John Milton, P.E.
Assistant State Design Engineer

Deviation Approval:

Date: 2/16, 2005

By: _____

FHWA

Project Description

The Legislative Nickel Package was passed in May 2003 and funding became available in July 2003. Within this funding, the legislature provided $164 million for the design and construction of the I-405, SR520 to SR522 Project (also referred to as the Nickel Project). The project will result in one additional northbound (NB) lane between NE 70th Street and NE 124th Street, and one additional southbound (SB) lane between SR-522 and SR-520.

To ensure Nickel Project compatibility with the corridor vision, the Legislature included funds for preliminary engineering for the Implementation and Master Plans for the I-405 corridor. This action was to ensure the most efficient use of taxpayer funds in moving forward with the I-405 corridor program. The Nickel Project design is being developed with the corridor vision as a backdrop.

The project objective is to relieve congestion in the worst bottlenecks in Kirkland, using a fixed amount of funds. The project scope was determined by selecting relatively low cost, high congestion relief features that would be utilized in building toward the 10-year Implementation Plan. The cost benefit analysis for the Nickel Project was 10.8 to 1.

The original legislative action provided Nickel Project construction funding beginning in 2010, which included one construction stage. Subsequently, it was determined that a relatively low cost lane addition project in Kirkland would yield enormous traffic relief for one of the corridor's worst bottlenecks. Accordingly, the Legislature shifted funding to construct this high-yield portion of the Nickel Project known as Stage 1. The Nickel Project was thus split into two construction stages, described in detail below.

I-405, SR520 to SR522

The Nickel Project proposes to add one additional lane NB on I-405 from the NE 70th exit to the NE 124th exit. Currently there is an auxiliary lane NB between SR-520 and NE 70th, which will be extended as part of the Nickel Project to NE 124th St.

In the SB direction, the project proposes adding one additional lane from SR-522 to the existing add lane to SR-520. Currently the SR-522 interchange (I/C) has two westbound (WB) SR-522 ramp lanes creating a SB add lane on I-405. The eastbound (EB) SR-522 ramp merges with the WB SR-522 ramps. The Nickel Project would create an additional lane from this SR-522 ramp and extend it to the existing drop lanes at SR-520.

The project is intended to widen existing pavement where necessary without rebuilding the NE 70th, NE 85th or NE 124th I/C's. Deviated sections are proposed both NB and SB through the 70th/85th I/C's and SB through NE 124th/132nd I/C's (see Figure 1).

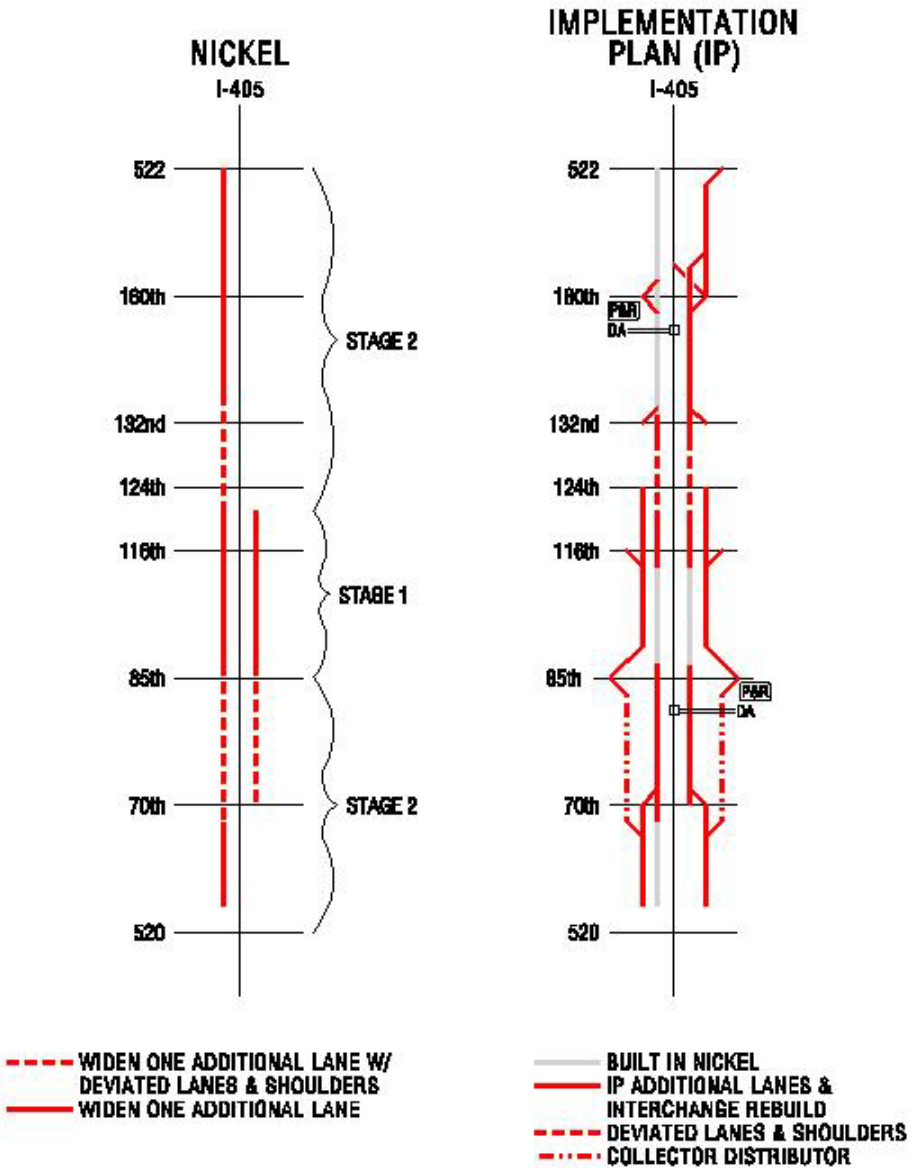
NICKEL
I-405
522
160th
132nd
124th
116th
85th
70th
520
STAGE 2
STAGE 1
STAGE 2
IMPLEMENTATION PLAN (IP)
I-405
522
160th
P&R
DA
132nd
124th
116th
85th
P&R
DA
70th
520
WIDEN ONE ADDITIONAL LANE W/ DEVIATED LANES & SHOULDERS
WIDEN ONE ADDITIONAL LANE
BUILT IN NICKEL
IP ADDITIONAL LANES & INTERCHANGE REBUILD
DEVIATED LANES & SHOULDERS
COLLECTOR DISTRIBUTOR

FIGURE 1

Stage 1

Stage 1 construction proposes an auxiliary lane both NB and SB from NE 85th to NE 124th. Standard lane and shoulder widths for the entire length will be achieved by rebuilding the NE 116th mainline structures. The NE 116th NB off ramp will be rebuilt with minor modifications required on the SB on ramp. Stage 1 is approximately 1.8 miles in length.

Stage 2

The second stage of construction is NB from the existing climbing lane at NE 70th to the lane constructed in Stage 1 at NE 85th. In the SB direction, Stage 2 constructs an additional lane from SR-522 to the Stage 1 lane at 124th, and from NE 85th to the existing drop lane at SR-520. Stage 2 requires some non-standard lane and shoulder widths to avoid rebuilding NE 70th, NE 85th, NE 124th and NE 160th I/C's. The Implementation Plan would later rebuild each of these I/C's, except the NE 124th I/C, and bring the majority of the non-standard elements up to standards. See Figure 1 for a comparison of non-standard elements in the Nickel versus the Implementation Plan.

Mainline Superelevation Transition

Deviation: Non-standard superelevation transition, NB I-405

NB405

Existing conditions:
The existing I-405 mainline is four 12 foot lanes, a 10 foot inside shoulder and a 10 foot outside shoulder. The posted speed limit on I-405 is 60 mph. I-405 crosses over the BNSF Railroad approximately 700' north of NE 116th St. The NB I-405 structure over BNSF has an existing 1.8" overlay that is part of the deck protection system and must remain. The NB I-405 structure over the BNSF Railroad has a load rating of 1.0 and cannot accept any additional load from an overlay. NB I-405 is in a curve to the left, with a radius of 4360 feet and a superelevation rate of 5%. The curve begins at the existing gore location for the NB off ramp to NE 116th St and ends approximately 230 feet north of the BNSF structure.

Proposed Improvements:
NB I-405 will be widened to 5 lanes in each direction, 1 HOV lane and 4 GP lanes, between NE 70th St and NE 124th St. The NE 116th St overcrossing structures will be replaced and the interchange rebuilt as a half-SPUI. NB I-405 will be raised by approximately 4 feet to improve the vertical clearance over NE 116th St and to provide for widening during the Implementation Plan. To facilitate the reconstruction, NB I-405 will be shifted east of its current location over NE 116th St to allow for future bridge expansion in the median. This shift will use a compound curve, with radii of 4589 feet and 3646 feet, extending the existing ahead tangent backstation to the north end of the BNSF structure.

Standard:
The design speed for I-405 is 65 mph. Superelevation rates are based on the 10% maximum super diagram, Figure 640-11a. Seventy percent (70%) of the superelevation runoff should be done on tangent, with the remaining thirty percent of the superelevation runoff completed on the curve. From Section 640.05, Figure 640-13a, WSDOT Design Manual (February 2002).

Alternatives:

Build to Full Standard – Reset superelevation transition rates and runoff location. The proposed curves require a 5% superelevation rate. Seventy percent of the runoff would be located on the tangent, with thirty percent on the curve. Because the PT of the curve is at the end of the BNSF structure, this would require adjusting the superelevation runoff rate across the BNSF structure. Changing the roadway plane for the superelevation runoff would lower the load rating on the bridge, resulting in new weight restriction requirements on the bridge. Adding weight restrictions would require the BNSF bridge to be rebuilt since I-405 is a busy freight corridor and could not function as such with weight restrictions on a bridge. Additionally, 230 feet of NB I-405 pavement would need to be reconstructed.

Proposed Design – Locate the superelevation runoff entirely off the structure without rebuilding the NB 405 pavement. One hundred percent of the runoff would be located on the tangent. The existing cross slope on NB 405 would not be adjusted.

Recommendations:
After reviewing the alternatives and the impacts of each, we recommend the Proposed Design alternative for the following reasons:

- The Full Standard option would require rebuilding in the Nickel Project structures that are planned to be upgraded in the Master Plan. The I-405 overcrossing of the BNSF railroad structure will be rebuilt when the NE 124th St interchange is rebuilt in the Master Plan. The Implementation Plan is to widen the existing SB structure but not affect the NB structure. The cost of rebuilding the BNSF structure is estimated at $5.2 Million. Rebuilding 230 feet of pavement would cost approximately $90,000.
- The existing superelevation runoff was designed for a wider pavement section than currently exists, resulting in the existing transition beginning approximately at the end of the BNSF structure, where the proposed curve ends. The proposed superelevation runoff would be based on the existing pavement section only, because neither the Nickel Project nor the Implementation Plan would add additional travelway in this area. The length of the existing transition is approximately 450 feet compared to a proposed transition length of approximately 300 feet. The result of the project is a nonstandard superelevation transition rate and location; a lengthened transition will be located on the tangent section.

While slight driver discomfort might result from the proposed design, it does not warrant the expenditures of additional monies necessary to build the full standard option. Rebuilding the pavement to a new standard runoff would reduce the effective transition rate in this area.

Design Deviation #2

Arterial Vertical Stopping Sight Distance

I-405, SR520 to SR522 Stage 1

MP 18.10 to 20.08

PIN – 84056A

December 9, 2004

Washington State Department of Transportation
Urban Corridors Office

Denise Cieri
Project Manager

Deviation Preparation:

Date: DECEMBER 9, 2004

By: WENDY M. TAYLOR, P.E

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Deviation Approval:

Date: 2/14, 2005

By:

FHWA

Project Description

The Legislative Nickel Package was passed in May 2003 and funding became available in July 2003. Within this funding, the legislature provided $164 million for the design and construction of the Kirkland Nickel Project. The project will result in one additional northbound (NB) lane between NE 70th Street and NE 124th Street, and one additional southbound (SB) lane between SR-522 and SR-520. A more detailed description of the project follows.

To ensure Nickel Project compatibility with the corridor vision, the Legislature included funds for preliminary engineering for the Implementation and Master Plans for the I-405 corridor. This action was to ensure the most efficient use of taxpayer funds in moving forward with the I-405 corridor program. The Nickel Project design is being developed with the corridor vision as a backdrop.

The project objective is to relieve congestion in the worst bottlenecks in Kirkland, using a fixed amount of funds. The project scope was determined by selecting relatively low cost, high congestion relief features that would be utilized in building toward the 10-year Implementation Plan. The cost benefit analysis for the Kirkland Nickel Project was 10.8 to 1.

