Technical Memorandum

Date: May 7, 2012

To: Brent Rusco, P.E., Joe Gladke, P.E.
Hennepin County Regional Railroad Authority

From: Paul Danielson, P.E.
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Subject: Bottineau Transitway Draft Environmental Impact Statement
Alignment D1-D2 Comparison

Introduction

Purpose of Memorandum

This technical memorandum has been prepared as part of the ongoing Scoping analysis for the Bottineau Transitway Draft Environmental Impact Statement (Draft EIS). The purpose of the memorandum is to describe the major differences between the D1 and D2 alignments being considered, and to document the efforts undertaken to identify these issues.

This memorandum identifies the differences between alignments based on the goals, objectives, and evaluation measures identified to date through the Bottineau Transitway study process, emphasizing those evaluation criteria that demonstrate the most contrast between the alternatives.

A summary evaluation against the goals and objectives is included in Appendix A. Figures illustrating the D1 and D2 Alignments are provided in Appendix B.

Project Background

The Bottineau Transitway project area extends approximately 13 miles northwest from downtown Minneapolis through the neighborhoods of north Minneapolis, and into the communities of Golden Valley, Robbinsdale, Crystal, Brooklyn Park, and Maple Grove in Hennepin County, Minnesota.

The Bottineau Transitway Alternatives Analysis (AA) study, which was completed by the Hennepin County Regional Railroad Authority (HCRRA) in 2010, evaluated a No-Build, an Enhanced Bus/Transportation System Management (TSM) alternative, and a wide range of commuter rail, BRT, and LRT alternatives. The study progressively narrowed the transitway Build alternatives from a wide range of options for each of the initial modes to a recommended set of 21 alternatives (9 LRT and 12 BRT) which underwent detailed evaluation.

The three most promising alternatives that came out of the AA study are:

- LRT alternative A-C-D1 (Maple Grove to Minneapolis via BNSF/Olson Memorial Highway)
- LRT alternative B-C-D1 (Brooklyn Park to Minneapolis via BNSF/Olson Memorial Highway)
- LRT alternative A-C-D2 (Maple Grove to Minneapolis via Penn Avenue/Olson Memorial Highway)

While the BRT alternatives as described in the AA were not among the most promising, a refined BRT alternative was subsequently developed to address some of the shortcomings of the initial BRT alternatives. This alternative is described as follows:

- BRT alternative B-C-D1 (Brooklyn Park to Minneapolis via BNSF/Olson Memorial Highway) with branched peak-hour service to and from Maple Grove on Route 732

It should be noted that none of the most promising alternatives identified BRT on the D2 alignment. As a result, this memorandum compares alignments D1 and D2 assuming the LRT mode only. Analysis of BRT on Alignment D1 is provided in a separate memorandum that compares LRT and BRT modes.

As documented in other technical memoranda, there are a number of concept assumptions used for this memorandum. These assumptions are consistent with study committee advice and include the following:

- Several sub-options for Alignment D2 along Penn and Oliver Avenues have been studied. For the purposes of this memo, Alignment D2 is assumed to be Option C (D2-C).
- Several sub-options for the Alignment D2 transition between the BNSF railroad corridor and County Road 81 (Bottineau Boulevard) through Robbinsdale have been studied. For the purposes of this memorandum, the 34th Avenue alignment is assumed.
- Two options for station locations have been identified for Alignment D1: Golden Valley Road and Plymouth Avenue/Wirth Park. For the purposes of this memo, the Golden Valley Road station has been assumed.

Alignment D1

Much of Alignment D1 is located within the limits of the existing BNSF right-of-way (ROW) between 34th Avenue in Robbinsdale and Trunk Highway(T.H.) 55 (Olson Memorial Highway) in Minneapolis. At T.H. 55, the alignment exits the BNSF ROW, enters the existing grass median between the eastbound and westbound travel lanes, and continues toward downtown Minneapolis. The alignment meets the existing Blue Line (LRT) trackway at the Interchange (current Target Field station) in downtown Minneapolis.

Alignment D2

Alignment D2 begins at 34th Avenue where the guideway exits the BNSF railroad corridor and heads east towards C.R. 81. This alignment traverses the existing embankment north of North Memorial Medical Center (NMMC), adjacent to the south side of the North Memorial Outpatient Center. From that point, the alignment crosses over the C.R. 81 southbound traffic lanes, enters the existing median on C.R. 81, and crosses over Victory Memorial Parkway on a new bridge constructed between two existing roadway bridges. Along West Broadway Avenue, the LRT alignment is center running with one travel lane on either side of the guideway. At Penn Avenue, the alignment turns and continues south towards T.H. 55. On Penn Avenue, the alignment operates in a center-running median with one lane for northbound vehicular traffic on the east side of the guideway and one lane for southbound vehicular traffic on the west side of the guideway. The proposed cross section is aligned with the existing ROW limits on the east side of Penn Avenue and would have substantial property impacts along the west side of Penn Avenue. At T.H. 55, the alignment turns east and enters the existing grass median between the eastbound and westbound travel lanes, and continues toward downtown Minneapolis. The alignment meets the existing Blue Line trackway at the Interchange (current Target Field station) in downtown Minneapolis.

