NSRL Peer Group / Working Group Meeting Notes – October 19, 2017

Background

MassDOT, as part of the North South Rail Link Reassessment Study and process, convened a Peer Group to consider the work-to-date at the 10-week point of the study. The purpose of October 19 Peer Group session focused on reviewing the study to date, providing guidance and identifying best practices from other cities.

Members of the Peer Group included:

- Becca Nagorsky, Rapid Transit Project Planning, Planning and Policy Division, Metrolinx-Toronto
- Jeanet Owens, Program Management/Regional Rail, Los Angeles Metro
- Matt Preedy, Director of Construction Management, Sound Transit-Seattle
- Ron Hopkins, Assistant GM of Operations, SEPTA-Philadelphia
- Edward La Guardia, Michael Baker International, formerly Chief Engineer, SEPTA

These agency staff were joined by three construction industry executives:

- Jack Brockway, President, Herrenknecht Tunneling Systems USA, Inc
- Jim Marquardt, Senior Vice President, J.F. Shea Construction, Inc.
- Norbert Fuegenschuh, Executive President, BeMo Tunneling USA

A Briefing Book was prepared in advance for the Peer Group to familiarize them with the background, history of the project, the demographic and physical characteristics of the project area, and potential alignments currently being studied.

Prior to an afternoon briefing session, MassDOT conducted an orientation walk from South Station to North Station, considering the various alignments and provided for inspection of potential constraints and conflicts.

Introduction

As the afternoon session commenced, Scott Hamwey (MassDOT) had attendees introduce themselves. He began by outlining MassDOT's intent in undertaking this study, noting that previous planning had stopped in 2003, and this reassessment is intended to determine what has changed since that time. The changes to be assessed include:

- Development within Boston,
- Technological advancements,
- Demographic shifts, and
- New regulations (both environmental and fire/life safety).

Mr. Hamwey stated MassDOT intends that this reassessment will help the Administration understand the feasibility and potential benefits of the project, to allow them to determine potential next steps.

Each of the agency peer participants provided an overview of their projects and themes relevant to the NSRL project. Joe Nolan (Project Team) moderated the discussion.

Toronto

Becca Nagorsky of Toronto Metrolinx gave a presentation on expanding and enhancing the commuter rail system in Toronto into a high-frequency regional rail system. Metrolinx plans and develops projects in the Greater Toronto Area (GTA), and operates both the regional fare card and commuter rail and regional bus (GO Transit), while working with both local and provincial partners. There are 30 municipalities in the GTA, including both Toronto and Hamilton, and the transit network consists of commuter rail, subway, bus rapid transit and light rail. The networks are mostly radial, with a focus on Union Station in downtown Toronto. Most of the region's recent population growth has occurred in the suburbs.

Toronto is underway with a ten-year, $13.5 Billion ($CAD) program to significantly upgrade the GO rail network. Metrolinx promoted the GO Regional Express Rail (RER) project, and funded a portion of it in 2015. This project aims to significantly increase GOTransit rail service frequencies (currently 7 lines with 65 stations) to provide increased connections and access to jobs in the region. The complete plan electrifies the GO system (263km/160 miles), double tracking (or greater) at all locations, 11 grade separations, and seeks a 300% increase in trips.

In the 2014 Toronto Mayoral Election, public transit was a major election issue. The successful candidate, now Mayor John Tory, proposed *SmartTrack.* The proposal was intended to make GO, currently perceived as a suburban service, into an urban focused service. Many of the concepts in *SmartTrack* were parallel or analogous to elements of the GO RER project.

Recent planning has focused on determination of the most appropriate station locations. Metrolinx uses a business case analysis process with key criteria to evaluate performance; travel time savings (both for new users of transit and existing users) is among the most important criteria. Metrolinx staff investigated potential new stations both from an individual and a network perspective; scenario testing considered potential impacts of different station stopping patterns. It was determined that combined local and express service was mostly infeasible due to track restrictions.

Metrolinx' takeaway from the analysis suggests difficulty finding new station sites where the time saved by new passenger journeys was greater than the time lost from the increase in journey times for existing customers, especially when capital and operating costs were taken into account. The initial Metrolinx recommendation was for four new stations, but the eventual plan called for seven new stations.

