Commission Briefing Paper 4L-04

Implications of Investments Targeted at Reducing Transit Passenger Bottlenecks

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Introduction

This paper is part of a series of briefing papers to be prepared for the National Surface Transportation Policy and Revenue Study Commission authorized in Section 1909 of SAFETEA-LU. The papers are intended to synthesize the state-of-the-practice consensus on the issues that are relevant to the Commission's charge outlined in Section 1909, and will serve as background material in developing the analyses to be presented in the final report of the Commission.

This paper presents information on the potential for transit capacity enhancements to reduce highway congestion by removing major transit passenger-oriented bottlenecks, what the costs of doing so would be, and what specific bottleneck or core capacity mitigation strategies would be. Several recent studies have shown that bottlenecks – specific points on the transit system where passenger capacity is restricted – have the potential to significantly limit the ability of transit to meet needs in major metropolitan areas. Removing the transit bottlenecks can also lead to significant reductions in highway congestion.

Background and Key Findings

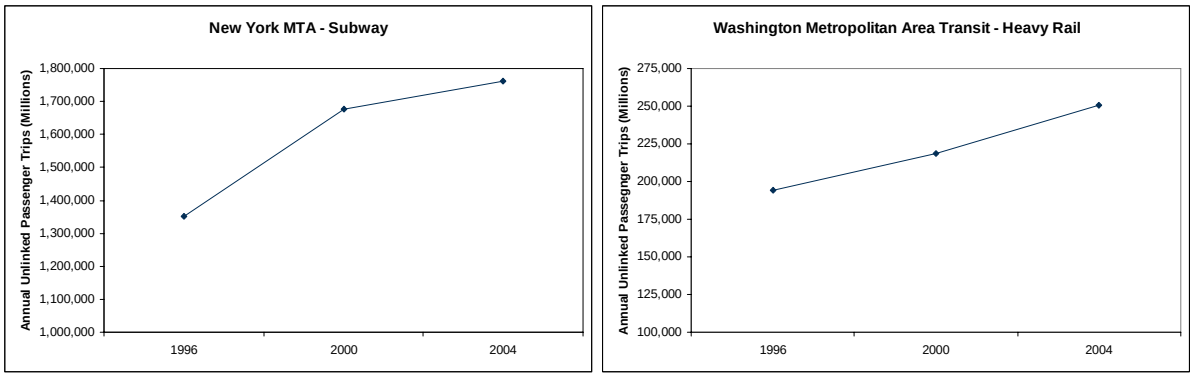
A transit bottleneck, also often referred to as a core capacity constraint, is defined as a limitation on transit system capacity that prevents service expansion, absent a significant capital investment, to meet growing demand. Ridership has exceeded the system's design capacity. In many of the largest urban regions in the nation, transit plays a key role in the regional transportation system and transit bottlenecks have the potential to contribute to travel delays and decreased mobility. The issue is most pronounced on commuter rail, heavy rail and light rail systems in large metropolitan areas that have faced rapid increases in ridership over a number of years. As transit ridership continues to rebound, particularly in a number of the nation's largest cities, more systems are facing this issue and may need to make significant capital investments. The demographics of increasing urbanization and limited options for roadway expansion means that the issue of core capacity is likely to become more significant and affect an increasing number of large urban systems. The issue has potential regional and even national significance for the nation's transportation system. Some of their most important considerations in developing a national approach to the issue include the following:

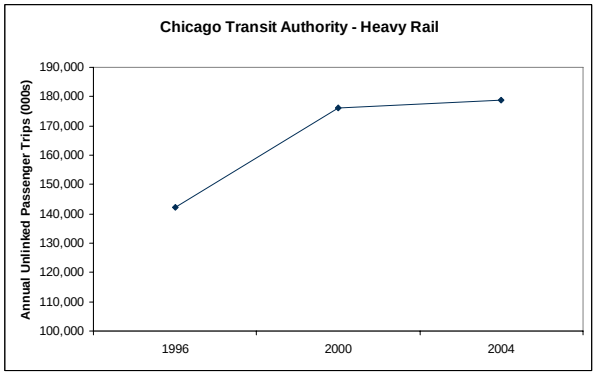
- The lack of an industry definition for a "transit bottleneck" does not readily allow for a assessment of the national need for capital investments to address current bottlenecks – though a recent survey by APTA suggests the identified need approaches $25 billion;
- Potential short-term effects of not addressing transit bottlenecks include an increase in transit operating cost, reduced system reliability, and an inability for transit to meet growing regional travel demand in large urban centers;