Memorandum Organization

The following sections identify key differentiators between the Alignment A and Alignment B alternatives, focusing on the following primary and secondary goals, which are included as part of the Bottineau Transitway Purpose and Need:

Primary Goals

- Goal 1: Enhance Regional Access to Activity Centers
- Goal 2: Enhance the Effectiveness of Transit Service within the Corridor
- Goal 3: Provide a Cost Effective and Financially Feasible Transit System

Secondary Goals

- Goal 4: Promote Sustainable Development Patterns
- Goal 5: Support Healthy Communities and Sound Environmental Practices

Primary Goals and Objectives

Goal 1: Enhance Regional Access to Activity Centers

Maximize total transit riders: Transit ridership has been modeled as part of the Scoping and Draft EIS process. As shown in the table below, the weekday ridership forecasts for the LRT transitway alternatives are similar, with alternative A-C-D1 having the highest forecast ridership (27,600) and B-C-D2 having the lowest (26,000).

	Alignment D1 Alternatives	Alignment D2 Alternatives
Total weekday transit trips	A-C-D1: 27,600 B-C-D1: 27,000	A-C-D2: 27,200 B-C-D2: 26,000

Improve service to people who depend on transit: As part of the Scoping process, data on people who depend on transit who live within a half-mile radius of stations was collected from the 2006-2010 American Community Survey 5-year estimates.

Data were analyzed at the block group level using four different indicators of transit dependency: population under 18; population age 65 and over; population in households below the poverty level; and population with zero vehicles available. These data show greater numbers of people who depend on transit in Alignment D2 station areas than in Alignment D1 station areas. However, the faster travel time on Alignment D1 could result in greater benefit to through-traveling transit-dependent populations (i.e., those living beyond the D1/D2 alignment areas).

Estimates based on ridership forecasts (zero car households) show relatively similar numbers of people who depend on transit being served by Alignment D1 and D2. The occurs because even though D2 has larger numbers of people in most of the other measures, the extensive bus service in the D2 alignment area also serves people who depend on transit. As a result, there are relatively fewer people in the Alignment D2 area who would be attracted by the new transitway service than in Alignment D1 where the bus service is less robust.

	Alignment D1	Alignment D2
Total population[1]	24,413	36,561
Population under 18	7,307	11,625
Population age 65 and over	2,043	2,940
Population in households below the poverty level	6,814	10,710

[1] Population residing in block groups within a half-mile of stations in alignment

Population with zero vehicles available	4,953	8,593
Daily transit riders from zero-car households (2030 ridership forecast)	A-C-D1: 9,700 B-C-D1: 9,200	A-C-D2: 9,950 B-C-D2: 9,200

Expand reverse commute and off-peak transit service: Reverse commute and off-peak trips on the D1 and D2 alignment alternatives have been estimated as part of ridership forecasting. As shown in the table below, the differences in forecast values between alternatives are relatively small.

	Alignment D1 alternatives	Alignment D2 alternatives
Total weekday transit trips	A-C-D1: 27,600 B-C-D1: 27,000	A-C-D2: 27,200 B-C-D2: 26,000
Reverse commute trips (A.M. peak period) reverse commute work trips)	A-C-D1: 4,120 B-C-D1: 3,600	A-C-D2: 4,130 B-C-D2: 3,560
Off-peak trips	A-C-D1: 12,100 B-C-D1: 12,000	A-C-D2: 12,100 B-C-D2: 11,800

Increase transit system linkages, access to regional destinations, and multimodal transportation opportunities: Distinguishing features of Alignment D1 are its connection to Theodore Wirth Parkway and the bicycle and pedestrian network of the Minneapolis Grand Rounds. Alignment D2, in contrast, does not connect directly to the Grand Rounds, but ties more directly into the urban street grid of north Minneapolis, which provides better bicycle and pedestrian connectivity through bike lanes and a complete sidewalk system. This includes connectivity to bike routes on Lowry and Plymouth Avenues. Because much of Alignment D1 is in the BNSF ROW or in less densely developed areas, it has less bicycle and pedestrian network connectivity. Both alignments intersect with multiple transit corridors.

Maximize access to housing, employment, schools, community services, healthcare facilities, and activity centers: While both alignments provide access to activity centers, Alignment D2 offers direct connections to Terrace Mall and NMMC, both of which are regional destinations. Alignment D1, in contrast, does not provide direct access to retail or medical centers of comparable size; however, it is assumed that the privately operated shuttle connection between NMMC and the Robbinsdale Transit Center would continue to be provided by North Memorial Medical Center.

Alignment D2 also provides a direct connection to NorthPoint Health and Wellness Center on Penn Avenue. Alignment D1 also provides access to NorthPoint, but through a connecting bus route.

Both alignments provide access to libraries, schools, parks, and community centers. Alignment D1 provides access to more parks; Alignment D2 provides access to more community centers. Due to the higher development densities, Alignment D2 provides greater access to housing and employment than D1. Detailed listings are provided in the summary evaluation in Appendix A.