These new seven stations are primarily located in secondary employment centers outside of downtown Toronto, as the employment centers performed better in analysis than new stations

performed in residential areas. In addition, the employment center stations are able to serve multiple trip types. The hope of Metrolinx is that the new stations, combined with the service improvements and other infrastructure improvements, will shake up the hierarchy of transit within the city, and provide better service to both new and existing customers.

Ms. Nagorsky encouraged a focus on keeping strategic goals in mind, as that allowed the Metrolinx team to continually ensure that the planning and negotiating on new system elements was meeting the goals set out by the agency. During Q&A, Ms. Nagorsky noted that the primary funding for this and similar projects in Toronto comes from the Province, and that there is likely little appetite for a local tax increase. It was noted that this is an interesting dynamic, as the constituency of the Province and municipalities might indicate otherwise. She noted that a tax measure in Vancouver had recently failed.

On the North-South Rail Link project, Ms. Nagorsky commented that the project seems to have significant potential, and encouraged investigation of the many unknowns. She cautioned against limiting operational flexibility to a 2-track tunnel, as the experience in Toronto showed that line capacity was a significant factor in providing quality service. She noted that creating a city vs suburbs divide was not helpful in advancing the project, and that focusing on the benefits to other transit corridors was a primary method for selling the work in Toronto. Ms. Nagorsky also noted that the Briefing Book mentioned the need to curtail service on the Worcester Line likely east of Yawkey to provide construction access and suggested using the Grand Junction line through Cambridge as a construction reroute. She noted that Cambridge has high regional employment and suggested this be considered as a permanent solution (noting that as a temporary solution it will likely gain a constituency anyway).

Finally, Ms. Nagorsky noted that the NSRL presentations made ample note of routes connecting through the city, but that in Toronto, even though that connection is possible, they do not see significant use of those routes. She cautioned that it is important to look exactly where the suburban connections are in relation to jobs, and not to oversell the potential for reverse commutes and suburb to suburb trips.

Los Angeles

Jeanet Owens, of Los Angeles Metro, presented on Link US, a plan to create new run-through tracks at Los Angeles' Union Station. Union Station has been primarily the same since it was built in 1939. Metro bought the station and surrounding area (totaling about 40 acres) in 2011 for $75 million, and has been investing significantly in restoring the station and developing the surrounding area. The station serves Metro subway and bus services and regional rail services of Southern California Regional Railroad Authority (SCRRA - Metrolink) as well as Amtrak. The governance structure for commuter rail in the Los Angeles region is complex, with five counties funding a joint authority for Metrolink capital and operating costs. A building boom for transit is currently underway.

The Link US project was originally environmentally cleared by Caltrans in the early 2000s, and is planned to support the expected 200,000 daily trips at Union Station in 2040. The project will transform a 14 track, stub-end station to a station with 8 run-through tracks, extending over U.S. 101(Santa Ana Freeway) and connecting into existing rail lines, including a loop to allow trains

to turn back. The project increases station capacity by 40% and allows the future California High Speed rail to serve the station on shared tracks. The entire rail facility (platforms and tracks) will be raised to allow the continuation of tracks over the roadway, and allowing a new passenger concourse to be built underneath, relieving the existing overburdened concourse. Connections will be provided to both Metro subway and bus services.

Ms. Owens discussed the design challenges of the project, as it would be built in a complex environment with significant other projects being constructed or planned simultaneously. Due to agreements with the railroad operators, Design-Build delivery cannot be used, and the entire station must remain operational through construction. The run-through raised tracks will be built first, before raising the station platforms. A few buildings need to be demolished for the project, and Metro is committed to creating a welcoming urban environment underneath the project alignment, but will not take responsibility for parks to be built. Overall, the project is expected to cost $1.8 to $2.5 billion, with funding currently only allocated for preliminary design, with an EIS expected in 2019.

During the Q&A, Ms. Owens spoke extensively about Los Angeles' history with tax measures to support transit, which she credits primarily as a response to roadway congestion. The tax measures typically listed the projects to be completed by the funds gained from each measure, but one measure seriously underestimated project costs, and only half the projects could be completed. In order to complete the listed projects, a new measure was undertaken, which passed with 71% of voters in favor. Los Angeles has also used significant federal funding to support projects. Ms. Owens recommended significant contingencies (50-60%) in early project cost estimates to match the significant unknowns of the project.