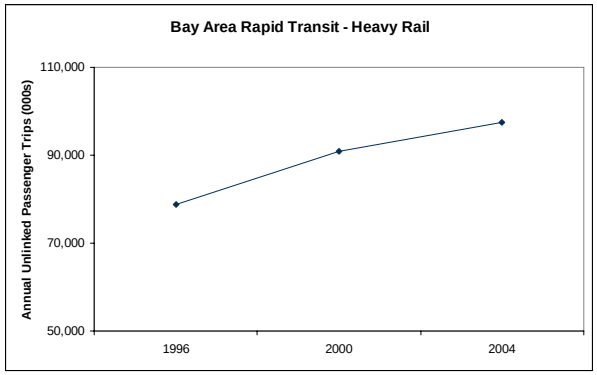
- The negative effect of transit bottlenecks on transit service has the potential to shift travel from transit to the automobile in major urban centers and increase regional highway congestion, potentially reducing regional air quality;
- Potential long-term effects include a dispersal of residential and job growth away from existing transit lines to areas not as readily served by transit; and
- FTA's current funding structure does not specifically target core capacity constraints with a designated funding source and large capital projects intended to address core capacity compete with an already highly competitive under-funded New Starts Program.

Transit Bottlenecks Defined

Transit is experiencing a resurgence, particularly in some of the nation's largest urban centers. Nationally, transit ridership peaked in the mid-1940's at more than 23 billion annual passenger boardings, then declined through the early-1970's to a low point of approximately 6.5 billion annual passenger boardings. The result of this decline was excess capacity on some rail systems, and an abandonment of others. Since the early 1970's, transit's role in the nation's transportation system has increased with ridership reaching 9.5 billion annual passenger boardings in 2004. Some of the nation's largest transit systems, including those in New York City and Washington, DC have absorbed continued increases in transit ridership for many years. In New York City, subway ridership is at its highest level since 1970 and the heavy rail system in Washington, DC continues to reach record ridership levels every year. Excess capacity available on a number of large rail systems has been consumed by this increasing ridership and portions of a number of systems are beginning to exceed their design capacity. Like highways, transit systems have a limit to the passenger loads they are designed to carry. Sample changes in ridership over just the last decade are shown below:







Although a number of transit systems are facing transit bottlenecks, or core capacity constraints, the reasons for these constraints vary and there is not yet a clear definition of transit bottlenecks within the industry. How many and the extent to which systems face the issue is unclear. Core capacity constraints are primarily found on heavy rail, commuter rail and light rail systems and include railroad line-haul capacity constraints, limitations on station capacity to handle additional passengers, operating system limitations or other specific constraints (such as platform lengths or location with regard to intersections) that prevent the addition of service to meet increasing demand. The issue is most relevant in large urban centers where job and residential growth, concentrated near the transit system, is contributing to significant increases in transit use. Similar to the nation's highway system, capacity constraints are most common during peak periods of travel. Examples of core capacity constraints for specific transit modes include:

- Commuter Rail – Constraints include line-haul capacity, particularly on lines competing with railroad freight movements as rail freight demand continues to increase nationally.
- Light Rail – Constraints include stations that prevent the addition of cars to meet increasing demand.
- Bus Service – Capacity constraints most often relate to limits on the street system that prevent the addition of new service with few options to shift service to parallel streets.
- Heavy Rail – Constraints include insufficient track capacity, tunnels that limit the addition of service, electrical systems unable to carry longer trains or physical constraints on facilities that limit the use of the system by more passengers. System constraints affecting passengers might include passenger loads in stations that exceed a level at which additional passengers can safely use the system, constraints on access to stations, such as stairs, escalators or platform capacity.