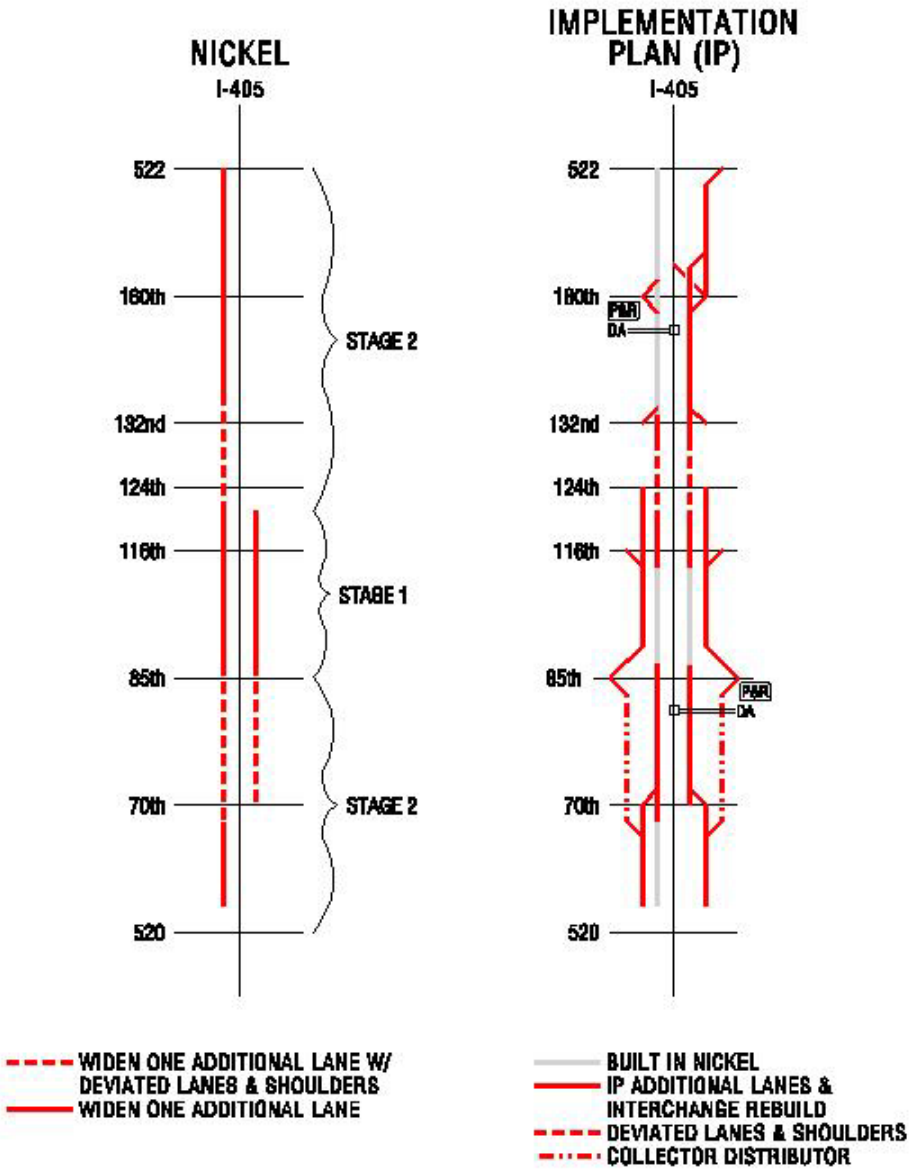
The original legislative action provided Kirkland Nickel Project construction funding beginning in 2010, which included one construction stage. Subsequently, it was determined that a relatively low cost lane addition project in Kirkland would yield enormous traffic relief for one of the corridor's worst bottlenecks. Accordingly, the Legislature shifted funding to construct this high-yield portion of the Kirkland Nickel Project known as Nickel Stage 1. The Kirkland Nickel Project was thus split into two construction stages, described in detail below.

Nickel Project

The Nickel Project proposes to add one additional lane NB on I-405 from the NE 70th exit to the NE 124th exit. Currently there is an auxiliary lane NB between SR-520 and NE 70th. This auxiliary lane will be extended as part of the Nickel Project to NE 124th.

In the SB direction, the project proposes adding one additional lane from SR-522 to the existing add lane to SR-520. Currently the SR-522 interchange (I/C) has two westbound (WB) SR-522 ramp lanes creating a SB add lane on I-405. The eastbound (EB) SR-522 ramp merges with the WB SR-522 ramps. The Nickel Project would create an additional lane from this SR-522 ramp and extend it to the existing drop lanes at SR-520.

The project is intended to widen existing pavement where necessary without rebuilding the NE 70th, NE 85th or NE 124th I/C's. Non-standard lane and shoulder widths are proposed both NB and SB through the 70th/85th I/C's and SB through NE 124th/132nd I/C's (see Figure 1).


NICKEL
I-405
522
160th
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116th
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FIGURE 1

Stage 1

Stage 1 construction proposes an auxiliary lane both NB and SB from NE 85th to NE 124th. Standard lane and shoulder widths for the entire length will be achieved by rebuilding the NE 116th mainline structures. The NE 116th NB off ramp will be rebuilt with minor modifications required on the SB on ramp. This project provides the greatest immediate relief of Kirkland's worst congestion areas and is within WSDOT existing right of way. Stage 1 is approximately 1.8 miles in length. The Kirkland Stage 1 project will be the first of the I-405 Nickel Projects constructed, with construction scheduled to begin in July 2005.

Stage 2

The second stage of construction is NB from the existing climbing lane at NE 70th to the lane constructed in Stage 1 at NE 85th. In the SB direction, Stage 2 constructs an additional lane from SR-522 to the Stage 1 lane at 124th, and from NE 85th to the existing drop lane at SR-520. Stage 2 requires some non-standard lane and shoulder widths to avoid rebuilding NE 70th, NE 85th, NE 124th and NE 160th I/C's. The Implementation Plan would later rebuild each of these I/C's, except the NE 124th I/C, and bring the majority of the non-standard elements up to standards. See Figure 1 for a comparison of non-standard elements in the Nickel versus the Implementation Plan. If funds are available, the completion of Implementation Plan 116th I/C and arterial improvements will be added to the Nickel scope and constructed as part of Stage 2. The planned arterial improvements will result in two WB through lanes, two EB turn bays from NE 116th St to the SB on ramp, two turn lanes WB to the SB on ramp, and a second SB left turn bay as well as greater storage and capacity on both ramps. Construction for Stage 2 is currently scheduled to begin in 2010.

Arterial Vertical Stopping Sight Distance

Deviation: Non-standard vertical stopping sight distance, NE 116th St and 120th Ave NE

NE 116th St and 120th Ave NE

<u>Existing conditions:</u>
The existing I-405 mainline is four 12 foot lanes, a varying inside shoulder and a 10 foot outside shoulder in each direction. The profile of I-405 has a crest vertical curve with a 55 mph design speed NB and 61 mph SB over NE 116th St, calculated based on existing vertical stopping sight distances. The minimum vertical clearance of the overcrossing structures is 15'6". The posted speed limit on I-405 is 60 mph. I-405 crosses over the BNSF Railroad approximately 600' north of NE 116th St.

The NE 116th St interchange is half-diamond to the south. NE 116th St has four lanes under I-405, widens to five lanes east of the interchange and narrows to three lanes across 120th Ave NE to the west. Along NE 116th St, the profile is roughly 'U' shaped, with a sag curve under I-405. The profile rises both east and west with crest vertical curves at NE 124th Ave to the east and the BNSF overcrossing to the west. The BNSF RR

overcrossing structure is approximately 120' west of the NE 116th St and 120th Ave NE intersection. The existing clearance for this structure is 23.7' with an existing structure depth of 3'.

The sag vertical curve on NE 116th St under I-405 has an existing stopping sight distance of 242 feet, which corresponds to a design speed of 36 mph. The crest vertical curve over the BNSF has an existing stopping sight distance of 411 feet, which corresponds to a design speed of 52 mph. The posted speed limit is 35 mph and the proposed design speed is 45 mph.

120th Ave NE intersects NE 116th St approximately 300' west of I-405. 120th Ave NE has three lanes north of NE 116th St and 2 lanes to the south. Approximately 400' north of NE 116th St, 120th Ave NE crosses the BNSF Railroad at-grade. NE 120th Ave has a sag vertical curve at the railroad crossing then climbs to a crest vertical curve at the intersection with NE 116th St.

The sag curve on 120th Ave NE at the BNSF crossing has a stopping sight distance of 311 feet, which corresponds to a design speed of 27 mph. The crest curve at the intersection with NE 116th St has a stopping sight distance of 158 feet, which corresponds to a design speed of 23 mph. The posted speed limit along 120th Ave NE is 25 mph south of NE 116th St and 30 mph to the north. The design speed for 120th Ave NE is 30 mph for the entire project limits.

Proposed Improvements:
I-405 will be widened to five lanes, 1 HOV lane and 4 GP lanes, both NB and SB. The interchange at NE 116th St will be rebuilt as a half-SPUI interchange and the I-405 overcrossing structures at NE 116th St will be replaced.

NE 116th St will be widened to five lanes under I-405, with two left-turn lanes for the WB to SB movement. At the intersection with 120th Ave NE, NE 116th St will be widened to six lanes, with 2 lanes dedicated for the EB to SB movement, and a right turn pocket for the WB to NB movement. NE 116th St will be widened for approximately 400' west of 120th Ave NE before tapering back to the existing 3 lane section, approximately 1000' west of 120th Ave NE. 120th Ave NE will be widened to add a SB left turn lane at the intersection with NE 116th St. The widening will begin south of the BNSF crossing and will not impact the RR ROW. The NB left turn lane will be restriped to increase the storage length. Sidewalks will be installed or upgraded along both sides of NE 116th St and 120th Ave NE. A bike lane will be installed or upgraded along both directions NE 116th St through the entire project limits.

Standard:
The design speed for I-405 is 65 mph. The design stopping sight distance for a 65 mph design speed is 645 feet, the crest curve K value is 313 and the sag curve K value is 157. From Section 650.05, Figure 650-2, WSDOT Design Manual as amended by the October 9, 2002 Design Manual Supplement.

The design speed for NE 116th St is 45 mph. The design stopping sight distance for a 45 mph design speed is 360 feet, the crest curve K value is 98 and the sag curve K value is 78. From Section 650.05, Figure 650-2, WSDOT Design Manual as amended by the October 9, 2002 Design Manual Supplement.

The design speed for 120th Ave NE is 30 mph. The design stopping sight distance for a 30 mph design speed is 200 feet, the crest curve K value is 30 and the sag curve K value is 36. From Section 650.05, Figure 650-2, WSDOT Design Manual as amended by the October 9, 2002 Design Manual Supplement.

Vertical clearance for a new bridge over a roadway is 16.5 feet. When widening under or over an existing structure over a roadway, the required vertical clearance is 16 feet. New structures over railroads must have a vertical clearance of at least 23.5 feet, while widening over a railroad requires at least 22.5 feet of vertical clearance. From Section 1120.04(5), Figure 1120-1, WSDOT Design Manual (September 2002).

Alternatives:

Build to Full Standard – Raise the profile of both I-405 and NE 116th St in order to flatten the vertical sag curve and grade separate the 120th Ave NE and BNSF crossing. Achieving a 45 mph design speed for the sag curve on NE 116th St necessitates flattening the grade of one of the approaches. Lowering the grade on the west approach is more feasible, because of the planned improvements to NE 116th St and 120th Ave NE. Overall, the profile would be raised approximately 6 feet under I-405 and as much as 3 feet at the intersection with 120th Ave NE. The NE 116th St over BNSF structure needs to be rebuilt with a deeper structure depth due to the widened bridge width, which would require raising the profile of NE 116th St approximately 1 foot to maintain 23.5 feet of vertical clearance over the railroad. All of these factors on NE 116th St will require raising I-405 approximately 10 feet to ensure standard clearances and an efficient bridge depth. Raising the I-405 mainline this much will necessitate rebuilding the I-405 overcrossing structures at BNSF.

The intersection of NE 116th St and 120th Ave NE would be raised by as much as 3 feet. It is not possible to raise the intersection, have an at-grade crossing at the BNSF, and improve the vertical stopping sight distance on 120th Ave NE. Therefore, 120th Ave NE would need to become grade separated over BNSF. This will result in taking 4 parcels due to loss of access, buying or modifying access points to 6 parcels and raising the intersection of NE 120th Ave and NE 118th St, approximately 850 feet north of NE 116th St, about one foot.