Goal 2: Enhance the Effectiveness of Transit Service within the Corridor

Maximize new transit riders: Using the Twin Cities Metropolitan Area Regional Travel Demand Model, developed by the Metropolitan Council, new transit riders for the Bottineau Corridor were forecasted. New transit riders are the estimated net change in transit users between the baseline (no project) and Build (project) alternatives. These riders represent people who would change their mode of travel as a result of the project, as forecast by the travel demand model used for the project.As shown in the

table below, the D1 alternatives generate approximately 600 net daily new transit riders more than the D2 alternatives.

	Alignment D1 Alternatives	Alignment D2 Alternatives
New transit riders	A-C-D1: 8,400 B-C-D1: 7,150	A-C-D2: 7,800 B-C-D2: 6,500

Maximize passengers per hour of revenue service: Passengers per hour of revenue service is a measure of the efficiency of the transit investment. Passengers per hour of revenue service were calculated by dividing the forecast year (2030) number of total transit riders by annual transitway (operator) vehicle hours. As shown in the table below, the Alignment D1 alternatives generate somewhat more passengers per revenue hour than the Alignment D2 alternatives.

	Alignment D1 Alternatives	Alignment D2 Alternatives
Passengers per revenue hour	A-C-D1: 217 B-C-D1: 181	A-C-D2: 182 B-C-D2: 175

Maximize travel time savings: As shown in the table below, travel time on Alignment D1 is shorter than on Alignment D2 for a similar distance, due to two operational factors.

First, Alignment D1 runs largely in the BNSF railroad corridor, which is grade separated from the street system in this portion of the alignment. As a result, there are no cross streets that require stops or slower travel speeds.

Second, Alignment D2 has five stations (Robbinsdale, North Memorial, Broadway/Penn, Penn/Plymouth, and Van White Boulevard) over this distance, as opposed to four (Robbinsdale, Golden Valley Road, Penn Avenue, and Van White Boulevard) for Alignment D1. While the additional station in Alignment D2 provides greater accessibility, it also increases travel time.

	Alignment D1	Alignment D2
From–to	Robbinsdale–Van White Boulevard	Robbinsdale–Van White Boulevard
Distance	4.6 miles	4.7 miles
Travel time	8 minutes 27 seconds	12 minutes 26 seconds
Average speed	32.8 miles per hour	22.8 miles per hour

Source: Bottineau Transitway DRAFT Operations Report (November 2011)

The advantage of D1 alignment's shorter travel time is expressed in the D1 alternatives' slightly higher user benefits. User benefits are a measure of mobility improvement and represent the aggregate actual and perceivedtravel time difference for transit users between each Build alternative and the TSM alternative.[2] They are used in the estimation of the FTA cost effectiveness index (CEI). CEI is a measure of the annualized capital and operating incremental cost divided by incremental annual hours of transportation system user benefits. The increment referenced is between the transitway build and baseline conditions. User benefits for the Alignment D1 and D2 alternatives are shown in the table below.

[2] The word "perceived" represent the difference between a person's perceived travel time and the actual travel time. Perceived travel time is used to account for mode and access bias. For example, if the actual travel time is the same for a bus and an LRT trip, the perceived travel time for a typical rider will be lower for the LRT since it is considered a more enjoyable ride, among other factors. Thus, the user benefit is calculated based on perceived travel time. Actual travel time is considered in other performance measures (for example, accessibility analysis).

	Alignment D1 Alternatives	Alignment D2 Alternatives
Daily hours of user benefits	A-C-D1: 9,460 B-C-D1: 8,520	A-C-D2: 9,000 B-C-D2: 7,940

Goal 3: Provide a Cost Effective and Financially Feasible Transit System

A comparison of the cost effectiveness index, capital costs, operating costs, and operating costs per ride are provided in the summary evaluation in Appendix A.

Secondary Goals and Objectives

Goal 4: Promote Sustainable Development Patterns

An assessment of the potential sustainable development benefits of the D1 and D2 alignments can be made by comparing the potential for each alignment to generate new transit-oriented development (TOD) at station areas.

Successful TOD relies on many factors, including a strong local real estate market. Transit investments can capitalize on untapped demand for new development and can organize development, but cannot create demand. Locations with land use regimes favorable to dense, multifamily and mixed use development are most likely to attract new investment. Moreover, significant TOD is not likely at every station along a given corridor. Instead, it will occur at key nodes that already have established development markets or large-scale sites with favorable land use conditions.

While a quantitative, parcel-level analysis or specific conclusions regarding development potential are beyond the scope of this memorandum, the discussion below identifies important known factors that could influence TOD along the different alignments.