No single source of information exists that effectively frames the magnitude of the core capacity issue nationally. A more specific definition of a bottleneck or core capacity constraint is necessary for transit agencies to consistently identify these constraints and provide a national picture of need. Some agencies have identified specific projects that very likely fall into the definition. A recent survey conducted by APTA estimated the cost of addressing existing core capacity issues at almost $25 billion, although the variation in cost across agencies suggests that a consistent definition is not being applied. Continued increases in ridership - expected by a number of large urban transit systems - are likely to increase the number of systems facing core capacity constraints.

Potential Effect of Transit Bottlenecks

Bottlenecks on transit systems can affect a number of transportation system users even beyond the most directly affected transit riders. The general effect of not providing the capital investment to address transit capacity constraints is a diminishing ability for transit systems to meet regional mobility needs. More specific potential effects include:

- Decreased transit system operating efficiency and increasing operating costs;
- Reductions in transit service reliability;
- Potential safety implications due to system overcrowding;
- Changes in travel demand with more travel during off-peak periods;
- Shifts in travel to other modes, particularly to the private automobile;
- Increasing roadway congestion on adjacent facilities due to changes in travel mode;
- Long-term shifts in residential or job growth to locations outside of affected corridors - potentially to result in more dispersed regional residential and employment growth;
- A potential secondary effect of increased travel on the roadway network due to dispersed employment and residential growth not readily served by transit; and
- Increased cost of freight movements due to increased regional highway congestion.

In regions facing transit core capacity constraints, roadway capacity expansion is equally difficult. Absent an investment to address the need for additional capacity for travel, decreasing mobility has the potential to affect long-term economic growth. An outstanding question is to what degree transit systems should accommodate peak demand. Many urban regions have changed their policies regarding acceptable levels of highway congestion given the realities of constrained funding and physical capacity to expand facilities. The same issue must be considered as transit systems begin to reach their design capacity. Given the potential capital cost of some investments to resolve these bottlenecks, it may be reasonable to accept some capacity constraint for relatively short periods of peak period travel. This consideration should be a part of the discussion on the definition of a core capacity constraint.

What is Payoff for Fixing Bottlenecks?

Overall, addressing transit bottlenecks provides the benefit of increased regional mobility. Transit users receive the most direct and immediate benefit, but more widespread indirect benefits are provided. Specific benefits include:

- Improvements in system operations to positively influence operating costs and reliability;
- Improved corridor and regional mobility;
- A reduction in regional highway congestion; and
- Support for long-term economic growth in the affected transit corridor.

Addressing core capacity constraints will have the benefit of improving system operating efficiency and have the potential to reduce agency operating costs. Systems running near to or above design capacity are more likely to have regular delays and a decrease in reliability. WMATA is a good example. Some lines on the system are now running close to capacity. The

absence of passing tracks and a limit in line-haul capacity results in significant passenger delays should any vehicle malfunction occur.

Targeted investments to address transit bottlenecks have the potential to reduce congestion on adjacent highway facilities. This is particularly true in cases where transit systems serve long distance trips, such as commuter rail lines, where a shift in travel to single-occupant automobiles is likely to increase the vehicle miles of travel more substantially. In some travel corridors heavily dependent on transit, addressing these constraints will be necessary to allow continued economic growth.

Addressing core capacity issues will support continued economic growth in transportation corridors where travel demand exceeds capacity. Congestion over the long-term is likely to encourage a shift in employment and/or residential locations to other parts of the region, and has the potential to increase vehicle miles of travel and, consequently, an increase in emissions. By contrast, concentrated residential and employment growth is more readily served by transit, encourages shorter trip lengths and contributes to improvements in air quality.

How Can Bottlenecks Be Fixed?

The relative challenge of solving bottlenecks varies. Bottlenecks might be addressed through minor capital improvements or relatively inexpensive operations strategies, or they can be very hard to resolve, such as where there are limits on the line-haul capacity of rail lines into the cores of major metropolitan areas such as New York or Washington, D.C. Specific strategies to address transit bottlenecks will vary depending on the identified constraint. Specific "point" improvements can be made, but the nature of the problem may require more systemic approaches – fixing one point may just transfer the problem to a different point on the same line.