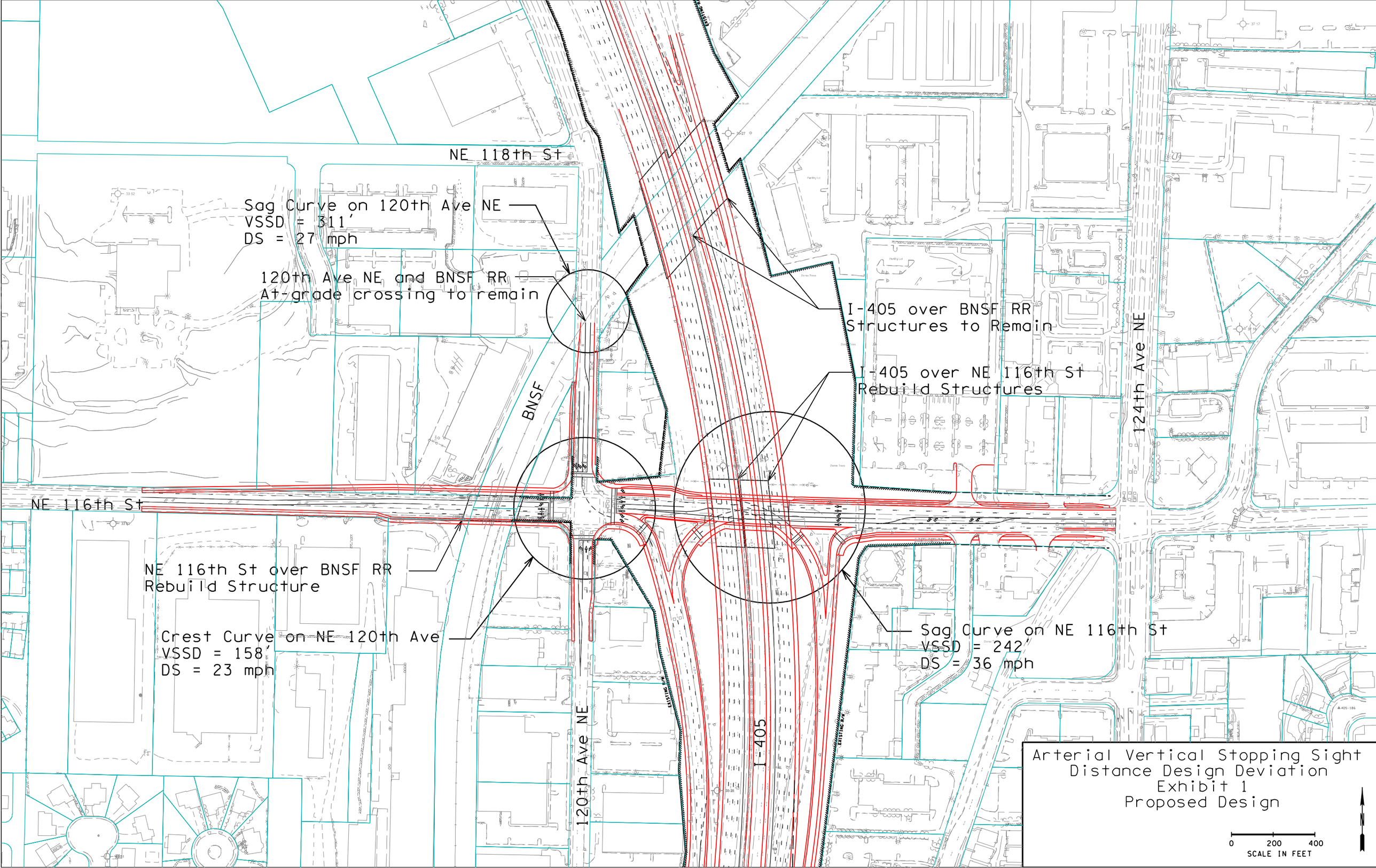
Proposed Design – Raise the profile of I-405 to provide adequate clearance over NE 116th St without rebuilding the I-405 overcrossing of BNSF and the vertical curves along NE 116th St and 120th Ave NE (see Exhibit 1). I-405 would be raised approximately 4 feet NB and 6 feet SB to provide adequate vertical stopping sight distance, to allow for standard vertical clearance over NE 116th St and to enable a more efficient structure type. Approximately one inch of additional asphalt overlay would be necessary on the SB BNSF overcrossing structure, while the load rating of the NB BNSF overcrossing

structure does not allow any changes to the pavement depth. Raising the mainline does not have any ROW impacts; all ROW impacts in this option are due to the arterial widening. The NE 116th St overcrossing structure at the BNSF track will be rebuilt with a larger structural depth of 37". The widening of NE 116th St will require the profile of the BNSF overcrossing structure to be raised approximately one foot to preserve 23.5' of minimum vertical clearance.

Recommendations:
After reviewing the alternatives and the impacts of each, we recommend the Proposed Design alternative for the following reasons:

- The Full Standard option would require rebuilding in the Nickel Project structures that are planned to be upgraded in the Master Plan. The I-405 overcrossing of the BNSF railroad structures will be replaced when the NE 124th St interchange is rebuilt in the Master Plan. The Implementation Plan is to widen the existing SB structure but not affect the NB structure. The new crossing of 120th Ave NE over the BNSF is not planned by either WSDOT or the City of Kirkland. Additionally, 120th Ave NE at the BNSF crossing is outside the limited access area owned by WSDOT. It would cost approximately $68 Million to build the "full standard" option.
- The Proposed Design prioritizes fixing non-standard conditions along I-405 and meets standards in all new elements. The existing sight distances along NE 116th St meet the posted speed limits, while the distances along 120th Ave NE are at or near the posted speed limit. The arterial roads in this area do not have a high volume of accidents per city records. As mitigation to the sag curve on NE 116th St, the new bridge will have flood lighting underneath it to enhance nighttime visibility. The sag curve on 120th Ave NE will also be mitigated with new lighting to enhance nighttime visibility during Stage 2 construction.

It does not appear that the expenditure of additional monies necessary to build the full standard option would provide a significant benefit.


NE 118th St
Sag Curve on 120th Ave NE
VSSD = 311'
DS = 27 mph
120th Ave NE and BNSF RR
At-grade crossing to remain
BNSF
I-405 over BNSF RR
Structures to Remain
I-405 over NE 116th St
Rebuild Structures
124th Ave NE
NE 116th St
NE 116th St over BNSF RR
Rebuild Structure
Crest Curve on NE 120th Ave
VSSD = 158'
DS = 23 mph
Sag Curve on NE 116th St
VSSD = 242'
DS = 36 mph
120th Ave NE
I-405
EXISTING WALL
EXISTING WALL
Arterial Vertical Stopping Sight
Distance Design Deviation
Exhibit 1
Proposed Design
0
200
400
SCALE IN FEET
N

Design Deviation #3

Limited Access along NE 116th St

I-405, SR520 to SR522 Stage 1

MP 18.10 to 20.08

PIN – 84056A

February 3, 2005

Washington State Department of Transportation
Urban Corridors Office

Denise Cieri
Project Manager

Deviation Preparation:

Date: February 2, 2005

By: Wendy Taylor

Wendy Taylor, P.E.

WENDY M. TAYLOR
STATE OF WASHINGTON
35558
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES 04/14/05

Deviation Recommended for Approval

Date: 2/3, 2005

By: Kim Henry

Kim Henry, P.E.
I-405 Chief Engineer

Deviation Approval: RECOMMENDED

Date: 2·10, 2005

By: Harold Peterfeso

Harold Peterfeso, P.E.
State Design Engineer

Deviation Approval:

Date: 2/14, 2005

By: James A. Leman

FHWA

Project Description

The Legislative Nickel Package was passed in May 2003 and funding became available in July 2003. Within this funding, the legislature provided $164 million for the design and construction of the Kirkland Nickel Project. The project will result in one additional northbound (NB) lane between NE 70th Street and NE 124th Street, and one additional southbound (SB) lane between SR-522 and SR-520. A more detailed description of the project follows.

To ensure Nickel Project compatibility with the corridor vision, the Legislature included funds for preliminary engineering for the Implementation and Master Plans for the I-405 corridor. This action was to ensure the most efficient use of taxpayer funds in moving forward with the I-405 corridor program. The Nickel Project design is being developed with the corridor vision as a backdrop.

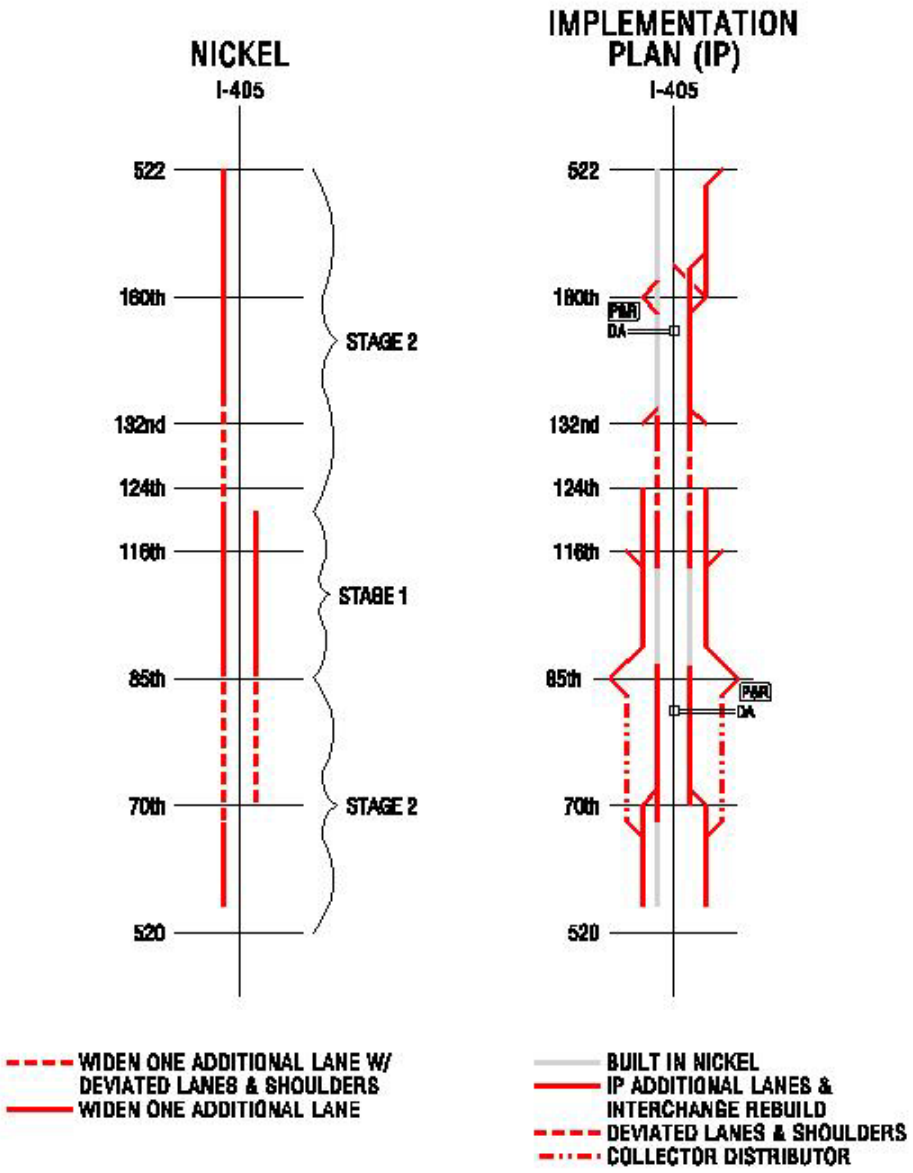
The project objective is to relieve congestion in the worst bottlenecks in Kirkland, using a fixed amount of funds. The project scope was determined by selecting relatively low cost, high congestion relief features that would be utilized in building toward the 10-year Implementation Plan. The cost benefit analysis for the Kirkland Nickel Project was 10.8 to 1.

The original legislative action provided Kirkland Nickel Project construction funding beginning in 2010, which included one construction stage. Subsequently, it was determined that a relatively low cost lane addition project in Kirkland would yield enormous traffic relief for one of the corridor's worst bottlenecks. Accordingly, the Legislature shifted funding to construct this high-yield portion of the Kirkland Nickel Project known as Nickel Stage 1. The Kirkland Nickel Project was thus split into two construction stages, described in detail below.

Nickel Project

The Nickel Project proposes to add one additional lane NB on I-405 from the NE 70th St. exit to the NE 124th St. exit. Currently there is an auxiliary lane NB between SR-520 and NE 70th St. This auxiliary lane will be extended as part of the Nickel Project to NE 124th St. In the SB direction, the project proposes adding one additional lane from SR-522 to the existing add lane to SR-520. Currently the SR-522 interchange (I/C) has two westbound (WB) SR-522 ramp lanes creating a SB add lane on I-405. The eastbound (EB) SR-522 ramp merges with the WB SR-522 ramps. The Nickel Project would create an additional lane from this SR-522 ramp and extend it to the existing drop lanes at SR-520.

The project is intended to widen existing pavement where necessary without rebuilding the NE 70th, NE 85th or NE 124th I/C's. Non-standard lane and shoulder widths are proposed both NB and SB through the 70th/85th I/C's and SB through NE 124th/132nd I/C's (see Figure 1).