The potential for development or redevelopment to occur is comparatively higher along the D2 alignment than it is along the D1 alignment. Development or redevelopment activities that are catalyzed by improved transit services typically occur at or near station locations. For this reason, the comparison of the D1 and D2 alignments focuses on the immediate station locations and a quarter-mile walk distance centered on the stations. For Alignment D1, the stations locations are Golden Valley Road and Penn Avenue. The D2 stations are North Memorial, Broadway/Penn, and Penn/Plymouth. Both alignments would also be served by the Van White and Interchange stations as well. Factors considered in the analysis included:

- Existing land use and development patterns
- Existing density
- Population concentrations
- Ridership forecasts
- Station accessibility
- Future development plans

In general, Alignment D2 provides a somewhat greater opportunity for TOD than Alignment D1 due to proximity of the D2 stations to dense urban neighborhoods, comparatively greater populations, and activity centers such as retail establishments, commercial businesses, institutional uses, and employment centers. While D1 would still serve dense urban neighborhoods via the Van White station and via connector bus service to the Penn/Plmouth station, there would be less economic development opportunity overall than with D2.

The D1 station at Golden Valley Road would serve an area that is not only less dense than the D2 station areas, but is adjacent to parkland, which is incompatible with new development. The Golden

Valley Road station is also located below street grade in the BNSF railway corridor. This change in elevation would prove to be a disadvantage with respect to visibility and accessibility from a development perspective.

Alignment D2 would require the acquisition of residential property on the west side of Penn Avenue for 11 blocks. While this is a disadvantage from the perspective of impacts on existing uses, it would, by definition, present an opportunity for substantial redevelopment that could be transit-oriented in station areas and along alignments between stations following construction of the transitway.

Goal 5: Support Healthy Communities and Sound Environmental Practices

The summary evaluation in Appendix A provides information on the many objectives for Goal 5. The The text below presents information on selected areas of the natural and built environment for which notable differences between alignments D1 and D2 have been identified:

- Wetlands, Water and Floodplains
- Parks (4f, 6f)
- Noise and Vibration
- Property Impacts
- Pedestrian/Bicycle Impacts
- Traffic Impacts

A discussion of differences with respect to economic development is incorporated into the discussion under Goal 4 above.

Wetlands, Water and Floodplains

Alignment D1
Wetlands, Federal Emergency Management Administration (FEMA) 100-year floodplain and FEMA-designated floodway areas were identified within the Alignment D1 corridor. These areas are adjacent to the existing BNSF railroad tracks, with the majority of the wetlands being drainage ditches within the railroad ROW. Potential wetland impacts for Alignment D1 were determined to be approximately 5.0 acres.

Based on the FEMA Flood Insurance Rate Maps (FIRM), the floodplain elevation is 826.0 at T.H. 55, 827.2 on the downstream side of the Golden Valley Road bridge and 830.0 on the upstream side of the bridge. Potential floodplain impacts were determined to be located between the Plymouth Avenue bridge and T.H. 55 and north of 26th Avenue North.

FEMA-designated floodway identifies potential floodway impacts between the Theodore Wirth Parkway bridge and T.H. 55. Portions of the existing BNSF track are located within the existing floodway areas.

It is anticipated that the proposed construction for this project would require approximately 20,000 cubic yards of fill within the identified floodway and floodplain areas.

Alignment D1 is located within the Bassett Creek Watershed Management Commission (BCWMC). The BCWMC has indicated that this project will be defined as a linear project, recognizing that the ROW constraints that exist along the corridor are similar to roadway projects. Further coordination with the BCWMC to determine appropriate best management practices (BMPs) that improve the quality of stormwater runoff will be considered. Temporary measures that address erosion and sediment control during construction would be included as part of the construction project. The construction project development may also include the need to acquire additional ROW for stormwater treatment in order to meet current treatment standards.

Alignment D2

One wetland area was identified within Alignment D2. No FEMA 100-year floodplain or FEMA-designated floodway was identified within Alignment D2. The wetland area identified is a drainage ditch located along the BNSF railroad track where the D2 alignment exits the BNSF ROW and enters 34th Avenue. Potential wetland impacts are approximately 0.5 acres.

Alignment D2 is located within the Shingle Creek and West Mississippi Watershed Management Commission (SCWM WMC), Mississippi River Watershed Management (MWMO), and the Bassett Creek Watershed Management Commission (BCWMC). Further coordination with each of these organizations in order to determine appropriate BMPs that improve the quality of stormwater runoff will be required for the alignment. Temporary measures that address erosion and sediment control during construction would be included as part of the construction project. The construction project development may also include the need to acquire additional ROW for stormwater treatment in order to meet current treatment standards.

Parks (4f, 6f)

The Section 4(f) legislation as established under the Department of Transportation Act of 1966 (40 USC 303, 23 USC 138) provides protection for publicly owned parks, recreation areas, historic sites, wildlife and/or waterfowl refuges from conversion to transportation use. Conversion to transportation use is not allowed unless all prudent and feasible alternatives to the Section 4(f) use and all possible planning activities to minimize harm have been considered.

Section 6(f) covers outdoor recreation properties planned, developed, or improved with funds from the Land and Water Conservation Fund (LAWCON). These properties cannot be converted to other uses unless replacement land of equal fair market value and equivalent usefulness is provided.

Review of Section 4(f) and Section 6(f) resources was limited to those resources adjacent to the existing roadway or BNSF Railway ROW for the alternative corridors under consideration. Publicly owned parkland, including parks, athletic fields, trails, and pathways, was evaluated for potential impacts. Historic sites were not included, unless they were also parkland. Park features were verified with aerial maps and/or field observation.

