

Evolving Use of Level of Service Metrics in Transportation Analysis – Metropolitan Council Case Study

Background and Context

As a federally-designated metropolitan planning organization (MPO) for the seven-county Minneapolis-St. Paul metropolitan area, the Metropolitan Council (Met Council) is responsible for overseeing transportation and multiple types of regional planning. Since the early 1990s, Met Council had emphasized capacity expansion and modest transportation demand management (TDM) as strategies to mitigate congestion and accommodate rapid regional growth. However, capacity expansion is expensive, and the same handful of legacy projects continued to appear in back-to-back Transportation Policy Plans through the early 2000s due to lack of funding. In August 2007, amid a growing recognition that the region would not be able to afford the transportation improvements it needed to sustain a growing population, the I-35W Mississippi River Bridge in Minneapolis collapsed during evening rush hour, killing 13 people and injuring over 100 more. Around the same time, the Minnesota Legislature voted to overturn the Governor’s veto of a transportation funding bill (H.F. 2800) in the next legislative session. However, it became clear that the revenues available for transportation investments were not sufficient to expand the highway system’s capacity to meet projected demand.¹

Leveraging political will for transportation investment and a consensus that the legacy projects would be impossible to fund, Met Council and the Minnesota Department of Transportation (MnDOT) concluded that they would not be able to build their way out of congestion, and they shifted focus to making system improvements through active traffic management and managed lanes to address congestion.² Where evaluations had previously relied on Level of Service (LOS) and volume-to-capacity (v/c) ratios as metrics, Met Council began to introduce travel time reliability and people-moving capacity as supplemental analyses.³ In the transition from operating at a system-wide scale to pursuing smaller-scale and more cost-effective spot improvements, Met Council found LOS to no longer be the most appropriate performance metric.



Figure 1: In Minneapolis, MN, a variable message sign above the I-394 HOT lanes shows current toll rates
Source: FHWA and MnDOT

Case for Change

Met Council can point to two catalysts for the paradigm shift from policies that move vehicles to policies that move people: the bridge collapse that underscored the importance of investing in transportation infrastructure, and the realization that even appropriating funding for transportation would not be

¹“Current funding, even with significant increases, will not provide roadway facilities to satisfy peak demand because 1) the public will not support the substantial funding increases needed; and 2) the impacts on the man-made or natural environment would be too extensive.” ([Principal Arterial Study, 2007](#), p. 28)

² [Metropolitan Highway System Investment Study](#), 2010, p. 4

³ [2030 Transportation Policy Plan, 2009, 2030 TPP Update, 2010, 2040 Transportation Policy Plan, 2015](#)



sufficient to finance the projects proposed in the existing Transportation Policy Plans. The legislation passed following the 2007 bridge collapse prompted a region-wide discussion of the state's deteriorating transportation infrastructure and the cost of maintaining and expanding highway systems. However, it became clear that even the strong political support in the legislature for investing in transportation would not make available enough money to enact the congestion mitigation plans awaiting funding. The 2030 Transportation Policy Plan (TPP) published in 2009 stated:

Even if current and future funding levels were commensurate with those of decades past, there would still not be enough money to “fix” congestion throughout the region's highway system. Adding enough highway capacity to meet forecasted 2030 demand over the next 20 years would cost some \$40 billion dollars, an amount that, if funded by the state gas tax alone, would add more than two dollars per gallon to the cost of fuel.⁴

Motivated by the reality of limited transportation funding, Met Council began to shift the narrative of its Transportation Policy Plans away from roadway expansion with moderate incorporation of TDM, and toward more practical and cost-effective approaches.