NICKEL
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COLLECTOR DISTRIBUTOR

FIGURE 1

Stage 1

Stage 1 construction proposes an auxiliary lane both NB and SB from NE 85th St. to NE 124th St. Standard lane and shoulder widths for the entire length will be achieved by rebuilding the NE 116th St. mainline structures. The NB off ramp to NE 116th St. will be rebuilt with minor modifications required on the SB on ramp. This project provides the greatest immediate relief of Kirkland's worst congestion areas and is within WSDOT existing right of way. Stage 1 is approximately 1.8 miles in length. The Kirkland Stage 1 project will be the first of the I-405 Nickel Projects constructed, with construction scheduled to begin in July 2005.

Stage 2

The second stage of construction is NB from the existing climbing lane at NE 70th St. to the lane constructed in Stage 1 at NE 85th St. In the SB direction, Stage 2 constructs an additional lane from SR-522 to the Stage 1 lane at 124th St., and from NE 85th St. to the existing drop lane at SR-520. Stage 2 requires some non-standard lane and shoulder widths to avoid rebuilding NE 70th St., NE 85th St., NE 124th St. and NE 160th St. I/C's. The Implementation Plan would later rebuild each of these I/C's, except the NE 124th St. I/C, and bring the majority of the non-standard elements up to standards. See Figure 1 for a comparison of non-standard elements in the Nickel versus the Implementation Plan. If funds are available, the completion of Implementation Plan 116th St. I/C and arterial improvements will be added to the Nickel scope and constructed as part of Stage 2. The planned arterial improvements will result in two WB through lanes, two EB turn bays from NE 116th St to the SB on ramp, two turn lanes WB to the SB on ramp, and a second SB left turn bay as well as greater storage and capacity on both ramps. Construction for Stage 2 is currently scheduled to begin in 2010.

Limited Access along NE 116th St

Deviation: Non-standard limited access, NE 116th St.

NE 116th St.

<u>Existing conditions:</u>
The existing I-405 mainline, NB and SB, is four 12 foot lanes, a varying inside shoulder and a 10 foot outside shoulder. The NE 116th St interchange is a half diamond to the south. NE 116th St has four lanes under I-405, widens to five lanes east of the interchange and narrows to three lanes across 120th Ave NE to the west. (See Exhibit 1)

West of I-405, the intersection of NE 116th St and 120th Ave NE is approximately 200 feet from the center of the SB on ramp. Along 120th Ave NE limited access has been purchased for 130 feet from the center of the intersection. Further west on NE 116th St, limited access has been purchased to the beginning of the BNSF overcrossing structure, approximately 160 feet from the center of the intersection. An existing driveway within the limited access boundary on NE 116th St services a Park and Ride lot owned and maintained by WSDOT. In the southeast quadrant of the NE 116th St/120th Ave NE

intersection, there is a driveway accessing a small parking lot within the existing limited access boundary.

East of I-405, the existing limited access ends approximately 300 feet from the centerline of the NB off ramp. On the south side of NE 116th St. beginning at the end of the existing limited access, a private driveway provides shared access to two restaurants (Shari's and Brown Bag Café) and a Best Western motel. East of the private driveway is a Conoco Phillips 76 gas station with two driveways, one immediately adjacent to the private driveway and the second located approximately 225 feet from the intersection of NE 116th St and 124th Ave NE. On the north side of NE 116th St, Dania furniture has a driveway approximately 65 feet from the end of the existing limited access. Further east, a driveway accesses a small strip mall including a 7-11 on the corner of NE 116th St and 124th Ave NE. NE 116th St in this area has five existing lanes, including a two-way left turn lane (TWLTL), extending east from the NB on ramp until it becomes a left turn pocket about 200 feet prior to the intersection with 124th Ave NE. The intersection of NE 116th St and 124th Ave NE is approximately 700 feet from the center of the existing NB off ramp.

The City of Kirkland is currently completing a project that addresses existing queuing and access issues at the intersection of NE 116th St and 124th Ave NE. The improvements widened 124th Ave NE, relocated access points along 124th Ave NE and increased storage length for turning vehicles. NE 116th St was also widened east of 124th Ave NE. The City's project did not make any improvements to NE 116th St between I-405 and 124th Ave NE.

<u>Proposed Improvements:</u>
I-405 will be widened to five lanes, 1 HOV lane and 4 GP lanes, both NB and SB. The interchange at NE 116th St will be rebuilt as a half-SPUI interchange and the I-405 overcrossing structures at NE 116th St will be replaced. (See Exhibit 2)

NE 116th St will be widened to five lanes under I-405, with two left-turn lanes for the WB to SB movement. At the intersection with 120th Ave NE, NE 116th St will be widened to six lanes plus a WB right turn pocket, with 2 lanes dedicated for the EB to SB 405 movement. NE 116th St will be widened for approximately 400 feet west of 120th Ave NE before tapering back to the existing 3 lane section, approximately 1000 feet west of 120th Ave NE. 120th Ave NE will be widened to add a second SB left turn pocket at the intersection with NE 116th St. The widening will begin south of the BNSF crossing and will not impact the RR ROW. The NB left turn lane will be restriped to increase the storage length. Sidewalks will be installed or upgraded along both sides of NE 116th St and 120th Ave NE. A bike lane will be installed or upgraded along both directions of NE 116th St through the entire project limits.

The existing Park and Ride lot on NE 116th St. will be closed as part of the proposed improvements. The driveway within limited access on the SE quadrant of the NE 116th St./120th Ave NE intersection will also be closed. Mitigation for either of these driveways is not anticipated.

Standard:
Full access control is required along all ramps, including 300 feet from the ramp terminals along the local road. For a Single Point Urban Interchange (SPUI), where a right turn or left turn ramp branch is separated by an island, access control is required for 300 feet from the intersection of the ramp branch center line and the center line of the side road through lane. Additionally, if a crossroad is less than 350 feet from a ramp terminal, limited access is required for 130 feet from the center of the intersection along all legs. From WSDOT Design Manual Section 1430.03(3), Figures 1430-1a and 1430-3, December 2003.

Deviation:
This deviation proposes maintaining the existing limited access control point on the east side of I-405 along NE 116th St. The proposal would result in 235 feet of limited access control as measured from the juncture of the SPUI right turn branch and NE 116th St. to the existing limited access control point. See Exhibit 3 for a comparison of existing and proposed limited access control point, standards and measurements.

Alternatives:

Alternative A Buy Additional Access Control (Exhibit 4) – Rebuild the existing half-diamond interchange as a half-SPUI, close the driveways west of the interchange and purchase approximately 65 feet of additional full access control east of the NB off ramp. Although the SPUI ramp terminal is only slightly east of the existing ramp terminal (Exhibit 3), the additional 65 feet is necessary because the reference point from which limited access is measured changes when turning movements are split by an island. The shared driveway and the driveway to Dania furniture would be affected by this option. However, Dania could rebuild their driveway, narrowing it by 5 feet, to avoid being constricted by WSDOT access control requirements. The western gas station driveway would be just beyond the new limited access boundary and therefore is out of WSDOT limited access control.

This alternative would benefit the community by helping to avoid conflicts near the interchange. However, this alternative would cost up to $20 million dollars to purchase out the 4 businesses. In addition the half-SPUI yield right to an add lane operates much the same as the existing half- diamond configuration does today.

Alternative B Build an access from private driveway to 124th (Exhibit 5) – Manage access, without acquiring additional limited access, along NE 116th St. by building a new access from the back of the private driveway exiting onto Slater Avenue. This new connection would require purchasing additional ROW and may involve taking a church rectory. Current congestion on Slater Ave and 124th Ave NE may require additional mitigation due to the increased traffic. Right in – right out access to NE 116th St would be provided for the private driveway, both gas station driveways and Dania furniture, with all other traffic routed to 124th Ave NE. C-curb would be installed with cooperation from the City of Kirkland to enforce the right in right out access. An exit from the back

of the Dania parking lot through a strip mall to 124th Ave NE already exists, though access rights for Dania to this driveway would have to be acquired.

This alternative would give the businesses right in right out access to NE 116th St. causing some travelers a more circuitous route through a more congested 124th Ave. NE. In addition, creating an exit from the shared driveway onto Slater Avenue presents potential legal and traffic problems. Driveway access onto Slater Avenue would require a significant rebuild of the improvements the City of Kirkland will make as a part of the 124th Ave NE project. The intersection of Slater Ave and NE 124th St is not signalized. Vehicles making a left turn from Slater must cross two lanes of traffic and merge into an existing queue that extends several hundred feet south of Slater Ave. NE 124th Ave has high traffic volumes and severe congestion during peak hour. Even with the City's planned improvements, the congestion along this road will not be eliminated. This alternative would cost $1 million to purchase the land to build the alternative roadway.

Because the private driveway is not publicly owned, the state does not have the eminent domain necessary to acquire the ROW to improve the driveway access of another parcel. The state cannot compel the owners of the private driveway to allow a new access from their driveway to the Conoco Philips 76 gas station, because the gas station would not be landlocked as a result of the project. At the end of September, the owner of the private driveway was approached about allowing access to the driveway for the Conoco Philips 76 gas station. The owner refused due to the increase in liability, which grounds he has also used to deny access to neighboring parcels.

Condemning the gas station would likely be necessary if one of the driveways is closed. While the State does not compensate for restricted access or circuity of travel, it could still be necessary to acquire this parcel. Closing the driveway would severely limit the access of supply trucks to the property, especially oil tankers to the tanks on the eastern boundary of the parcel. If oil tankers cannot reach the tanks, this business will not be able to operate. The cost to acquire that property as a total take is estimated at $3 Million. Conversations with Bryce Brown, AG and Chief Counsel for Transportation, reinforced the finding that restricting access to this parcel would result in a total take.

Alternative C Buy the Private Driveway (Exhibit 6) – This alternative would purchase the private driveway to create a new public road. The road would be deeded to the City of Kirkland to maintain and operate. Improvements would be necessary to upgrade the driveway to a road with a 25 mph design speed, including increasing the curve radius and installing a turnaround. The new road would be stop controlled with a right turn pocket and a left/through lane.

Since the new road is within 350 feet of the limited access measurement point, an additional 130 feet of access control would be necessary along each leg of the intersection. The western gas station and the Dania driveway would both be affected by the new limits of limited access. The western gas station driveway would be closed and a new access opened onto the new road, approximately 200 feet from the center of the intersection. Standard access to the Dania driveway could not be provided. Either the

access rights would need to be acquired or an approved deviation would need to be obtained.

The parking lot from Dania currently connects to an existing driveway at the north side of the parcel. This driveway is shared by three parcels and exits to 124th Ave NE. While Dania is not owed compensation for circuitity of travel, acquiring access rights for Dania to this driveway would cost about $1.5 Million and take approximately three years, including appraisals and court proceedings. It would not be necessary to acquire the Dania parcel, since we can provide access through this back driveway. The cost of acquiring Dania's access to NE 116th St is estimated at $500,000.

A new driveway for the gas station has potential problems. The new driveway would displace an existing propane gas tank, creating the potential for a HAZMAT site. Additionally, it is not clear if the tankers would be able to access the storage tanks on the east border of the property. Tanker access and circulation within the property is currently being studied. The total cost of the land and improvements to the private driveway, including new access for the gas station, is estimated at $300,000.

Alternative D Modify SPUI-Build New Ramp within Existing Limited Access (Exhibit 7) – This alternative will replace the existing half-diamond interchange with a tight half-SPUI interchange. The tighter half-SPUI ramp design would situate the reference point for limited access measurement in the same location as the existing configuration, eliminating the need to purchase additional access control. The radius for the left turning vehicles is the minimum necessary to meet the design speed through the SPUI (160 foot radius for a 25 mph design speed). The right turn pocket needs a 35 foot radius to match the limited access reference point, which is the design standard for a passenger vehicle. The right turn pocket would be widened and tapered to allow a WB-50 truck to complete the turn, though a WB-67 truck would encroach into the second lane to complete the turning movement.

Squeezing the SPUI ramp into the existing limited access area is not an optimal design for the NB off ramp. In order to build a ramp without increasing the span length of the bridge beyond its current limit, the storage length on the ramps would need to be decreased. Based on traffic models of design year (2030) conditions, this ramp configuration would not provide sufficient storage length for left turning vehicles, while queuing in the right turn lane could interfere with the operation of the SPUI. Increasing the span length of the bridge to increase the ramp storage length results in inefficiencies in the structure type and depth, an unpleasant appearance for the interchange, and the potential for pedestrian discomfort with the offset bridge abutments. Both the NB and SB bridges over NE 116th St. would need to be lengthened to meet the Context Sensitive Solutions (CSS) guidelines for the corridor. The total cost of lengthening the bridge span is approximately $1 Million, including soft costs, inflation and a contingency.

Alternative E No new Access Control (Exhibit 8) – Optimize driveway configurations and channelization to limit conflicting movements without purchasing additional access control along NE 116th St. Upgrading the existing half-diamond interchange to a half

SPUI and closing the driveways west of the interchange would also be included in this option. The Dania furniture driveway will be relocated to align directly with the private driveway. The gas station driveways will remain in their existing location. Limited access would extend 235 feet from the reference point on the SPUI ramp.