Along Alignment D1 there are six Section 4(f) properties, two of which are also Section 6(f) properties. Because the proposed transitway improvements will be primarily located within the BNSF Railway ROW, impacts on parks are anticipated to be minor. It is anticipated that there will be a low impact potential at Sochacki Park (culvert reconstruction), low impact potential at South Halifax Park (fill for track), low to moderate impact potential at Theodore Wirth Parkway (floodplain, roadway to railway transition, station) and a low impact potential at bridges over the BNSF railroad (potential bridge modifications). In addition, the alignment traverses several wetland and floodplain areas. It is recognized that potential wetland and floodplain mitigation areas may be located within these parks and may have minor impacts to the adjacent parkland areas.

Along Alignment D2 there are three Section 4(f) properties, one of which is also a Section 6(f) property. It is anticipated that there will be no 4(f) or 6(f) impacts associated with the Victory Memorial Parkway and the off-road bicycle trail that runs along the east side of Theordore Wirth Parkway and crosses under West Broadway Avenue. If the new transitway bridge does not fit within the existing transportation easement/ROW that allows the existing bridge structures to cross Victory Memorial parkway, there may be Section 4(f) impacts associated with the new transitway bridge structure. A 3.7-acre unnamed parcel containing a soccer field, owned by the Board of Education, is located between Oak Park Avenue and 12th Avenue and is bounded on the east by Penn Avenue and Queen Avenue on the west. The soccer field is directly across the street from Lincoln Community School. Because of the ROW that would likely be required on Penn Avenue, this soccer field is likely impacted.

Noise and Vibration

A noise and vibration screening assessment was completed in September 2011 for the Bottineau Transitway. The Federal Transit Administration (FTA) guidance manual contains information regarding a screening-level assessment for noise and vibration. The screening assessment is intended to provide information on the relative level of potential impacts for noise and vibration from different alternatives. It is not an assessment of those impacts, but instead provides information on locations and magnitudes of potential impacts.

For both noise and vibration, the FTA provides screening distances for different project types and land uses. The screening distances are based on typical operational characteristics of projects, and provide a conservative assessment of the potential for impacts.

The existing noise environment along Alignment D1 is dominated by trains on the BNSF railroad, as well as local roadway traffic and community activity. The existing vibration environment is dominated by trains on the BNSF railroad. Noise-sensitive land use includes single and multiple family residences, schools, churches, parks, and Sumner Library. These land uses are also vibration sensitive, with the exception of parks. There are no noise or vibration-sensitive land uses along the transitway alignments east of I-94 in Minneapolis.

The existing noise environment along Alignment D2 is dominated by traffic on those roads, as well as local roadway traffic and community activity. North Memorial Medical Center, NorthPoint Health and Wellness Center, and KMOJ radio station are noise-sensitive land uses that are adjacent to this Alignment. Other noise-sensitive land use includes single and multiple family residences, schools, churches, parks, and Sumner Library. These land uses are also vibration sensitive, with the exception of parks. There are no noise- or vibration-sensitive land uses along the alignment east of I-94 in Minneapolis. The following table summarizes the potential noise impacts for Alignment D1 and D2.

Mode	Alternative	Area	Approximate Screening Distance (ft)	Potential Noise Impacts
LRT	D1	North of Golden Valley Road	350	314
		South of Golden Valley Road	300	67
		Olson Memorial Highway	85	3
		Total		**384**
	D2	CR 81	100	92
		Penn Avenue	250/50*	182**
		Olson Memorial Highway	85	3
		Total		**277**

** Represents the screening distances on each side of Penn Avenue (West/East)*

*** Does not include assumed property acquisitions (123 full property acquisitions on Penn Avenue).*

In Alignment D1, the vibration environment is dominated by trains on the BNSF railroad. Vibration-sensitive land use includes single and multiple family residences, schools, churches, and Sumner

Library. There are no noise- or vibration-sensitive land uses east of I-94 in Minneapolis. Vibration impacts in the D1 alignment are estimated to be 132 potential impacts for the LRT mode.

In Alignment D2, the vibration environment is dominated by roadway traffic. Vibration-sensitive land use includes single and multiple family residences, schools, churches, and Sumner Library. North Memorial Medical Center, NorthPoint Health and Wellness Center, and KMOJ radio station are also sensitive to vibration. There are no noise- or vibration-sensitive land uses east of I-94 in Minneapolis. Vibration impacts in the D2 alignment are estimated to be 242 potential impacts for the LRT mode.

Potential mitigation strategies to address noise impacts include:

- Noise barriers
- Relocation of crossoverse or special trackwork
- Wayside horn/quiet zones
- Building sound insulation
- Property acquisitions or easements
- Vehicle noise specifications

Potential mitigation measures for reducing vibration impacts from LRT operations include:

- Location and design of special trackwork
- Vehicle suspension
- Special track support systems
- Building modifications
- Buffer zones

Historic/Cultural Resources

Potential historic and cultural resource impacts will be assessed as part of the Draft EIS.

Environmental Justice (EJ)

Potential environment justice impacts will be assessed as part of the Draft EIS.