Ms. Owens also asked a number of questions about how the cost estimates for the NSRL project will be completed. She noted that project delivery methods are key for understanding potential project costs and risks. On Metro's Regional Connector (a 1.9-mile tunnel for light rail), unknown utilities were a significant concern, as most were not located until the project was under construction, despite significant upfront investigation in order to find said utilities. This resulted in the project ending both late and $300-400 million over budget. She strongly recommended significant early investigation into utilities.

Seattle

Matt Preedy, currently of Sound Transit, presented on two major tunnel projects in Seattle. The Northgate Link Tunnel is a portion of the region's significant investment in rail connections and the expansion of Sound Transit. The project is a total of 4.3 route miles long, with two single-track tunnels, each 3.4 miles long and two underground stations. Tunnel Boring Machines (TBMs) are being utilized to construct the tunnels, and while there have been some issues, the size of the TBMs has not been a significant factor in those challenges. The soil conditions in Seattle have meant that extensive ground freezing and pumping had to be utilized to stabilize the ground at mined sections of the tunnels, which include the cross passages between the two tunnels needed for safety. As a result, Mr. Preedy tends to prefer single larger diameter tunnels for ease of construction, as this can be completed with one TBM and less mined structure.

The Northgate project's $1.9 billion cost is paid via a tax measure in Seattle which has infused the rail system with $54-65 billion for projects. This package will add more than 116 miles to the regional rail network, a significant increase in the size of the network. The tax package also benefits Amtrak and BNSF, who share track time with Sound Transit commuter trains. During Q&A, Mr. Preedy noted that the tax packages in Seattle have been presented to be without time limits, and that significant federal funds and bonding capacity have been leveraged off of the local commitments (which were in excess of $15 billion). While the tax is imposed over three-counties, there are "return-to- source" provisions that distribute the revenue generated by each county to projects within the same county. Initially, infighting between leaders caused false starts, but ultimately political championing of the various projects has helped lead to significant public support.

Prior to working for Sound Transit, Mr. Preedy was the construction director for the SR99 (Alaskan Way Viaduct) tunnel project. This tunnel buries a significant highway viaduct underneath downtown Seattle and reclaims the land for public use. The project was completed with a TBM that was the largest in existence when built – 57' outside diameter – that provides two traffic lanes in each direction stacked on top of each other. The tunneling was done completely below the water table of the surrounding area, but in mixed face soil conditions. Extensive 3D modeling was undertaken to conduct clash analysis and detection, however a mechanical issue with the TBM required it to be removed partway through construction via a special pit, and then re-introduced.

The Alaskan Way project resulted in no surface movement, in part due to the significant mitigation completed on various structures, including pre-mitigation, grouting and micropile walls. The contract was structured to encourage innovation, including allowing the contractor to determine the type of TBM to be used, and to allow for shared risk pools to offset the costs to the agency (as the contractor earned the balance of any unspent pool, they were incentivized to mitigate properly). The success of tunneling in Seattle has led to discussions of the future of many projects in the area, which may be completed via similar methods.

As his work in Seattle relates to the NSRL, Mr. Preedy recommended significant increases in risk allocations, specifically by assuming more mixed face soil conditions than is shown on the diagrams to date. Mr. Preedy observed that soil conditions may vary from the information currently collected, especially under bodies of water. He also recommended significant consideration of the procurement and contract methodology for any future program, as that will have a significant impact on cost and risk allocation.

Philadelphia

Ed LaGuardia and Ron Hopkins spoke about their experiences with Philadelphia's Center City Commuter Connection, a tunnel linking the two sides of the SEPTA network. As Mr. LaGuardia explained, the SEPTA rail network was created from the remnants of two competing and ultimately defunct railroads. Each former railroad had their main terminal (both stub end) on an opposite side of downtown. In order to improve service, the two terminals were connected by a tunnel in the early 1980s. As the Philadelphia area was very congested, there was only one reasonable engineering alternative for connecting the terminals, and the tunnel includes one new station, a rehab of an existing terminal into a station, and a significant number of sub-grade

connections from old buildings and the existing subway system. The approaches to the tunnel have a maximum 2.8% grade, which can prove a challenge to SEPTA under adverse weather conditions, and a very significant ventilation and HVAC system for maintaining air quality. Mr. LaGuardia noted that the project has provided important connections across the downtown of Philadelphia, including linking major institutions (academic and medical), and was noted as an engineering success in part for avoiding any damage to the historic Philadelphia City Hall.