This option is proposed for the following reasons:

- Modifying the existing access along NE 116th St between I-405 and 124th Ave NE was not seen as necessary by the City of Kirkland. The City studied this area when planning improvements at the intersection of NE 116th St and 124th Ave NE and determined that the accident history did not warrant changes to the existing access. The interchange modifications will improve the flow of traffic through this area. The right turn lane on the NB off ramp has been designed to encourage vehicles to yield at NE 116th St. and clearly channelizes EB traffic. Slowing the right turning traffic will provide vehicles in the TWLTL or driveways with larger gaps in oncoming traffic to complete their turning movements.
- The accident data furnished by the City of Kirkland supports this alternative with its limited modifications to the existing driveways and channelization. Exhibit 9 shows the five accidents within the area of limited access discussion including the Dania and the private driveway. Four of the accidents, including one injury, were associated with vehicles making lefts turn movements at either Dania or the private access driveway. The fifth accident in this area was a vehicle turning right out of the Dania driveway. It is the policy of NW Region Access Management to further control a driveway if five (5) left turning accidents occur in a three year span, including at least one each year. Based on that standard, none of the existing driveways qualify for further control. Dania and the shared access driveway each had one accident in 2001, none in 2002 and one in 2003.
- Exhibit 10 shows all the accidents within the project limits on NE 116th St between 120th Ave NE and 124th Ave NE. These include an additional seven accidents associated with the driveways east of I-405 for a total of twelve accidents altogether. Three accidents, including two with injuries, were rear-ends occurring in a queue on NE 116th St. One accident was a vehicle turning left from the strip mall driveway. Three accidents, including one injury, were associated with the Conoco Phillips 76 gas station and vehicles making left turns.
- Relocating the Dania driveway across from the shared driveway aligns the highest turning volumes in this area and reduces the potential conflicts between vehicles accessing these properties.
- The cost of this option is minimal in comparison to the other alternatives.

<u>Conclusion</u>

Buying additional limited access (Alternative A, Exhibit 4) was not considered reasonable given that the accidents in this location don't warrant additional control and that the additional limited access would cost close to $20 million dollars if all 4 businesses along the private drive were purchased. The owners along this private drive were approached; however they are not interested in any voluntary changes. Therefore

condemnation would be required to purchase the road to make changes. Dania's drive would be slightly within limited access limits so this alternative assumes Dania would alter their drive to not be within the limited access boundary.

Controlling access to the private drive (Alternative B, Exhibit 5) allowing only right in and right out and building an additional access for the private drive onto 124th Ave NE didn't seem to make sense from a traffic standpoint. Traffic along 124th Avenue NE is much more congested than NE 116th Street and without signal control at Slater Avenue making left movements would be difficult and problematic. In addition, this new roadway would tear out portions of what the City is currently building to improve this intersection. This alternative was approximately $1 million.

Buying the private drive to turn it into a public road (Alternative C, Exhibit 6) results in an intersection within 350' of the ramp and requires purchasing limited access for 130 feet along all legs of the new intersection. The Dania driveway would be closed and one access to the gas station relocated to the new road. Relocating the gas station driveway may still result in a condemnation if the tankers are unable to navigate the new access. The total cost of this option is $2.3 million. It would also result in approximately 3 years of schedule delays to acquire all the necessary access rights and could result in clean-up of a HAZMAT site.

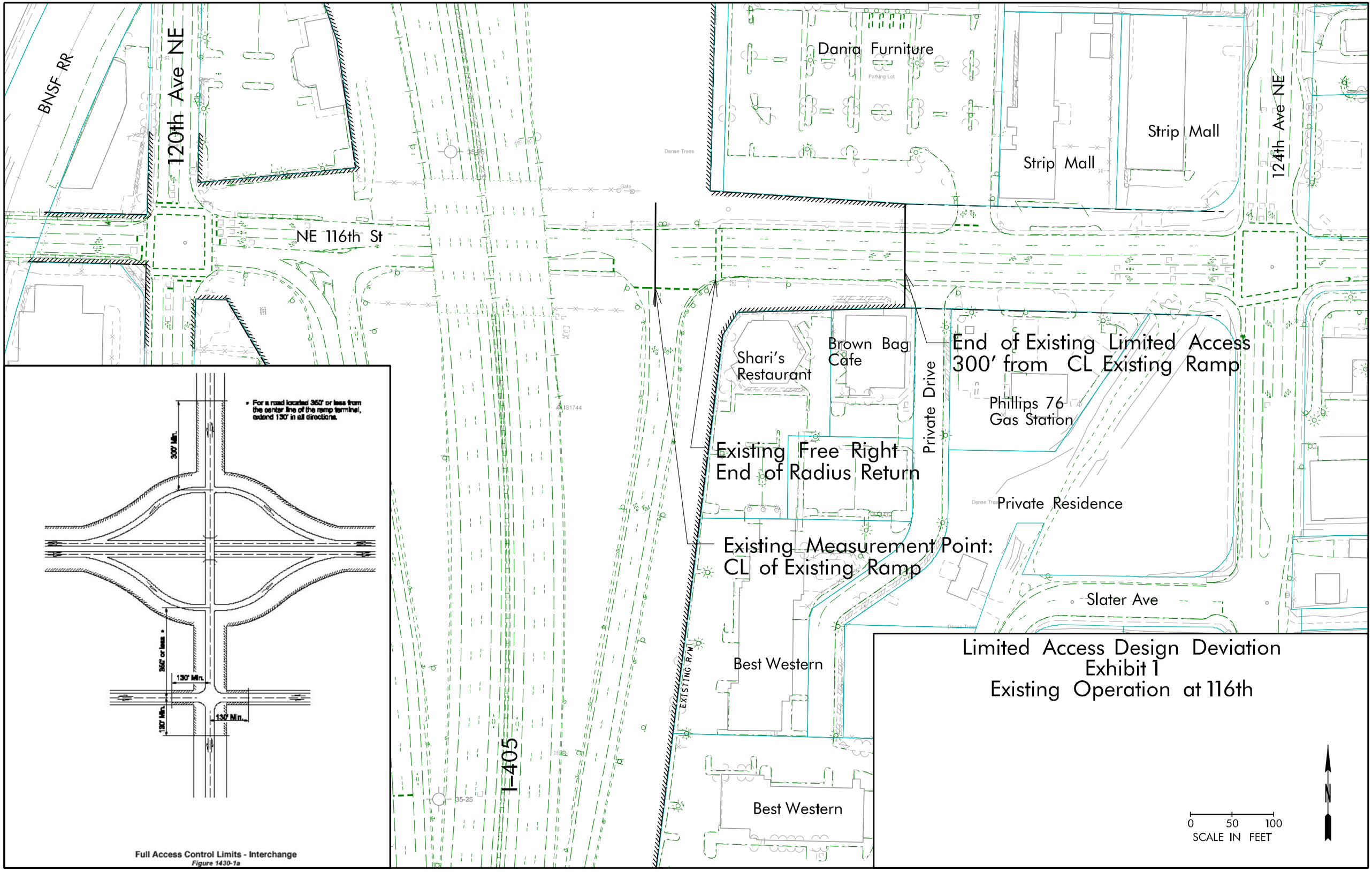
Tightening the half-SPUI ramps to remain within the existing limited access (Alternative D, Exhibit 7) would align the measurement points for the proposed and existing limited access in the same place. The tighter half-SPUI ramp design would eliminate the need to purchase additional access control. This alternative was not selected because in order to provide sufficient storage on the off- ramp the NB bridge would have to be lengthened, increasing bridge cost significantly and degrading the operations of the interchange significantly. This alternative was approximately $1 million.

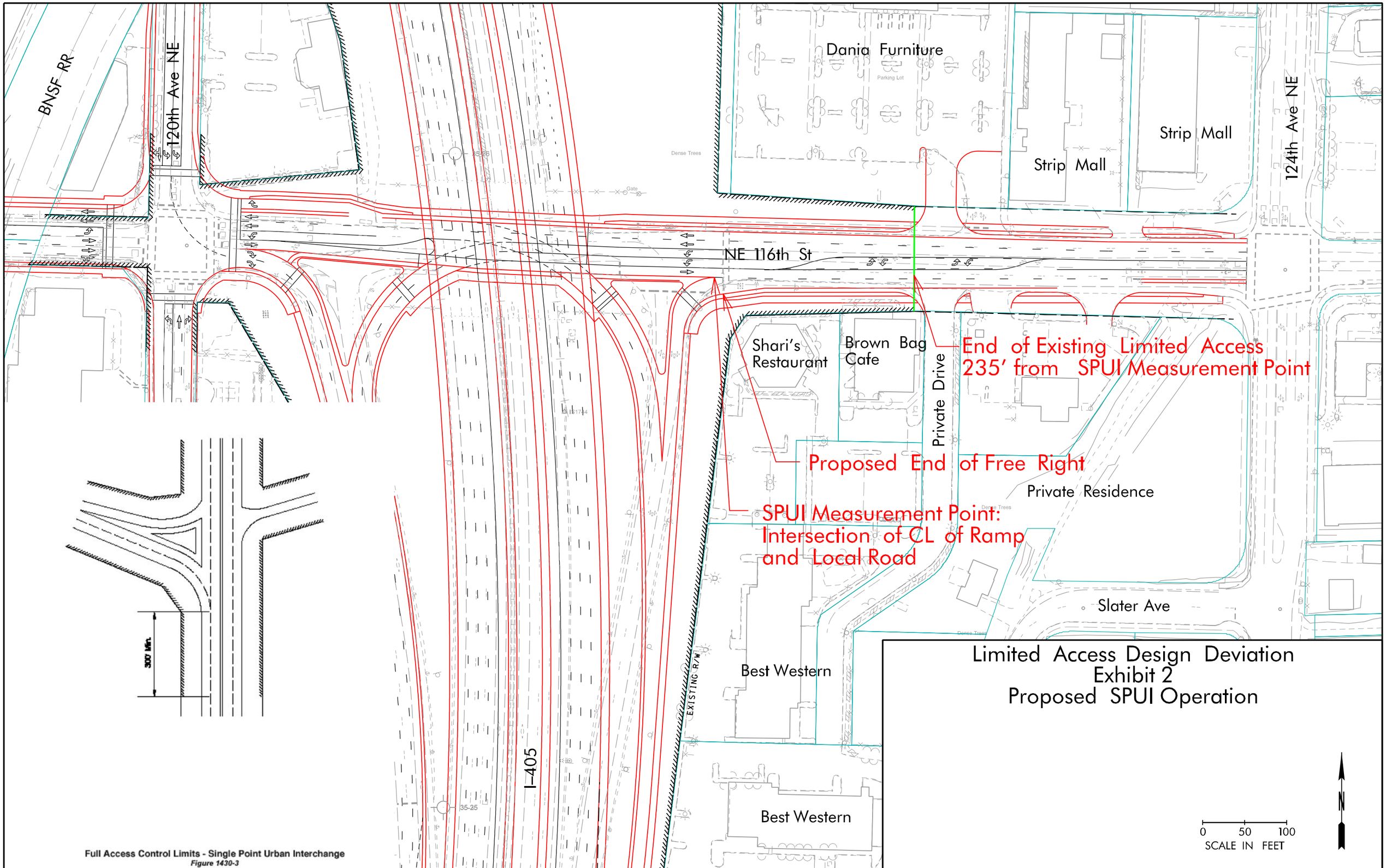
The recommended alternative (Alternative E, Exhibit 8) is to not buy additional access control and to optimize driveway configurations and channelization to limit conflicting movements. The Dania furniture driveway will be relocated to align directly with the private driveway. The gas station driveways will remain in their existing location. Limited access would extend 235 feet from the reference point on the SPUI ramp.

To support this conclusion the accident history was researched. Dania and the private access driveway had a total of five accidents. The Dania had two accidents in 2001, none in 2002 and one in 2003. The private drive had one accident in 2001, none in 2002 and one in 2003. Of the accidents at these drives, four (one with injury) were associated with vehicles making lefts turn movements at either Dania or the private access driveway. The fifth accident in this area was a vehicle turning right out of the Dania driveway. It is the policy of NW Region Access Management to further control a driveway if five (5) left turning accidents at the same driveway occur in a three year span, including at least one each year. The potential safety enhancements gained by acquiring additional access control are not significant enough to justify the very high additional expenditures. By making small modifications to the channelization and driveway configurations, safety

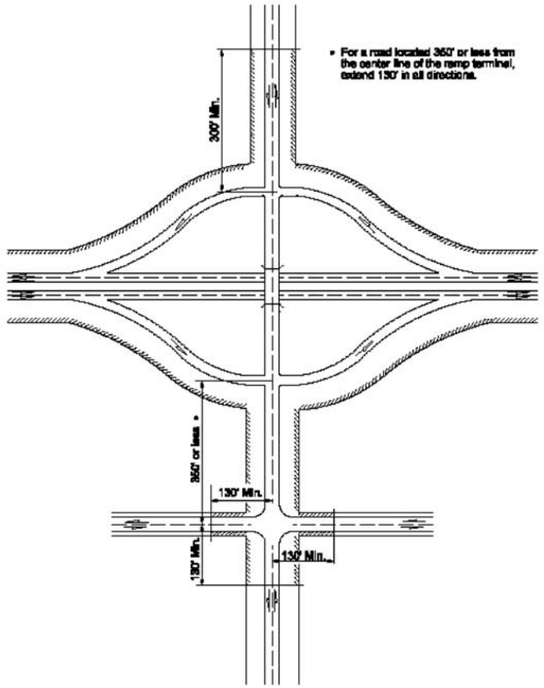
and mobility will be enhanced. In the future, it will be possible to acquire further access control if the requirements set by the NW Region Access Management are met.