Property Impacts

Located primarily within the BNSF railroad ROW and the existing median on T.H. 55, Alignment D1 would require minimal acquisitions of adjacent properties.

Alignment D2 would have significant property impacts both in Robbinsdale and in Minneapolis to accommodate the proposed alignment. Within Robbinsdale, the alignment would impact 20 properties, and within Minneapolis the proposed alignment will impact 4 commercial properties along West Broadway Avenue in order to accommodate bus pull-outs at 26th Avenue and 29th Avenue and would require the full acquisition of all parcels on the west side of the Penn Avenue. A portion of the NorthPoint Health and Wellness Center could potentially be retained, but a more detailed assessment is needed to determine the exact impacts.

In total, approximately 138 properties would be affected by the D2 alignment, with 15 partial parcel takes and 123 full parcel takes.

Pedestrian/Bicycle Impacts

Alignment D1 ranks better than Alignment D2 with respect to minimizing adverse impacts on existing pedestiran and bicycle facility connections. For Alignment D1, seven existing pedestrian/bicycle connections will be closed, compared to 20 for Alignment D2. Pedestrians and bicycles would only be allowed to cross the street/transitway at signalized intersections.

Traffic Impacts

Since Alignment D1 is primarily located within the BNSF railroad corridor, the traffic impacts associated with Alignment D1 are very minor when compared to Alignment D2.

Alignment D2 is located within a fully developed portion of Robbinsdale and Minneapolis and has a large impact to the existing street network along 34th Avenue in Robbinsdale, West Broadway Avenue and Penn Avenue in Minneapolis. The proposed LRT guideway will be located in the middle of these streets with one travel lane located on either side of the guideway. The introduction of the guideway in these areas would require the following:

- Four existing intersections may be terminated with a cul-de-sac on West Broadway Avenue
- Ten intersections on Alignment D2 would be not be allowed to cross the LRT guideway and would be converted to right-in/right-out intersections, as compared to three intersections on Alignment D1
- Thru-street access would only be allowed at signalized intersections
- An increased amount of traffic would be diverted from West Broadway Avenue and Penn Avenue
- On-street parking would be reduced or eliminated

