From: **Stephen Kaiser** skaiser1959@gmail.com
Subject: KENDALL-NORTH STATION-NORTH-POINT-SOMERVILLE DEVELOPMENT AND TRIP GENERATION
Date: July 13, 2016 at 6:14 PM
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To : Kendall Square Transportation Observers and Analysts

From : Stephen H. Kaiser, PhD Citizen Engineer

I have assembled the attached summary and spreadsheet of development growth concentrated in Eastern Cambridge and the North Station area of Boston. It contains a summary letter as introduction, and a spreadsheet containing three pages of more technical description and one page of the development summary, with total amounts of square footage and new auto and transit trip generation estimates.

This effort is in draft form and subject to modification as well as extensions into subsequent areas of analysis, including trip assignment to various links in the T transit system, and a comparison of growth impacts with existing ridership and estimated capacity of the system if trains are operated with even spacing.

Again, I should emphasize that the challenge posed by drastic increases in transit ridership is primarily a responsibility of private developers and local municipalities, and the search for capacity solutions should be led by -- and funded by -- developers and municipalities, as well as regional organizations such as the MAPC. The MBTA will be a vital part in implementing any plans to solve the capacity deficit and to produce a transit system where transit service is able to balance travel demand.

Stephen H. Kaiser

Citizen Engineer

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July 12, 2016

TRANSIT TRIP GENERATION FOR NEW DEVELOPMENT PROPOSED AT NORTH STATION, KENDALL SQUARE, NORTH POINT and SOMERVILLE

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On June 28 BRA officials presented information to the first meeting of the North Station mobility study. The sum total of proposed development identified to date is 8 million square feet.

Kendall Square development proposed is about 9 million square feet.

North Point is expected to grow by 4 million square feet.

Other GLX development in Somerville could be 13 million square feet.

TRIP GENERATION FOR NEW DEVELOPMENT PROPOSED AT NORTH STATION, KENDALL SQUARE, NORTH POINT and SOMERVILLE

CALCULATED BY S. KAISER July 12, 2016

On June 28 City of Boston officials presented information on proposed development for the North Station mobility study. The sum total of Proposed development identified to date is 7.7 million square feet. Transit trip generation expected from two projects in East Cambridge (CRA's Amendment 10 and MIT at Main Street), suggest that 1500 and 1700 new transit riders would normally be predicted for the North Station 7.7 million SF During the AM and PM peak hours. Traditional transportation analysis assumes that the modal split of cars and transit is about the same – 35%.

The North station area includes severe bottlenecks at Charles Circle, Leverett Circle, Keany Square and on the Leverett downramp from I-93. There are no easy fixes to traffic bottlenecks, and no pristine path to more capacity for auto traffic. Roads and streets will not be able to serve the transport needs of new development. The only transportation service with a chance for improved capacity and service is rail transit (other than peds).

Most traffic analyses assume that for dense urban areas the percentage of trips by car and transit are about equal – usually in the range of 35% to 45%. This method is very traditional and does not presume a no-growth scenario for congested street traffic. I have included this traditional calculation, and have also specifically provided for a second calculation – reducing the auto percentage and increasing the transit percentage. A nominal 10% auto trip growth would allow for limited vehicle access, and with a positive transit capacity scenario, mode shifts to transit could easily nullify the apparent traffic increase. The new transit mode share would be 60%, more in keeping with the concept of Transit Oriented Development.

In recognition of the street capacity and congestion limits (and the possible ways of increasing transit capacity), a new modal split percentage will be assumed, with 10% new auto trips and 60% new transit trips (the Transit Oriented Development Assumption). With this TOD modal split, the increased transit ridership from the North Point area becomes 2550 riders in the morning peak and 2950 riders in the afternoon peak hour.

These figures are not precise, because the exact mix of land uses is often shifting with changes in detailed plans. For this reason, all trip generation figures have been rounded off to the nearest 50 trips in the peak hour, to reflect the preliminary nature of trip estimation.

During World War II the Boston transit system carried three times as many passengers as today. Can we recoup these lost capabilities and combine historical capacity with effective modern technology to bring about significant increases in performance on the Green and Orange Lines? Recently MBTA officials have estimated that its order for a completely new and expanded Orange Line fleet will increase capacity by up to 35 percent. Unfortunately, no plans or estimates for improved capacity on the Green and Red Lines have been offered so far.