Limited Access requirements near interchanges were designed to improve freeway operations and safety. The proposed half-SPUI at NE 116th Street improves the current half-diamond interchange and arterial operations by allowing movement more efficiently and safely. It removes the queue backups in the west direction. In addition, going east the through movement is separated from the right turn movement at the northbound ramp termini. Currently the backup in the west direction along with the lane confusion in the east direction are the cause for most of the accidents in this area. The half-SPUI will improve the northbound to eastbound movement and reduce accidents. It is unlikely that additional access control will result in additional safety improvements. The economic considerations of the first four alternatives studied are felt to be excessive ($1M-$20M). The 235 feet of limited access is well above the suggested 130 feet in the case of excessive economic considerations. Due to the economic considerations and the improved safety and operations of the proposed SPUI and channelization improvements to NE 116th Street we would recommend alternative E and not buy additional limited access.

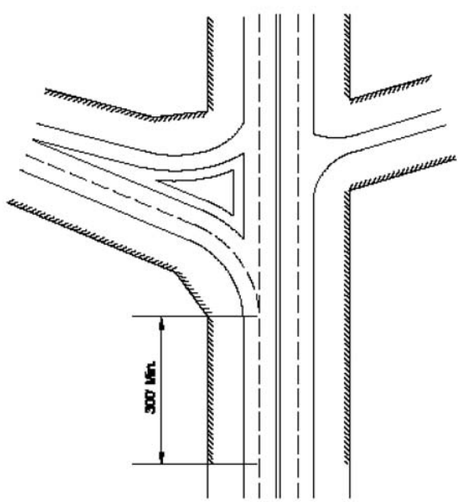

BNSF RR
120th Ave NE
NE 116th St
Dania Furniture
Parking Lot
Strip Mall
Strip Mall
124th Ave NE
Dense Trees
Gate
Shari's Restaurant
Brown Bag Cafe
End of Existing Limited Access
300' from CL Existing Ramp
Private Drive
Phillips 76
Gas Station
Existing Free Right
End of Radius Return
Private Residence
Existing Measurement Point:
CL of Existing Ramp
Slater Ave
Best Western
EXISTING R/W
I-405
Best Western
35-25
Limited Access Design Deviation
Exhibit 1
Existing Operation at 116th
0 50 100
SCALE IN FEET
N
For a road located 350' or less from the center line of the ramp terminal, extend 130' in all directions.
300' Min.
350' or less
130' Min.
130' Min.
130' Min.
Full Access Control Limits - Interchange
Figure 1430-1a



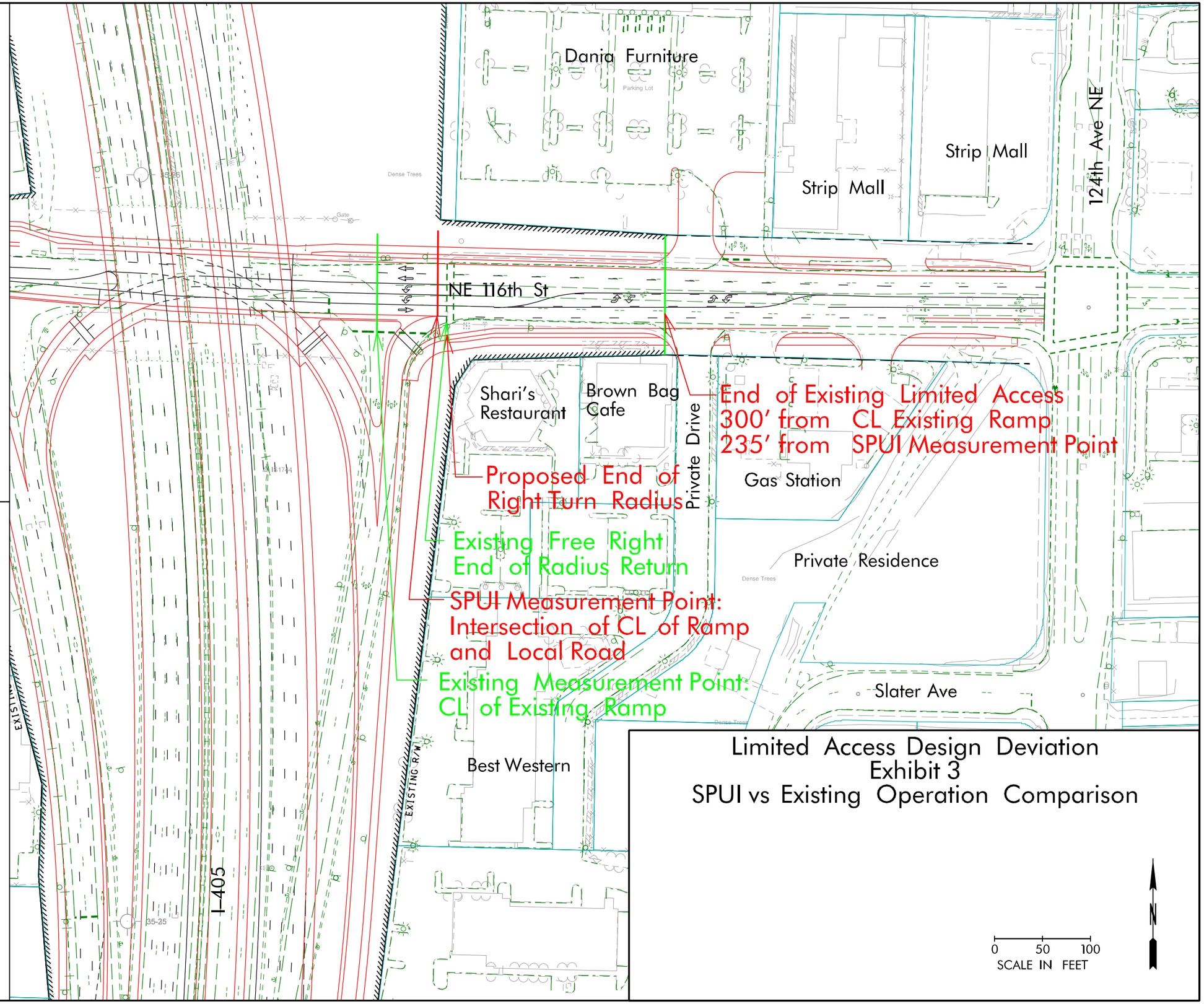
Full Access Control Limits - Single Point Urban Interchange
Figure 1430-3



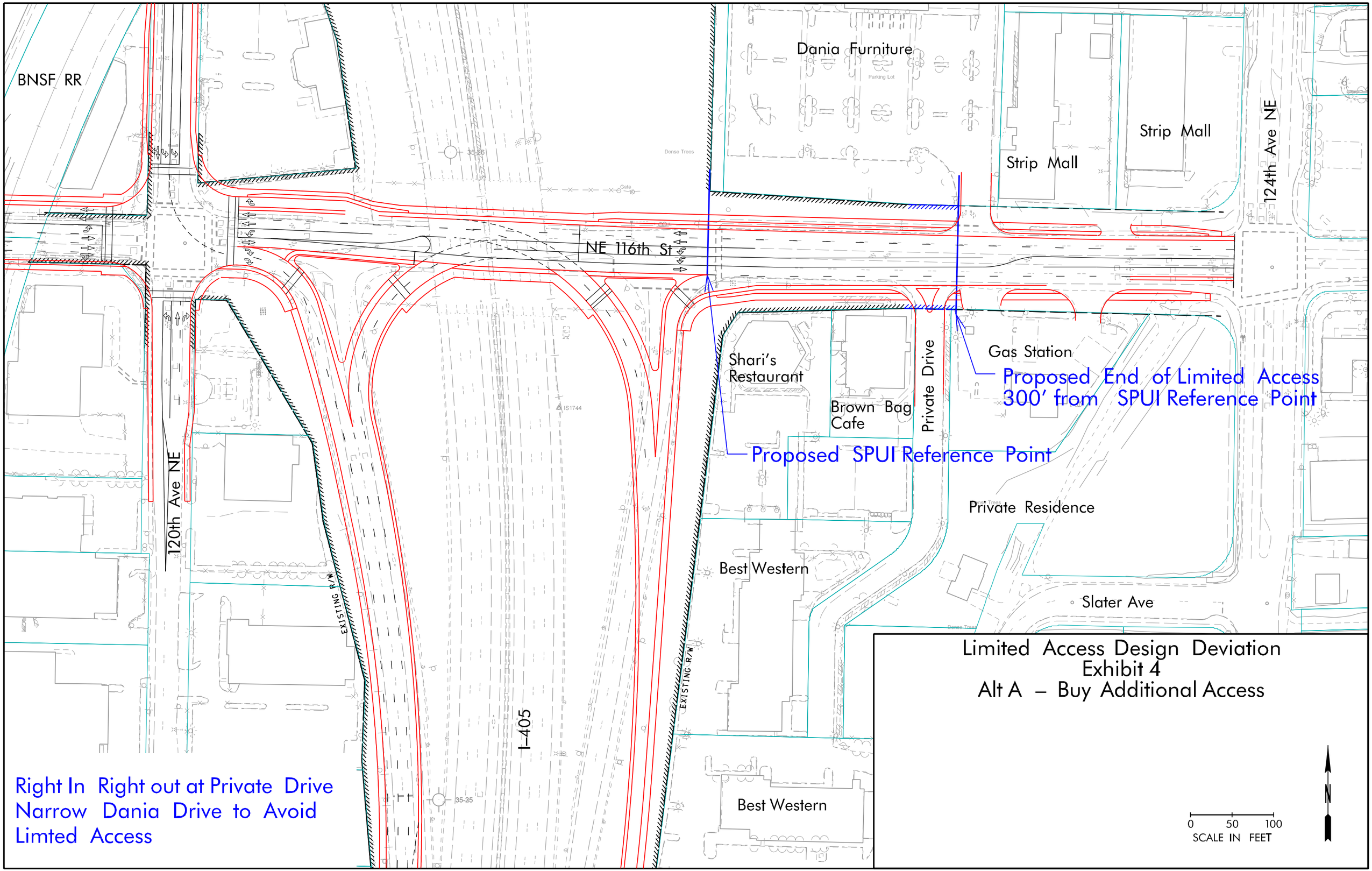
Full Access Control Limits - Interchange
Figure 1430-1a