Potential strategies to address core capacity or "bottlenecks" include:

- Changes in transit operations;
- Managing peak demand through fare policies or other targeted efforts to spread the peak demand;
- Upgrading existing equipment to allow for increased operations (e.g. switching or electrical);
- Expanding capacity on existing lines (e.g. addition of a passing tracks or additional track);
- Expansion of station facilities (e.g. platform expansion, station egress expansion); and
- Construction of parallel facilities on a new alignment.

How Have Some Regions and States Dealt with Transit Bottlenecks?

Several transit agencies are undertaking efforts to define existing transit system core capacity constraints and corresponding investment and operating strategies to address the identified issues. WMATA, the operating system for the Washington, DC Metropolitan Area, the New York Metropolitan Transit Authority (MTA), and the Chicago Transit Authority (CTA) provide some of the most compelling examples. These regions are facing limits on core capacity into their business districts and have identified specific strategies to meet growing demand for service.

Washington Metropolitan Area Transit Authority (WMATA)

WMATA evaluated a wide range of potential improvements to address capacity constraints on its system. WMATA is assessing looming core capacity constraints that are the result of an exceptional period of transit ridership increases. As ridership on the rail system continues to expand, the existing operation will not be able to maintain this growth without significant capital investment. Identified strategies include a mix of operating strategies, new facilities, and targeted capital investments. Identified investments include a mix of line haul capacity expansion, efforts targeted at managing peak demand and station enhancements. Specific strategies include:

- Demand management - WMATA has a long history of charging peak period fares and recently introduced a proposal to charge an additional $.35 peak period fare for 19 of its downtown stations. WMATA has implemented a new connection between two rail lines, and also proposed a new connection between two additional rail lines to reduce the need for transfers at Metro Center, one of its most crowded stations.
- Station enhancements – WMATA has identified a number of specific transit station improvements to enhance the capacity of station ingress and egress including "express" lane for Smart Cards, additional ticket gates, new entrances and exits, and changes in escalator operations.
- Operating strategies – WMATA has proposed potential changes to its system operations to reduce the number of trains operating in the Rosslyn tunnel, which is currently operating near design capacity.
- Longer trains – WMATA is beginning to operate 8-car trains and has identified specific investment needs in the operating system to expand the use of longer trains which will allow for increased capacity without increasing service frequency.
- Line-haul capacity – WMATA has introduced the possibility of new, parallel, lines to increase the capacity of service across the Potomac River.

New York Metropolitan Transit Authority (MTA)

The New York MTA has identified several specific capital investments that will address current and long-term capacity constraints on the subway and commuter rail systems. The East Side Access project is providing a new connection for the Long Island Railroad into Grand Central Station which will allow some service to shift from Penn Station, which is operating near capacity. The construction cost for this project is estimated at $7.8 billion. Similarly the Second Avenue Subway Line, now under construction in Manhattan, is intended to alleviate overcrowding on the parallel Lexington Avenue Line. The cost estimate for the first, 2.3 mile segment of this line is estimated at $4.9 billion. A further project, "Access to the Region's Core (ARC)" would involve a new tunnel under the Hudson River from Secaucus Junction in New Jersey. This project would cost another $7 billion.

Chicago Transit Authority (CTA)

CTA's Ravenswood Line (or Brown Line) experienced a significant surge in ridership that was beginning to tax the system's ability to safely serve passengers. The declining condition of the system together with increased ridership was contributing to significant delays in service and on some portions of the line, trains were forced to travel at slow speeds. The system, as designed,

was limited to six car trains. CTA successfully applied for New Starts funds and is rehabilitating the line and expanding stations to allow for eight-car trains. Expected benefits in travel time and new riders justifies the investment through the New Starts Program.

What Would a National Transit Bottleneck Mitigation and Core Capacity Program Look Like?