There are four basic ways of increasing subway capacity – in order of increasing cost :

(1) Operation all trains with equal spacing and even loading, so that all trains are efficiently run.
(2) Increase the loading of subway cars, so each train carries more people (like the Japanese use of “pushers.”)
(3) Increase the average speeds of trains and avoid the efficiency losses from severe congestion and delay.
(4) Increase the number of trains, thus lowering the spading between trains (headways)
(5) Increase the number of train tracks (Add tunnels or widen existing ones)

The most suitable options for Boston appears to be some combination of #1, #3, and #4. The exact methods of capacity improvement do not need to be defined now. The important factor is to recognize how much new capacity is needed in terms of the number of new passengers who must be served during the peak hours. The next step in planning strategy is to identify the most cost-effective ways of increasing capacity.

Current operations of MBTA rail are in the range of 7,000 to 10,000 passengers per hour on a single track. Because riders could be coming from both directions on the Orange and Green lines, any ridership increase from North Station can be spread over two tracks.
capacity improvements achieved when we "Fix the T." This means peak hour travel to and from North Station in the afternoon peak hour is about 2,050 new transit riders. Spread over two Orange Line tracks that would mean that the addition load on the Orange Line trains would be approximately 10 to 15 percent – just from North Station development. There would be additional loads from downtown Boston development, including Back Bay Station, and other new construction along the Orange Line corridor.

At Kendall Square, the identified new development proposed is about 8.7 million square feet – or about 15% more than development totals for North Station. North Point is in a category all by itself, with 4 million sf of undeveloped space – slightly more than half as much as the North Station total. Kendall would place most of its transit load on the Red Line, but some passengers could come from linked trips via the Green and Orange Lines. Similarly, transit riders arriving at North Station could come via linked trips using the Red Line.

At **North Point** there is one primary developer, working with a 40+ acre site and a proposed additional development of 4 million sf. – slightly more than half the total development proposed near North Station.

Somerville officials have estimated development associated with the **Green Line Extension** as 18 million s.f., but this figure probably includes a 4-5 msf allowance at North Point. Thus the non-North-Point Green Line development in Somerville and Medford can be estimated as 13 msf.

The combined total of new development from Boston, Cambridge, and Somerville is approximately 33 million sf. About 25 million sq. ft. would be concentrated on the Orange and Green Line services, creating 8,150 new TOD transit riders in the AM peak hour, and 9,350 during the PM. We can assume optimistically that this increased ridership load would be evenly distributed over both directions of the Orange Line or 5000 new riders on each track. The highest peak hour ridership loads on the Orange Line are about 8,000 passengers an hour on each track, which suggests a need for a 60% capacity increase on the Orange line, not the current 35% currently planned. The Green Line is in no shape to handle additional riders today.

With well-planned Transit Oriented Development in place (with increased transit capacity to handle most of the new trips), we might achieve 3,000 riders an hour on each track of additional capacity from the new Orange Line fleet. An additional allowance for other Orange and Green Line riders would come from other developments like Back Bay Station, other development growth, and repressed demand today by potential riders who cannot use the Orange and Green Lines in peak periods because of the congestion and lack of capacity with today's service schedules.

The recent London experience is informative. Capacity of the subway system was doubles by adding more trains and various operational changes equal to a 100% increase in capacity. Almost immediately, ridership increased by 50% from induced transit ridership due to better service. With a 60% increase in Orange Line capacity needed to service growth, at least a 100% increase in total Orange Line capacity could be needed for the MBTA to accommodate projected service needs of the future.

So far MBTA officials have identified capacity improvements only for the Orange Line. No planned improvements have been identified for the Red Line or Green Line. In the future any automobile traffic increases are likely to make street congestion worse (as will driverless cars). Therefore, Street movement by buses (MBTA and private) will be thwarted by traffic congestion, as we can see so clearly at Alewife in Cambridge. As a result, Transportation capacity and service improvements must necessarily come from rail transit.

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NOTE : Development projects and sizes are based on information available as of July 1, 2016. Modified versions of this analysis will be prepared based on new information and any necessary corrections.

Actual increases in the loading of trains depends on trip distribution assumptions : how many riders are going in which direction ? Such calculations are commonplace in traffic studies for new developments. Once the number of new growth transits trips have been distributed throughout the MBTA rail network, the amount of growth in ridership on each section of track during AM and PM peak hours can be estimated. Again by analogy to traffic analysis, the number of peak hour riders can be terms the ridership “volume” and can be compared with estimated transit track capacity to create a Volume-to-Capacity ratio, also termed the V/C Ratio or VC. Where the V/C ratio exceeds 1.0 capacity is exceeded. Where V/C is less than 1.0, the ridership is less than capacity, which is the desirable condition.

The calculations above simply estimate the total transit trips generated, and do not yet include trip distribution and calculations of ridership volumes on each section of track. Therefore they do not at this time include any calculation of V/C Ratio.