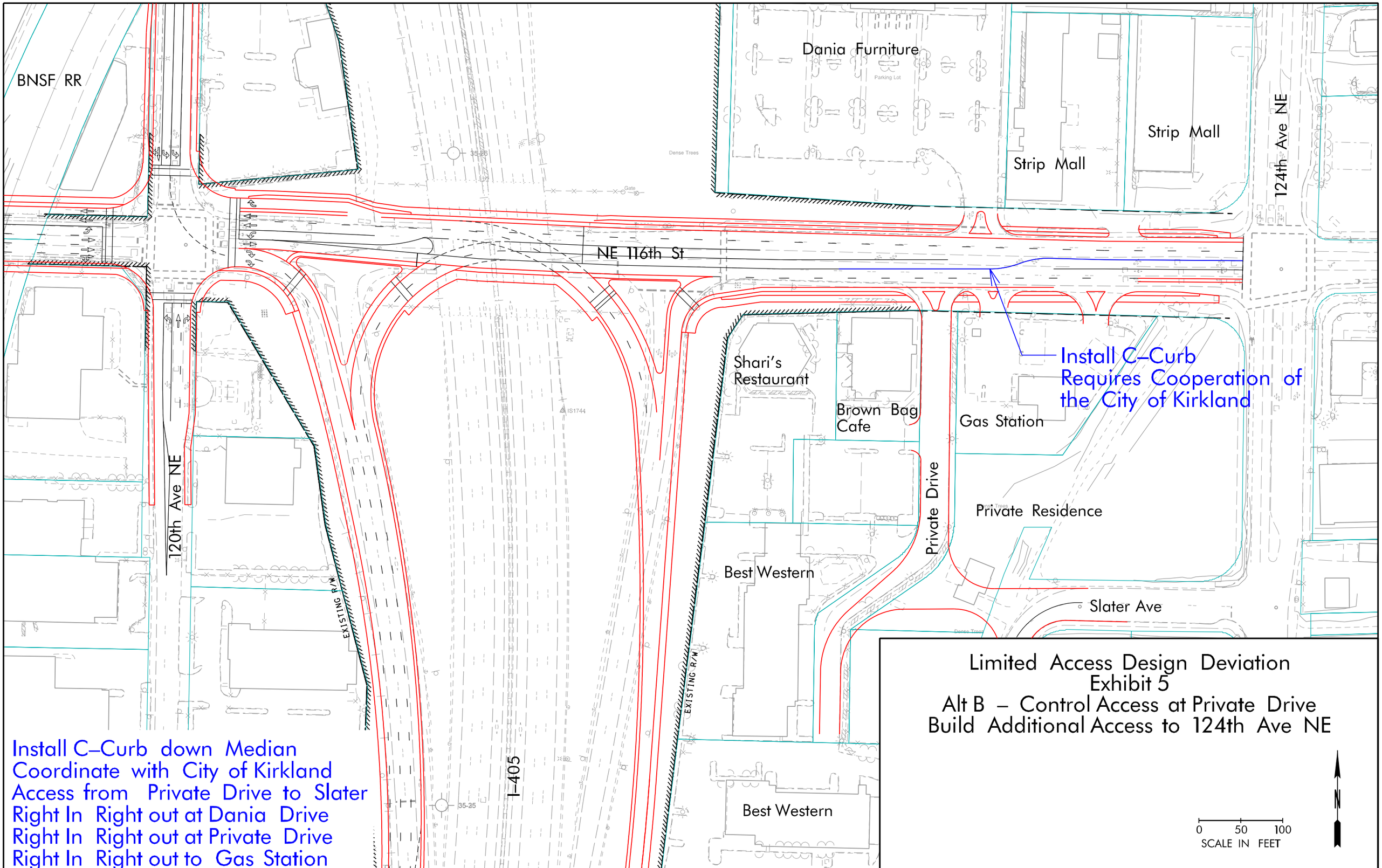


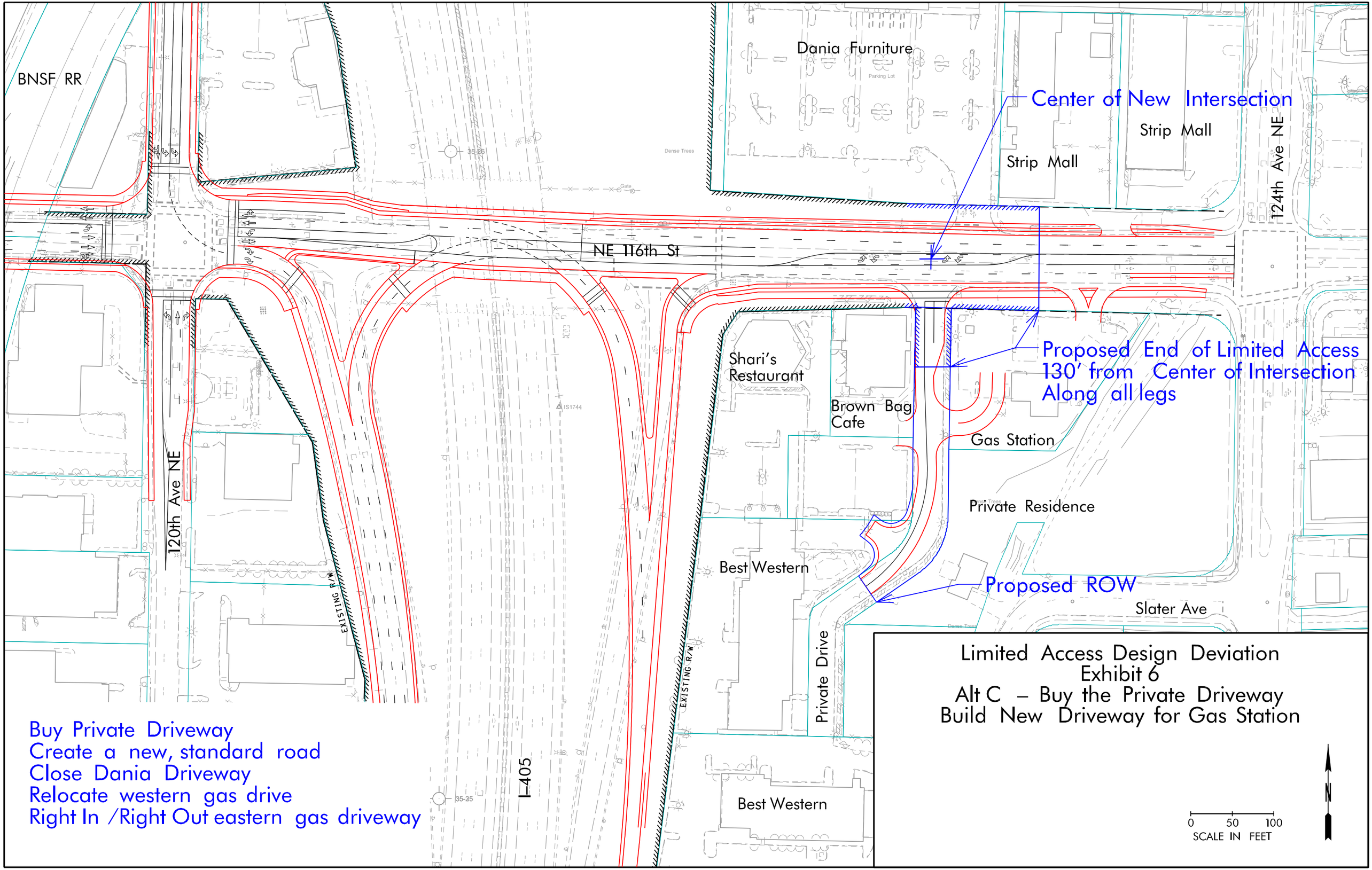
Full Access Control Limits - Single Point Urban Interchange
Figure 1430-3

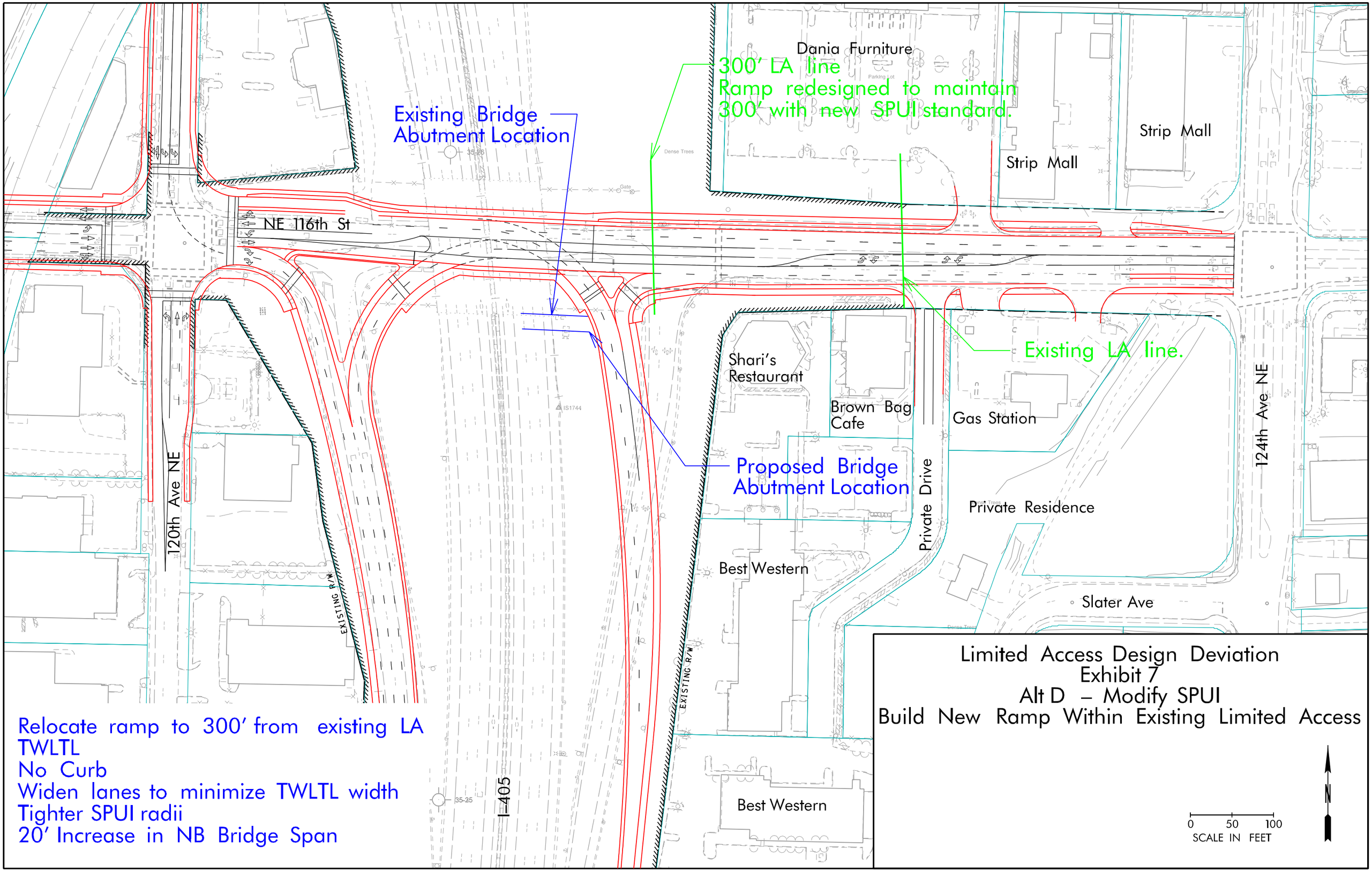


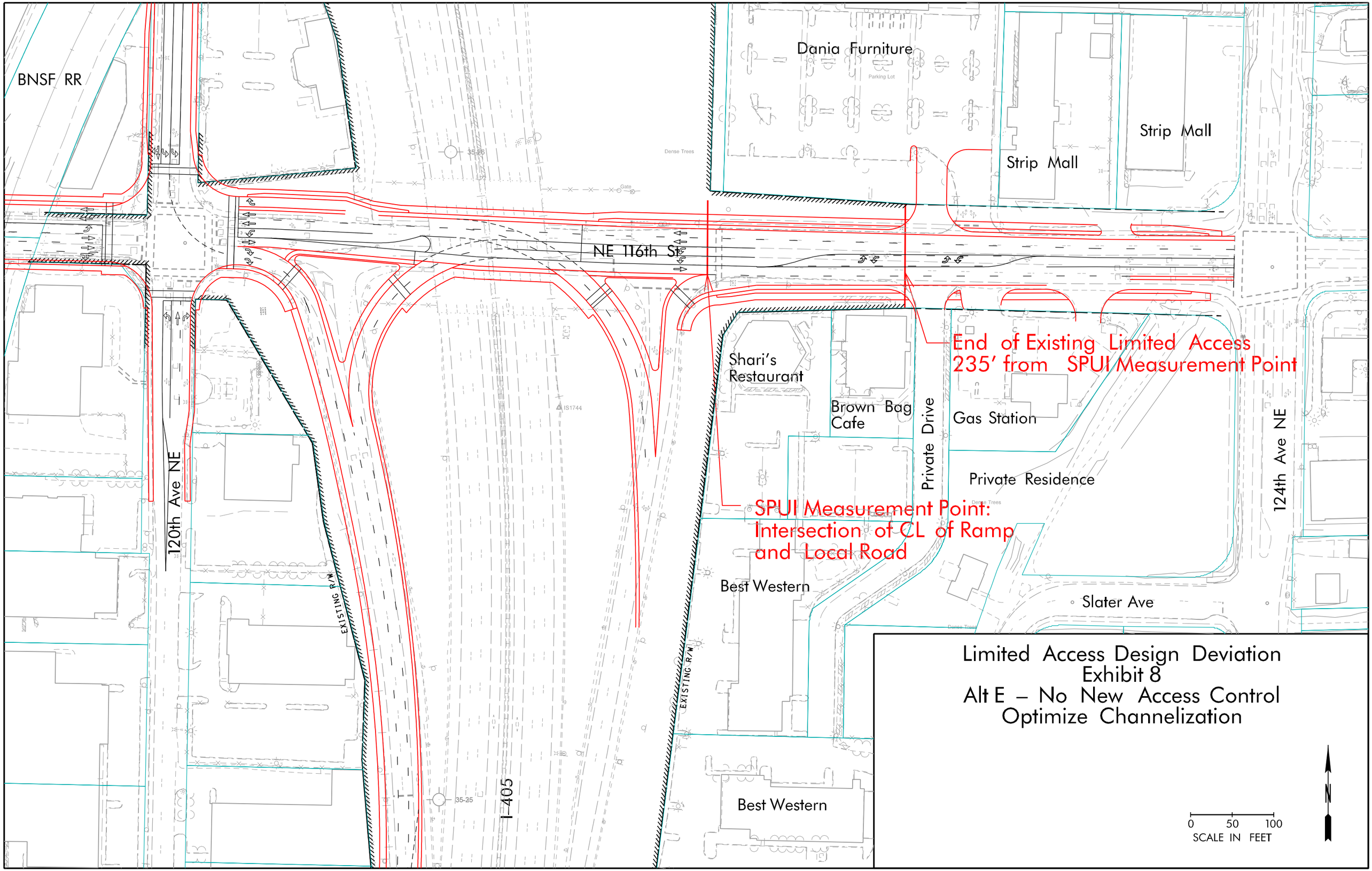
Limited Access Design Deviation
Exhibit 3
SPUI vs Existing Operation Comparison