Appendix A:
Alignment D1-D2 Summary Evaluation

Appendix B:
Alignment D1-D2 Aerial Exhibits

Bottineau Transitway Summary Evaluation

Better ○ ○ ○ ○ ● Worse

			Alignment D1 (LRT) (BNSF Railway)		Alignment D2 (LRT) (West Broadway/Penn Avenue)	
Differentiating Physical/Operating Characteristics (between 36th Avenue and 300 feet east of Penn Avenue)						
	Station locations		3 stations: Golden Valley Road Penn Avenue Van White Boulevard		4 stations: North Memorial Broadway/Penn Penn/Plymouth Van White Boulevard	
	Alignment length		4.6 miles (Robbinsdale to Van White Boulevard)		4.7 miles (Robbinsdale to Van White Boulevard)	
	Running time	B-C-D1 vs. B-C-D2	08:27		12:26	
	Average speed		32.8 mph (Robbinsdale to Van White Boulevard)		22.8 mph (Robbinsdale to Van White Boulevard)	
	Existing and proposed signalized grade crossings		2		9	
	Net number of pedestrian and bicycle crossings		10 crossings remain open		20 crossings remain open	
	Number of curves		13 (1 under 500' radius)		20 (4 under 500' radius)	
	Number of bridge structures (modify existing)		5		0	
	Number of bridge structures (new)		0		3 (720' long structure between France Avenue and NMMC, 2000' long structure between NMMC and Lowry Avenue, 50' long structure at Halifax and 34th)	
Primary Goals and Objectives that Directly Address the Primary Project Needs						
Goal 1: Enhance Regional Access to Activity Centers						
1	Maximize total transit riders	Total weekday transitway trips	A-C-D1: 27,600 B-C-D1: 27,000	◐	A-C-D2: 27,200 B-C-D2: 26,000	◐
2	Improve service to people who depend on transit (Source: 2006-2010 American Community Survey 5-Year Estimates; Census Block Groups within 1/2 mile of stations)	Total population within 1/2 mile of stations	24,413 (3 station areas)	N/A	36,561 (4 station areas)	N/A
		Population under 18	7,307	◐	11,625	●
		Population age 65 and over	2,043	◐	2,940	●
		Population in households below the poverty level	6,814	◐	10,710	●
		Population with zero vehicles available	4,953	◐	8,593	●
		Daily transit riders from zero-car households (2030 ridership forecast)	A-C-D1: 9,700 B-C-D1: 9,200	◐	A-C-D2: 9,950 B-C-D2: 9,200	◐
3	Expand reverse commute and off-peak transit service	**Reverse commute** (Ridership model output: Corridor AM peak period work trips in off-peak (northbound) direction)	A-C-D1: 4,120 B-C-D1: 3,600	◐	A-C-D2: 4,130 B-C-D2: 3,560	◐
		Off-peak (Ridership model output: Corridor off-peak period trips (both directions, all trip purposes))	A-C-D1: 12,100 B-C-D1: 12,000	◐	A-C-D2: 12,100 B-C-D2: 11,800	◐
4	Increase transit system linkages, access to regional destinations and multimodal transportation opportunities	Bicycle connections	Direct connection to Minneapolis Grand Rounds but less overall bike connectivity than D2	◐	Bike routes on Lowry Avenue and Plymouth Avenue; street grid	●
		Pedestrian connections	Direct connection to Minneapolis Grand Rounds but less overall pedestrian connectivity than D2	◐	Street grid intact, sidewalks are provided	●
		Local bus connections	Connections to routes 7 and/or 14, 19; challenging connectivity to stations in BNSF corridor due to lack of direct access, potential of bus operations on Parkway.	◐	Connections to bus routes 5, 7, 14, 19	●
		Park-and-rides	No park-and-rides	○	No park-and-rides	○
5	Maximize transit access to housing, employment, schools, community services, health care facilities, and activity centers (within 1/2 mile of stations)	Retail centers	None	○	Terrace Mall. Commercial centers at Broadway/Penn and Penn/Plymouth stations	◐
		Employment	1,146	◐	5,584	●
		Population (Source: 2010 Census; Total population in Census Blocks within 1/2 mile of stations)	14,223	◐	25,809	●
		Occupied housing units	5,061	◐	8,574	●
		Libraries and schools	St. Margaret Mary School Seed Academy & Harvest Preparatory School Harrison Education Center	◐	North Community High School Prairie Seeds Academy Lincoln School (closed) Plymouth Christian Youth Center West Central Elementary Academy Harrison Education Center	●
		Parks	Wirth Park Sochacki Park South Halifax Park Glenview Terrace Park Mary Hills Nature Area	◐	Lakeview Terrace Park Soccer Field across from Lincoln Community School	◐
		Community centers	Wirth Park Chalet	◐	North Commons Recreation Center Urban Research Outreach Engagement Ctr/UROC	●
		Health centers	None	○	North Memorial Medical Center NorthPoint Center for Health and Wellness	●
Goal 2: Enhance the Effectiveness of Transit Service within the Corridor						
6	Maximize new transit riders	New transit riders	A-C-D1: 8,400 B-C-D1: 7,150	◐	A-C-D2: 7,800 B-C-D2: 6,500	◐
7	Maximize passengers per hour of revenue service	Passengers per revenue hour.	A-C-D1: 217 B-C-D1: 181	●	A-C-D2: 182 B-C-D2: 157	◐
8	Maximize travel time savings	Transportation system user benefits (daily hours)	A-C-D1: 9,460 B-C-D1: 8,520	●	A-C-D2: 9,000 B-C-D2: 7,940	◐
Goal 3: Provide a Cost-Effective and Financially Feasible Transit System						
9	Balance project costs and benefits (minimize CEI)	Cost effectiveness index	ACD1: 23 BCD1: 26	●	ACD2: 26 BCD2: 31	◐
10	Minimize project capital and operating cost	Project capital cost ($2017)	ACD1: $960 million BCD1: $1,000 million	●	ACD2: $1,050 million BCD2: $1,090 million	◐
		Project operating cost ($2011)	Annual passenger trips: 8.9 million–9.1 million Annual operating cost: $22.4 million-$24.1 million Operating cost/passenger: $2.46-$2.70	○	Annual passenger trips: 8.6 million–9.0 million Annual operating cost: $23.7 million-$25.1 million Operating cost/passenger: $2.64-$2.92	○
11	Maximize long-term investment in the Regional Transit System	Qualitative assessment of connectivity with existing and planned transitway system (LRT and BRT)	Does not preclude construction of other regional transit system investments	●	LRT on West Broadway does not preclude rapid bus; may preclude addition of streetcar in this segment	◐
12	Maximize flexibility to efficiently expand the transit investment to accommodate transitway demand beyond 2030 weekday travel demand forecasts	Transitway capacity and forecast demand	Allows for expanded service	◐	Expanded service may adversely impact community circulation, increased traffic congestion.	◐
Goals and Objectives that Reflect Secondary or Additional Opportunities						
Goal 4: Promote Sustainable Development Patterns						
13	Promote land development and redevelopment that supports sustainable transportation policies	Qualitative assessment	Relatively less support for sustainable transportation policies due to relatively less transit-oriented development potential.	◐	Relatively greater support for sustainable transportation policies due to greater transit-oriented development potential.	●