NORTH STATION, KENDALL SQUARE, NORTH POINT and SOMERVILLE/GLX : Development proposed and Rough Estimate of Peak Hr Trips

File : SK Development Trip Generation | # TRIPS | | | # TRIPS | | S. Kaiser | July 12, 2016

Avg Transit Trip Rate | **550** per KSF | **AM** | **PM** | **630** per KSF | Average CRA/MIT

NORTH STATION **NORTH STATION** **NORTH STATION**

#	NORTH STATION Development	KSF	Total AM Trips	Auto Trips @ 35% AM	Auto Trips @ 10% AM	MBTA Trips @ 35% AM	MBTA Trips @ 60% AM	Total PM Trips	Auto Trips @ 35% AM	Auto Trips @ 10% AM	MBTA Trips @ 35% AM	MBTA Trips @ 60% AM
1	131 Beverly St. (Lovejoy Wharf)	220	--	--	--	--	--	--	--	--	--	--
2	160 N. Wash St. (Lovejoy Wharf)	220	--	--	--	--	--	--	--	--	--	--
3	296 Cambridge Street	30	--	--	--	--	--	--	--	--	--	--
4	Boston Garden Development	1,870	--	--	--	--	--	--	--	--	--	--
5	Boston Public Market	29	--	--	--	--	--	--	--	--	--	--
6	Canal Street Hotel	47	--	--	--	--	--	--	--	--	--	--
7	Forecaster Building	100	--	--	--	--	--	--	--	--	--	--
8	Garden Garage	910	--	--	--	--	--	--	--	--	--	--
9	Gov. Center Garage Development	2,397	--	--	--	--	--	--	--	--	--	--
10	Nashua Street Residences	636	--	--	--	--	--	--	--	--	--	--
11	One Canal Street	438	--	--	--	--	--	--	--	--	--	--
12	The Merano	484	--	--	--	--	--	--	--	--	--	--
13	The Victor	361	--	--	--	--	--	--	--	--	--	--
	TOTALS	7,742	4258	1490	426	1490	2555	4877	1707	488	1707	2926
	Rounded to nearest 50 trips	7,750	4250	1500	450	1500	2550	4900	1700	500	1700	2950

KENDALL SQUARE, NORTH POINT **KENDALL SQUARE, NORTH POINT** **KENDALL SQUARE, NORTH POINT**

#	KENDALL SQUARE Development	KSF	Total AM Trips	Auto Trips @ 35% AM	Auto Trips @ 10% AM	MBTA Trips @ 35% AM	MBTA Trips @ 60% AM	Total PM Trips	Auto Trips @ 35% AM	Auto Trips @ 10% AM	MBTA Trips @ 35% AM	MBTA Trips @ 60% AM
1	Kendall Sq, Urban Renewal Plan#10+	1,125	--	--	--	--	--	--	--	--	--	--
2	Volpe Center New Development	2,577	--	--	--	--	--	--	--	--	--	--
3	650 Main Street	416	--	--	--	--	--	--	--	--	--	--
4	Alexandria Center	1,753	--	--	--	--	--	--	--	--	--	--
5	Courthouse Development	476	--	--	--	--	--	--	--	--	--	--
6	Ames Street Housing	200	--	--	--	--	--	--	--	--	--	--
7	399 Binney Street	180	--	--	--	--	--	--	--	--	--	--
8	Mass and Main	300	--	--	--	--	--	--	--	--	--	--
9	MIT at Kendall	1,760	--	--	--	--	--	--	--	--	--	--
	TOTALS	8,787	4,833	1,691	483	1,691	2,900	5,536	1,938	554	1,938	3,321
	Rounded to nearest 50 trips	8,800	4,850	1,700	500	1,700	2,900	5,550	1,950	550	1,950	3,300
	NORTH POINT Development	4,000	2,200	770	220	770	1,320	2,520	882	252	882	1,512
	Rounded to nearest 50 trips	4,000	2,200	750	200	750	1,300	2,500	900	250	900	1,500
	SOMERVILLE/GLX Development	13,000	7,150	2,503	715	2,503	4,290	8,190	2,867	819	2,867	4,914
	Rounded to nearest 50 trips	13,000	7,150	2,500	700	2,500	4,300	8,200	2,850	800	2,850	4,900
	T-O-T-A-L-S- (excl. Kendall)	24,742	13,608	4,763	1,361	4,763	8,165	15,587	5,456	1,559	5,456	9,352
	Rounded to nearest 50 trips	24,750	13,600	4,750	1,350	4,750	8,150	15,600	5,450	1,550	5,450	9,350
	(effects on Orange & Green Lines)	KSF	Total AM Trips	Auto Trips @ 35% AM	Auto Trips @ 10% AM	MBTA Trips @ 35% AM	MBTA Trips @ 60% AM	Total PM Trips	Auto Trips @ 35% AM	Auto Trips @ 10% AM	MBTA Trips @ 35% AM	MBTA Trips @ 60% AM