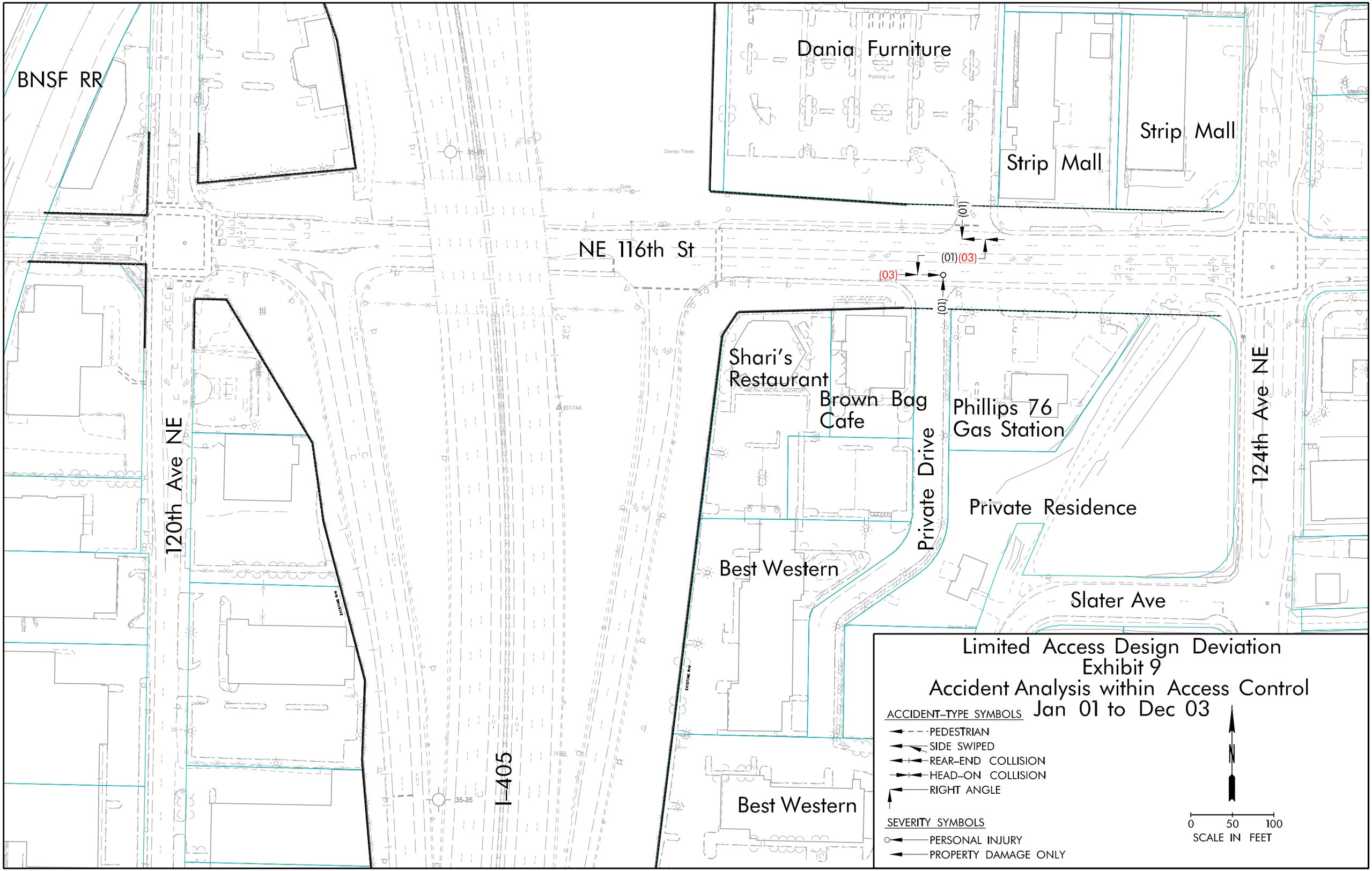

BNSF RR
Dania Furniture
Parking Lot
Strip Mall
Strip Mall
124th Ave NE
NE 116th St
Shari's Restaurant
Brown Bag Cafe
Private Drive
Gas Station
Proposed End of Limited Access
300' from SPUI Reference Point
Proposed SPUI Reference Point
Private Residence
Best Western
Slater Ave
120th Ave NE
EXISTING R/W
I-405
EXISTING R/W
Best Western
Limited Access Design Deviation
Exhibit 4
Alt A – Buy Additional Access
0 50 100
SCALE IN FEET
N
Right In Right out at Private Drive
Narrow Dania Drive to Avoid
Limted Access

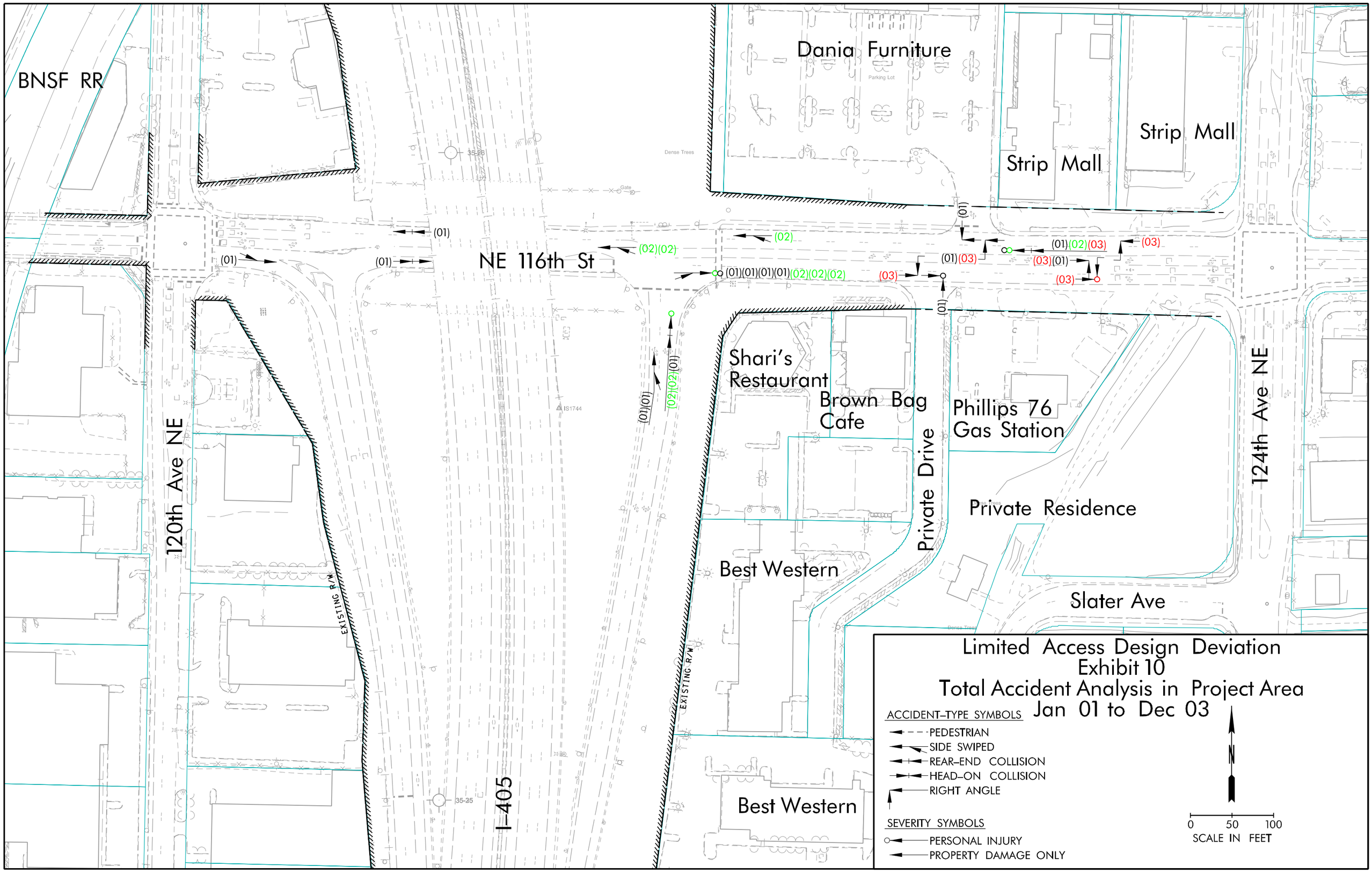

BNSF RR
Dania Furniture
Parking Lot
Strip Mall
Strip Mall
124th Ave NE
NE 116th St
Install C–Curb
Requires Cooperation of
the City of Kirkland
Shari's
Restaurant
Brown Bag
Cafe
Gas Station
Private Drive
Private Residence
Best Western
Slater Ave
120th Ave NE
EXISTING R/W
EXISTING R/W
I–405
Best Western
Install C–Curb down Median
Coordinate with City of Kirkland
Access from Private Drive to Slater
Right In Right out at Dania Drive
Right In Right out at Private Drive
Right In Right out to Gas Station
Limited Access Design Deviation
Exhibit 5
Alt B – Control Access at Private Drive
Build Additional Access to 124th Ave NE
0 50 100
SCALE IN FEET
N


BNSF RR
Dania Furniture
Parking Lot
Center of New Intersection
Strip Mall
Strip Mall
124th Ave NE
NE 116th St
Proposed End of Limited Access
130' from Center of Intersection
Along all legs
Shari's Restaurant
Brown Bag Cafe
Gas Station
Private Residence
Best Western
Proposed ROW
Slater Ave
120th Ave NE
EXISTING R/W
EXISTING R/W
Private Drive
I-405
Best Western
Buy Private Driveway
Create a new, standard road
Close Dania Driveway
Relocate western gas drive
Right In /Right Out eastern gas driveway
Limited Access Design Deviation
Exhibit 6
Alt C – Buy the Private Driveway
Build New Driveway for Gas Station
0 50 100
SCALE IN FEET
N


Existing Bridge Abutment Location
300' LA line
Ramp redesigned to maintain 300' with new SPUI standard.
Dania Furniture
Strip Mall
Strip Mall
NE 116th St
Existing LA line.
Shari's Restaurant
Brown Bag Cafe
Gas Station
Proposed Bridge Abutment Location
Private Drive
Private Residence
124th Ave NE
120th Ave NE
Best Western
Slater Ave
EXISTING R/W
EXISTING R/W
I-405
Best Western
Relocate ramp to 300' from existing LA
TWLTL
No Curb
Widen lanes to minimize TWLTL width
Tighter SPUI radii
20' Increase in NB Bridge Span
Limited Access Design Deviation
Exhibit 7
Alt D – Modify SPUI
Build New Ramp Within Existing Limited Access
0 50 100
SCALE IN FEET
N


BNSF RR
Dania Furniture
Parking Lot
Strip Mall
Strip Mall
Dense Trees
Gate
35-26
NE 116th St
End of Existing Limited Access
235' from SPUI Measurement Point
Shari's Restaurant
Brown Bag Cafe
Private Drive
Gas Station
Private Residence
124th Ave NE
SPUI Measurement Point:
Intersection of CL of Ramp
and Local Road
Best Western
Slater Ave
120th Ave NE
EXISTING R/W
EXISTING R/W
IS1744
35-25
I-405
Best Western
Limited Access Design Deviation
Exhibit 8
Alt E – No New Access Control
Optimize Channelization
0 50 100
SCALE IN FEET
N


BNSF RR
Dania Furniture
Parking Lot
Strip Mall
Strip Mall
Dense Trees
NE 116th St
(01)
(01)(03)
(03)
(01)
Shari's Restaurant
Brown Bag Cafe
Phillips 76 Gas Station
Private Drive
124th Ave NE
Private Residence
Best Western
Slater Ave
120th Ave NE
I-405
Best Western
Limited Access Design Deviation
Exhibit 9
Accident Analysis within Access Control
Jan 01 to Dec 03
ACCIDENT-TYPE SYMBOLS
PEDESTRIAN
SIDE SWIPED
REAR-END COLLISION
HEAD-ON COLLISION
RIGHT ANGLE
SEVERITY SYMBOLS
PERSONAL INJURY
PROPERTY DAMAGE ONLY
N
0 50 100
SCALE IN FEET



Limited Access Design Deviation
Exhibit 10
Total Accident Analysis in Project Area
Jan 01 to Dec 03