Mr. Hopkins spoke about the operational benefits and challenges of routing trains through the center city. One significant challenge was the nature of the SEPTA dispatch and control operations, as well as the locations of yards and service areas, which significant limit capacity. Originally, the lines on each side were paired, as there were an equal number of routes to each side of the city. However, unbalanced passenger loads have led them to remove the strict route pairing system and change to a variable structure, where trains can have different destinations based on need. While this change has been good for operations, it may have a negative impact on passenger comprehension for those looking to ride across the city center. The location of midday storage yards and crew locations have proven to be significant factors in providing a consistent operation. One major lesson, according to Mr. Hopkins, has been the impact of delays on a connected system. Previously, with the two stub-end terminals, delays were recoverable through extra equipment sets or changes to crew and equipment assignments. Now, with longer routing, less recovery time built into the schedule, and a greater number of possible destinations for each train, delays can cascade from one side of the city to the other, affecting customers on future trains in a magnified fashion.

During Q&A, Mr. LaGuardia noted that the SEPTA tunnel had to be closed six days after it opened, as infrastructure failures on either side of the new tunnel forced changes to service. He emphasized the need to make sure that outlying infrastructure (beyond the limits of the major project) performs, or the major investment may not live up to full potential. As far as lessons learned for Boston, he noted that dual-mode locomotives have a significant impact on yard facilities, which can be very expensive due to the number of interlockings and signals. The onset of Positive Train Control (PTC) has complicated these projects, and changes in egress code compliance have changed project design, and encouraged emergency egress to be accomplished without elevators and escalators. He also asked how MassDOT intends to interface with Amtrak, especially considering the different services Amtrak runs to each side of the city.

Around the World

A variety of tunneling experts shared some insight on best practices. Jim Marquardt, JF Shea Construction, discussed some common issues with tunneling projects, and strongly recommended early participation with contractors in order to get feedback, as is happening on the Gateway project in New York. Norbert Fuegenschuh, BeMo Tunneling USA, discussed a number of recently completed tunnels completed through a variety of methods, and some new technologies, including an “uphill excavator”. Jack Brockway, Herrenknecht Tunneling Systems USA, noted that technology has changed significantly over the last decade, reducing the technological challenges of excavating the TBM tunnels for this project, especially if a specifically-design TBM is utilized.

Boston – Project Status

MassDOT and the Project Team presented on the project and the current status. Jeff Tubbs and Tony Bruzzone (Project Team) introduced the project and summarized the work done in the 2003 DEIR. Mr. Bruzzone reviewed the 2003 alignment and discussed the 2 and 4 track options, the original project cost estimates ($3.5-6.5 billion) and the ridership estimates of the 2003 work. He noted that the costs and ridership projections varied so widely in part due to the potential size differences in the infrastructure, and the changes in frequency and parking capacity assumed at the time.

Anne Patrone (Project Team) presented on the current commuter rail system and potential NSRL service alternatives. She noted that there has been a reduction in commuter rail ridership since 2009, and that there is an imbalance of passengers between north and south sides of the system. Over the last decade and a half, Gateway cities have grown faster than the urban core and other suburbs, but there has been a significant population increase in the urban core. The service alternatives presented all linked lines across the city, and Ms. Patrone explained the various service alternatives the team is considering.

Jon Hurt (Project Team) discussed some of the engineering challenges of the project, and the challenges of the 2003 DEIR alignment. He noted that the team is confident in the ability to construct the tunnel sizes originally proposed, but there are still pros and cons between the single and double bore options, including cost and constructability. However, the 2003 station designs may be more problematic, as they have larger spans than are commonly constructed. Arup recommends spans of no greater than 80 feet, and the team is considering station options to accommodate this recommendation. Other key issues for the project engineering include: construction staging, excavation methods, limiting ground movement and impact on surface structures, the mixed face soil locations, underground obstructions and fire life safety.