Core capacity constraints are currently addressed through a variety of funding sources through the Federal Transit Administration, though no targeted program is in place and the source of funds varies. The New Starts Program is the first option and the major funding source for the three New York MTA projects, East Side Access, the Second Avenue Subway, and the ARC. Other projects are funded through the rail modernization program. Rail modernization is an option for needed investments to upgrade existing rail systems that result in an enhanced system capacity. Formula funds are a third option, though the total dollars available are limited. Finally, some flexible funds under the Federal Highway programs may also be used for transit purposes, at the direction of the State Department of Transportation. These funds include Congestion Mitigation and Air Quality (CMAQ) in air quality non-attainment areas, as well as the Surface Transportation Program (STP).

There are several options available to develop a more systematic, national approach to target core capacity constraints. The first is to use the existing New Starts Program with an expansion of funding and the second is to establish an independent program specifically targeted at core capacity on existing systems.

Expansion of the New Starts Program

A number of existing projects in the New Starts Program, as discussed in this paper, are using the New Starts Program to fund projects that are attempting to relieve core capacity constraints. The current funding stream for New Starts does not provide sufficient funding for the multitude of projects that have been justified with less than $1.5 billion in funding proposed for the program in Fiscal Year 2007. The actual Federal share of funding for projects is now at 50% or less (even though the projects remain eligible for funding at the 80% level) and projects still face delays due to a lack of funding. By effectively rationing New Starts dollars with this lower Federal match, compared to the 80% federal match for new capacity highway projects, the inadvertent result is that a transit investment may become less competitive in regional prioritization plans, particularly when leveraging of federal funds is considered.

The advantage to expanding the existing New Starts Program is that it has developed a detailed process to evaluate the user benefits of projects that can be applied to core capacity projects. However, there are two important issues to consider with the current process. First is the possibility that a core capacity project may not be deemed eligible under New Starts definitions, which require the inclusion of certain fixed guideway infrastructure elements. Second is how such projects might rate according to the established New Starts criteria measures. Because some core capacity projects are likely to involve upgrades to existing transit elements that improve operations and reliability but do not result in major changes to travel time – the key measure used by FTA to rate New Starts projects – the projects may not be deemed "meritorious."

A further disadvantage is the sheer magnitude of cost of these projects and the political implications of projects that benefit only a single metropolitan area. A single core capacity

project, like the East Side Access project at $7.8. billion, with more than $2.6 billion proposed from the New Starts Program, is almost twice the annual funding for New Starts. This project would consume a large share of the New Starts Program funding and potentially delay a number of other projects across the country. This has political implications and sets up direct competition between large urban centers with older transit systems and many smaller to mid-size urban regions attempting to introduce rail into their regional transportation systems. Projects at the scale of those attempting to address core capacity issues often face funding delays and are under pressure to increase the share of local funding. In the case of East Side Access, Federal funding is proposed at just 34 % of the project.

Distinct Core Capacity Program

An alternative, given the potential benefits of some of these investments, is consideration of a targeted program to address transit core capacity constraints. Similar to the New Starts Program, any targeted program should establish a mechanism to assess the relative value of projects based on specific criteria and user benefits. The program should provide the flexibility to fund a range of potential strategies. The challenge, politically, is that it would be difficult to establish a new program, with sufficient funding, without taking away funding from existing capital programs. If insufficient funding is provided to a targeted program, projects with significant funding requirements would likely face delays due to insufficient funding. Further, the targeting of funding to what may be a small number of existing systems may create equity issues for other urbanized areas that have adopted their own strategies and supplied their own funds to provide adequate transit capacity.

Conclusion

The issue of transit bottlenecks is emerging as a growing concern among large urban transit agencies as recent investments in transit and a renewed emphasis on urban development are contributing to an increasing number of transit riders. Although the significance of the issue is primarily limited to large urban transit systems, the potential benefits of targeting transit investments to address bottlenecks and improve regional mobility, warrants consideration of a new program targeted at such investments. There may be smaller urban areas where commuter rail service could generate significant mobility benefits. However, core capacity issues with regard to freight service in the same corridor could raise the cost of the commuter service significantly. Current funding programs available through FTA do not provide sufficient funding to adequately address the magnitude of capital needs.