Implementation

The first post-2007 Transportation Policy Plan, the 2030 TPP—Met Council's fiscally constrained long-range plan—acknowledged the limitations of expanding highway capacity to accommodate projected growth, particularly in the face of inadequate funds.⁵ It introduced new metrics—people-moving capacity and person throughput—to mitigate congestion and enhance performance, all using existing infrastructure. This emphasis on making more efficient use of existing capacity allowed for a shift to low-cost/high-benefit improvements (see Figure 1 for an example). With the Congestion Management Safety Plan, MnDOT introduced strategies for spot improvements and supplementation of high-occupancy vehicle (HOV) lanes with high-occupancy toll (HOT) lanes. The 2009 plan called for the reassessment of the scope and cost of major expansion proposals, and the 2010 update added objectives related to improving travel time and trip reliability.⁶ ⁷ By 2015, when it published the 2040 TPP, Met Council was focusing on managing congestion with “innovative, cost-efficient” approaches, maintaining existing infrastructure, and investing in multimodal travel options to achieve sustainable growth.⁸ The 2040 TPP also describes a Congestion Management Process (CMP) that identifies multimodal performance measures, including “intensity, extent, and duration of congestion,” a reliability index, and person throughput by mode.⁹ Similar performance measures appeared in the 2010 update of the 2030 TPP and the Metro Highway System Investment Study (MHSIS), also published in 2010.

Table 1 shows the use of a variety of metrics to evaluate system performance. The v/c ratio is still included in the list of metrics, but it is now only one of 19 measures. That a measure traditionally associated with LOS continues to appear in Met Council's approach to transportation planning demonstrates its retained utility: v/c ratios and LOS are now used as easily tabulated indicators of problematic congestion, and other metrics are used to identify appropriate interventions. If the v/c ratio is too high, instead of expanding capacity through adding vehicle lane-miles, projects may reduce volume through TDM or expand capacity through alternative modes or higher-occupancy vehicles.

⁴ [2030 Transportation Policy Plan](#), Metropolitan Council, 2009, p. 1

⁵ Ibid.

⁶ [2030 Transportation Policy Plan](#), Metropolitan Council, 2009, p. 3

⁷ Ibid.

⁸ [2040 Transportation Policy Plan](#), Metropolitan Council, 2014

⁹ Ibid. (p. 503)



Objectives	Performance Categories	Measures of Effectiveness
Increase the people-moving capacity of the metropolitan highway system	Person Throughput	Person Miles Traveled (PMT) by facility/ lane type
		Vehicle Miles Traveled (VMT) by facility/ lane type
	Transit Mode Split	Change in treatment corridor mode share
		Change in regional mode share
Transit and Active Transport	Facility Performance	Ratio of PMT / VMT (mode distribution)
		Lane miles at volume / capacity > 0.95
		Average speed by facility/lane type
Accommodate future demand within the metropolitan highway system	Peak Period Vehicle Travel Volumes	Change from baseline in peak hour volumes
		Change in peak period VMT
	Temporal Extent of Congestion	Hours per day operating with congestion
		Change in freeway links operating with congestion
		Change in non-freeway corridors operating with congestion
		Change in VMT during congested conditions
		Change in Vehicle Hours Traveled (VHT) during congested conditions
Increase trip reliability	Travel Time Reliability	Variability of travel time by facility/ lane type
		Change in travel time index (total travel time compared to free-flow travel time) of travelers
Reduce travel time	Travel Time Savings	Corridor-based travel time by facility/ lane type
		Change in travel time by treatment corridor
		Differentiation of travel time by mode

Table 1: Performance measures used by Met Council (Reproduced from MHSIS Appendix G: Performance Measures)