David Hunt (Project Team) presented on potential alignment options, including the 2003 DEIR alignment. One alternative being investigated is to move the (underground) North and South stations closer to the center of the city, potentially to obviate the need for a central station between them. These stations could have passenger connections that rise to the surface closer to the center of the city than the stations in the 2003 design. A new alignment option utilizing Congress and Pearl streets is currently under development, with detailed examination of the horizontal and vertical geometry underway. The 2003 alignment used a greater than 3% grade at points, and the MBTA would prefer to stay under 2%. Currently, a 3D model of the subsurface city is being developed to allow for identification of obstructions and allow for more accurate cost estimates.

Mr. Nolan moderated a group discussion (many of the topics are covered more fully in the geographic-specific sections above). Brad Bellows (NSRL Working Group) noted that he appreciates that the team is looking at new ideas, and that he agrees the stations are the most difficult part of the program. He is opposed to any option that eliminates a portal to the Old Colony lines, and would suggest including an analysis of the potential development opportunities at current layover as part of the study. He also suggested the team look at inclined walkways for an egress solution to reach the surface.

A discussion of underground utilities amongst many participants covered that while tunneling will likely occur underneath utilities, they can be an issue for stations, headhouses and ventilation structures. There was a difference in understanding about how comprehensive local databases are in terms of current utility locations, but all Peer Group members noted that upfront investigation can mitigate long-term risk. A discussion around the terminology of the current project addressed whether there are multiple phases to this project, and if a "preferred alternative" will be designated. Mr. Bruzzone noted that this project is simply a reassessment of the state of the 2003 DEIR.

Ed Mueller (NSRL Working Group) mentioned that the presenters talked about the projects in their respective communities as "revolutions" in transportation and in action. Mr. Preedy picked up on the theme and discussed how the State of Washington with public support decided to spend billions of dollars of public money to improve its transportation system. Mr. Hamwey asked each presenter to discuss funding solutions they have utilized locally (each response is noted in the respective section above).

Mr. Brockway raised the problems with the construction claims process. He asked the group to look at examples in Europe of collectively dealing with claims. Mr. Hamwey acknowledged the importance of the issue, but indicated that this study would not cover the claims process.

Mr. Bellows made it clear that international participation via teleconference would have broadened the range of input gathered in the workshop. Chris Dulake from Crossrail in the UK made himself available, but was unable to participate due to technical difficulties with the teleconference system. Members of the Working Group expressed disappointment that the opportunity to have Chris Dulake's input in the event was lost.

Boston – Purpose and Need

Mr. Bellows presented on the purpose and need of the Rail Link. He noted that Massachusetts is in a difficult position vis-à-vis public trust in project delivery and infrastructure in comparison to peers. He believes the Boston transportation network will require new options be explored in order to keep up with the region's development boom. He discussed similar projects in other cities worldwide and suggested that Boston engage and explore why projects are so expensive here. Mr. Bellows suggested significant investments in upfront work, similar to work in the UK which has invested in workforce training prior to major projects and significant upfront investment. Finally, he noted it would be a missed opportunity to not use current interest rates to finance the NSRL project.

During Q&A, members of the Working Group asked members of the Peer Group for recommendations on how to move the project forward. Responses focused on the need for unity between political leaders on the project, and that momentum is key. Taking a strategic approach to building both coalitions and developing project goals and budgets was also mentioned. Mr. Hamwey noted that while we are looking at peer projects for comparisons, there will not be an analysis of contracting methods from other countries at this time.

Attendees

MassDOT	*Peer Group*
Scott Hamwey	Jack Brockway, Herrenknecht Tunneling Systems USA
Caroline Vanasse	Chris Dulake, Mott MacDonald (phone)
	Norbert Fuegenschuh, BeMo Tunneling USA
	Ron Hopkins, SEPTA (phone)
	Ed LaGuardia, SEPTA (Retired)
Project Team	Jim Marquardt, JF Shea Construction
Anthony Bruzzone	Becca Nagorsky, Toronto Metrolinx
Matthew Ciborowski	Jeanet Owens, Los Angeles Metro
Guiliana Galante Casazza	Matt Preedy, Sound Transit
David Hunt	
Jon Hurt	*Working Group*
Tom Lindberg	Lynn Ahlgren
Joe Nolan	Brad Bellows
Anne Patrone	Evan Efstathiou
Joe Sgroi	Ed Mueller
Brian Swett	Clay Schofield
Jeff Tubbs	Lynn Ahlgren