Bottineau Transitway Summary Evaluation

Better ○ ◔ ◑ ● Worse

			Alignment D1 (LRT) (BNSF Railway)		Alignment D2 (LRT) (West Broadway/Penn Avenue)	
14	Ensure compatibility with local and regional comprehensive plans	Qualitative assessment of comprehensive plans	No major compatibility issues	○	No major compatibility issues	○
Goal 5: Support Healthy Communities and Sound Environmental Practices						
15	Support economic development and redevelopment efforts	Qualitative assessment	Segment D1 has comparatively less development potential, with only two stations (Penn/TH 55 and Van White) that are in proximity to dense urban neighborhoods and no stations that would directly serve activity centers.	◔	In general, Segment D2 provides greater opportunity for TOD due to proximity of this alignment's stations to dense urban neighborhoods, comparatively greater populations, and activity centers such as retail establishments, commercial businesses, institutional uses, and employment centers.	◔
16	Minimize impacts to the natural and built environment	Impacts on wetlands, water, and floodplains	Wetland Impact = 5.0 ac Floodplain / Floodway Impact = 20,000 CY of fill in existing floodplain/floodway areas	●	Wetland Impact = 0.5 ac Additional ROW may be required in order to provide water treatment No potential floodplain of floodway impacts identified	◔
		Impacts on parks	Potential impact at Sochacki Park for wetland / floodplain mitigation and culvert reconstruction Low impact potential at South Halifax Park (fill for track) Potential impact to Glenview Terrace Park; park boundary abuts BNSF right of way Low to moderate impact potential at Theodore Wirth Parkway (floodplain, roadway to railway transition, station) Low impact potential at bridge over BNSF Railway (potential bridge modifications)	●	No anticipated impacts for Lakeview Terrace Park (Robbinsdale) and Victory Memorial Parkway (Minneapolis). The soccer field directly across the street (west) from Lincoln Community School will be impacted due to the right of way that will be required on Penn Avenue.	◑
		Impacts on visual resources	Anticipated bridge reconstruction and modifications within Segment D1 are not anticipated to have an impact on visual character. Segment D1's proximity to Theodore Wirth Park may change the existing visual character of the park.	◑	Includes construction of two major structures near NMMC. These bridge structures are a total of 2720 feet long and are a minimum of 16'-4" above the existing roadway elevation. These structures will have an adverse impact on visual character at this location.	◑
		Noise and vibration impacts	Potential noise impacts: 384 properties (LRT) Potential vibration impacts: 132 properties (LRT)	◑	Potential noise impacts: 277 properties (LRT) Potential Vibration Impacts: 242 properties (LRT)	◑
		Impacts on historic and cultural resources	Not Available at Scoping	TBD	Not Available at Scoping	TBD
17	Minimize short- and long-term impacts to property, property access, and on-street parking	Loss of property access	0	○	90	●
		Impacts on boulevards	0	○	0	○
		Loss of on-street parking	0	○	300	●
		Businesses/residences lost through full takes (parcels (acres))	0	○	127 (20)	●
		Right-of-way acquisition through partial takes (parcels (acres))	3 (0.2)	◔	21 (2.2)	◑
18	Maximize cohesion and preservation of Bottineau Transitway communities	Qualitative assessment	Transitway may impact existing character of Wirth Park	◑	Limitation of pedestrian access on D2 may create a barrier to the community.	●
19	Maximize pedestrian and bicycle connections to the Bottineau Transitway	Bike/pedestrian crossings closed. The following 4 ped/bike closings are common to both D1 and D2: Highway 55 & Elwood Avenue Highway 55 & Logan Avenue Highway 55 & Newton Avenue Highway 55 & Oliver Avenue	7 total; 3 unique to D1: Highway 55 & Queen Ave Highway 55 & Russell Ave Highway 55 & Sheridan Ave	◑	20 total; 16 unique to D2: Penn Ave N & 8th Avenue North Penn Ave N & Oak Park Avenue Penn Ave N & 12th Avenue North Penn Ave N & 14th Avenue North Penn Ave N & 15th Avenue North Penn Ave N & 16th Avenue North Penn Ave N & 17th Avenue North (south end) Penn Ave N & 17th Avenue North (north end) Penn Ave N & 21st Avenue North West Broadway Ave & 24th Avenue North West Broadway Ave & Queen Avenue North West Broadway Ave & Sheridan Avenue North West Broadway Ave & 27th Avenue/Thomas Avenue West Broadway Ave & Upton Avenue North 36th Street North & Grimes Avenue North 36th Street North & Halifax Avenue North	●
20	Maximize health and environmental benefits to the Bottineau Transitway communities	Assessment based on ridership projections at each station, along with multimodal connection opportunities/design at stations	Not available at Scoping	TBD	Not available at Scoping	TBD
21	Minimize disproportionately high and adverse impacts on the region's minority and/or low-income communities		Not available at Scoping	TBD	Not available at Scoping	TBD
22	Minimize area traffic impacts	Impacts from traffic diversion	None	◔	Expected diversion in 2030: Approximately 20 percent of through traffic along West Broadway Avenue and Penn Avenue	●
		Impacts on local street network	None	◔	Access across 34th Avenue in Robbinsdale will be limited to Halifax Avenue. West Broadway is converted to provide only one travel lane in each direction; no left turn lanes and no on-street parking. Penn Avenue is converted to provide one travel lane in each direction; vehicular access across Penn Avenue is limited to signalized intersections at 23rd Avenue N, Golden Valley Road, Plymouth Avenue and Oak Park Avenue; some on-street parking is provided. France Ave would become a gated crossing	●
		Intersection closures	None	○	6: 27th & Thomas 21st & Penn 16th & Penn 14th & Penn 12th & Penn Oak Park & Penn	●
		Intersections converted to right-in/right-out	3	◑	10	●