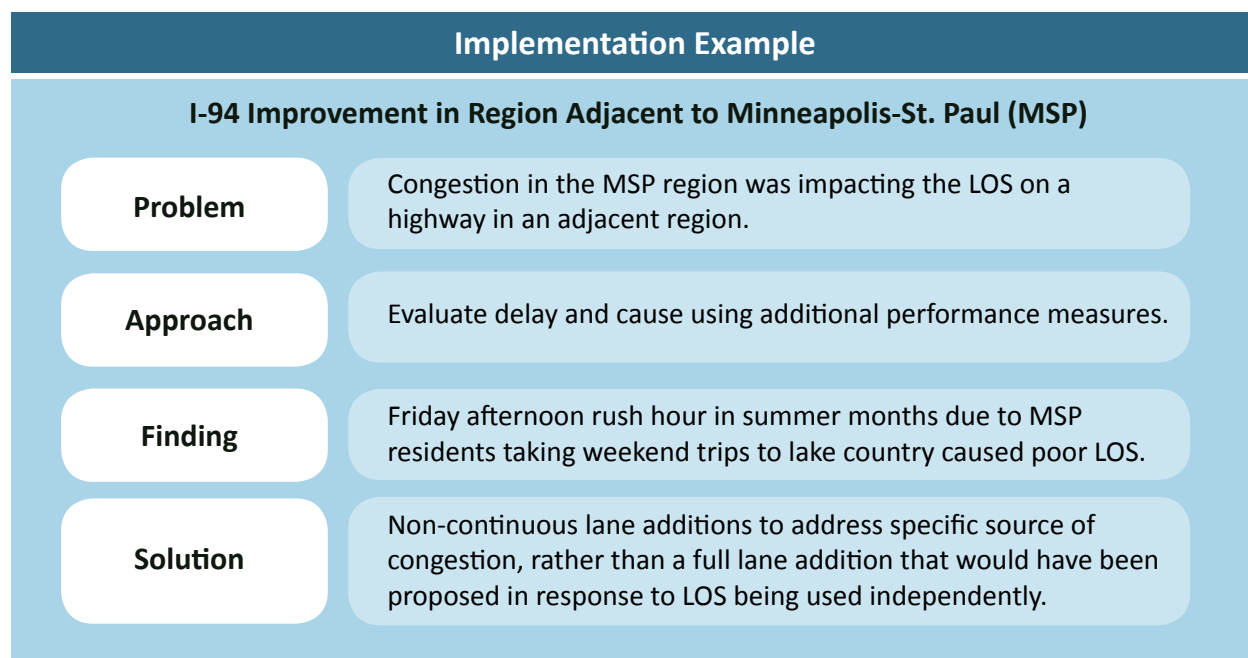


Figure 2: An example of how new performance measures were used to address local congestion

In concert with the changing focus of the regional transportation plans, the regional solicitation process for allocating federal funding has also been revised to ensure that the criteria for scoring, measuring, and designing are consistent with the goals and objectives of the regional vision plan, Thrive MSP 2040, and the 2040 TPP.¹⁰ Though 97% of federal funding is dedicated, the remaining 3% represents about \$2.2 billion available for distribution from the Surface Transportation Program (STP), the Transportation Alternatives Program (TAP), Congestion Mitigation and Air Quality Improvement (CMAQ) Program, and the Highway Safety Improvement Program (HSIP). Based on an evaluation by Met Council and the Transportation Advisory Board, the entity that allocates the funds, the regional solicitation process now includes prioritization criteria that align with the regional plans, including equity, affordable housing, and emissions reductions.¹¹ The MHSIS also includes a list of guiding principles to assist in the evaluation of alternative projects and approaches (see Figure 2). Included in the list are stipulations that projects with managed and priced lanes receive higher priority than general purpose lanes, and that traditional capacity may not be added if demand management or alternative modal capacity is sufficient to address needs. These guiding principles respond directly to the objectives outlined in the MHSIS to increase the highway system's people-moving capacity while reducing future demand, to manage and optimize the existing system, and to implement strategic and affordable capacity expansion projects.¹²

¹⁰ 2040 Transportation Policy Plan, Metropolitan Council, 2014, p. 250

¹¹ Ibid.

¹² <https://metro council.org/Transportation/Publications-And-Resources/MHSISAppGPerformanceMeasures-pdf.aspx> MHSIS Appendix G: Performance Measures



Metropolitan Highway System Investment Study (MHSIS) Guiding Principles

Utilize the most cost-effective operational and management techniques to optimize system performance.

Managed lanes are a higher priority for improvement than general purpose lanes.

There are some areas where traditional capacity will not be added; this does not preclude management, operational and pricing solutions.

Needed segments of general purpose lanes may be converted to managed lanes.

Highway improvements should enhance and support transit use where existing or planned express transit service exists.

Flexible design may be needed to accommodate an improvement or project within the existing right-of-way. Overall safety must be maintained or improved.

Complete the six-lane beltway and unfinished connections to utilize existing and planned investments.

Do not add inbound capacity outside the beltway that cannot be accommodated by projects or operational changes/strategies on, or within, the beltway.

Manage access to Interregional Corridors (IRCs) or other Principal Arterials.

Asymmetrical improvements may be considered.

Figure 3: A summary of the Guiding Principles included in the Metropolitan Highway System Investment Study published by Met Council in 2010

Since the mid-1990s, the Twin Cities region had been moving in the direction of increased support for TDM, multimodal planning and MMLOS, and coordinated land use, without gaining significant traction until around 2008. Though some had previously pushed for alternatives to capacity expansion due to induced demand and other fundamental limitations, it was not until consensus emerged that insufficient funding required a more practical approach that Met Council shifted its focus from trying to eliminate congestion to managing it. Issues of funding, preservation concerns, and asset management all combined with political will following the 2007 bridge collapse to play a role in moving the region toward a more holistic transportation planning approach.



Insights and Lessons Learned

Met Council's transition to broader, performance-based measures presents a number of lessons for state and local agencies seeking to realize similar transitions, the most succinct of which is that Level of Service and traditional volume-to-capacity ratios represent only a small subset of many measures that may be useful in selecting projects to improve regional mobility.

- **Financial constraints may force an agency to seek alternative performance measures or approaches to managing congestion.** Implementing all the capacity expansion projects identified to address congestion, especially in areas with growing populations, is unaffordable. Met Council started to recognize the financial limitations as large scale projects appeared in back-to-back Transportation Policy Plans, and MnDOT projected that within a few years revenues to the region would only support maintenance projects and not major construction. The fiscal reality led Met Council to introduce a broader range of performance metrics that would result in lower cost, higher benefit projects.
- **LOS and volume-to-capacity ratios are now used primarily as easily tabulated indicators of congestion.** As communities move to a broader set of transportation metrics, traditional measures such as LOS and v/c ratios remain useful in identifying areas that may benefit from further analysis. New performance metrics help determine how to address the problems highlighted by more traditional measures.
- **Performance metrics focused on existing transportation capacity enable the region to realize more affordable projects while maintaining service expectations.** The use of new metrics has shown that low LOS or a decrease in LOS does not necessarily translate to increased delays or unacceptable travel times for road users. When interventions are needed, the solutions proposed as a result of current metrics are different from what would have been proposed if Met Council were only using LOS or number of vehicles in its analysis. Where indications of congestion previously would have automatically led to highway capacity expansion, they may now result in spot improvements, capacity expansion of alternative modes, and mechanisms to reduce travel time, all of which represent more affordable and holistic interventions than extensive capacity expansion.
- **Asymmetric or spot improvements may mitigate congestion without inducing travel.** Spot improvements have the benefit of addressing localized congestion challenges without inducing demand as full-scale capacity improvements have been observed to do.
- **Stakeholders are more focused on strategies and solutions than on the new performance measures.** The public response to new performance measures has been limited, and feedback tends to focus on the perceived impact. Businesses expressed concern that a decrease in automobile traffic would result in lower revenues, and communities were both interested in immediate spot improvements and concerned that they would result in incomplete solutions.

Met Council has experienced a learning curve in how it frames new interventions, which has resulted in requiring a more substantial educational element in project development. Local stakeholders, such as city councils, business owners, and residents—who are familiar with v/c ratios and LOS as metrics—need to better understand the background cause of congestion and how a proposed project would address that cause. In the past, project need would typically be justified based on afternoon peak hour v/c ratio or LOS data, which would be considered an indicator of longer-term congestion. But a deeper exploration of the problem may reveal that it represents only a brief period of congestion (as in the “Implementation Example” described above in Figure 1) and that a major capacity expansion, which would be underutilized for most of the time, is not the most effective solution.