



# Transportation – Part 2A

Updated Critical Sums & Transit Analysis

Central Square Advisory Committee . September 12, 2012





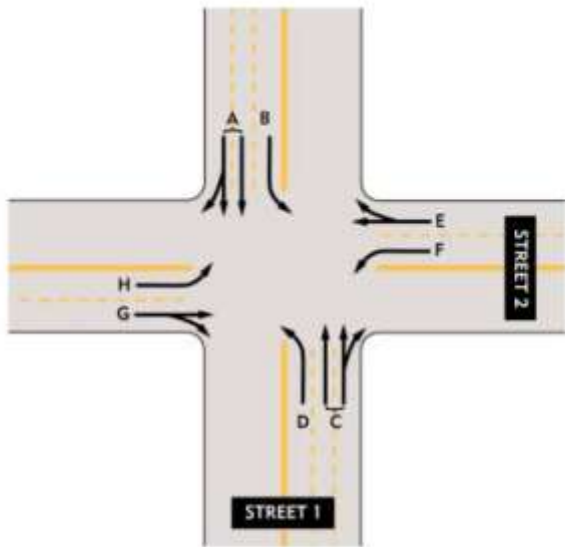
Critical Sums Analysis  
Update September 12, 2012



# Overview of Critical Sums Analysis

- Critical Sums Analysis is a planning tool used to evaluate build-out scenarios
- Compares how different levels of build-out impacts specific intersections in general way
- Not a traffic engineering tool
- Same methodology used in prior planning studies:
  - 2001 Citywide Rezoning
  - 2001 ECaPS
  - 2004 Concord-Alewife Plan

# Critical Sums Methodology



Street 1:  $(A+2) + D$  or  $(C+2) + B$ , whichever is more

Street 2:  $E + H$  or  $G + F$ , whichever is more

Critical Sum = Result of Street 1 + Street 2

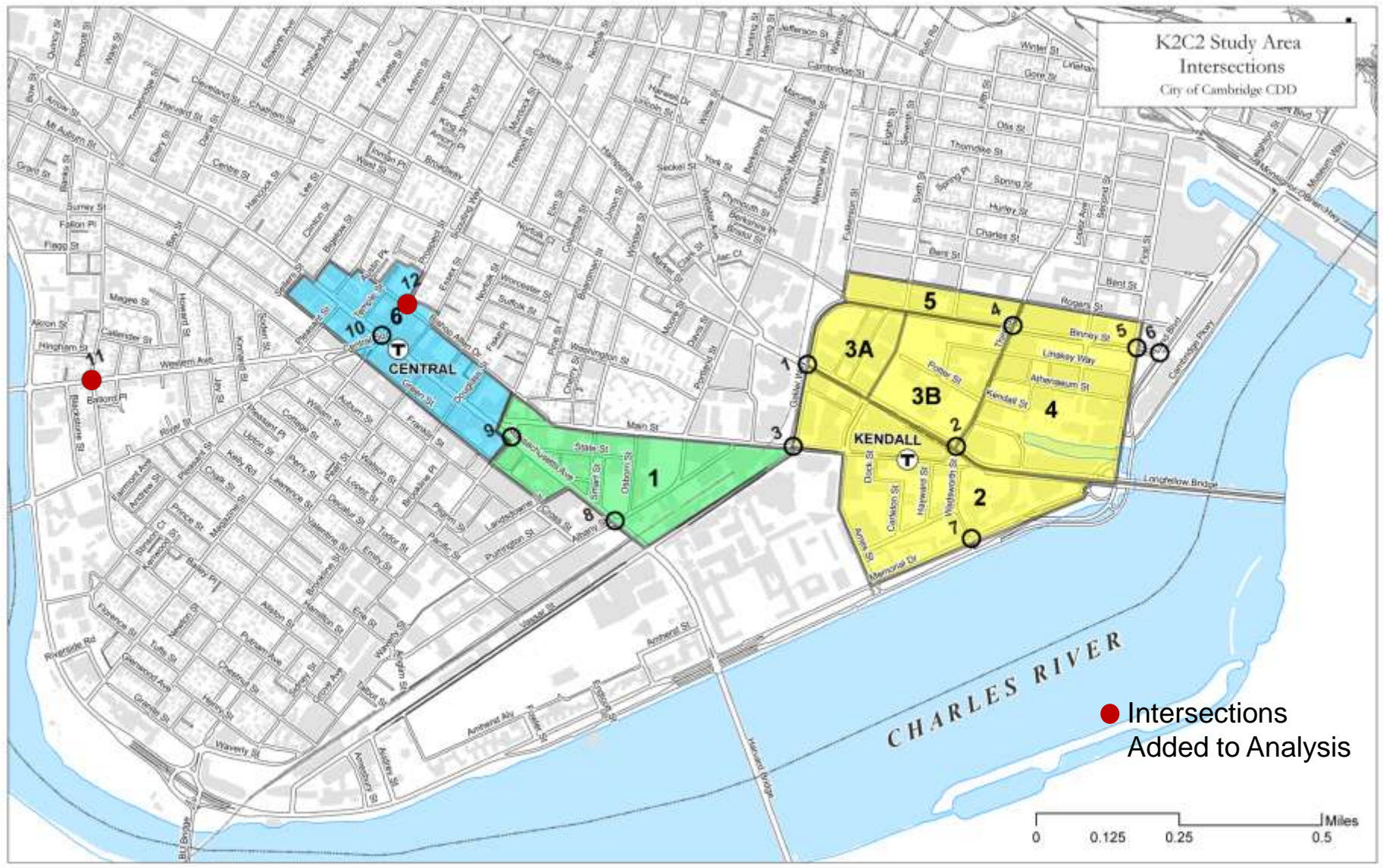
Critical movement volume at an intersection is the sum of all conflicting traffic movements (vehicles per hour).

Intersections with 1,500 or fewer vehicles per hour considered to operate adequately, i.e. motorists will wait no more than two light cycles to get through the intersection.

When thresholds are exceeded, intersection operation starts to deteriorate exponentially.



# Intersections in Study Area



# Critical Sums by Intersection 2030 Existing Zoning

	2010		2030 Buildout	
	Existing Conditions		Existing Zoning	
	Total Volume	Critical Sum	Total Volume	Critical Sum
<b>1. Broadway/Galilei</b>	2292	768	2732	897
<b>2. Broadway/Third</b>	1964	1111	2437	1333
<b>3. Main/Galilei/Vassar</b>	1764	711	2183	986
<b>4. Binney/Third</b>	2007	742	2597	982
<b>5. Binney/First</b>	1311	590	1983	682
<b>6. Binney/Land</b>	2382	654	3019	917
<b>7. Memorial Drive / Wadsworth</b>	1361	680	1638	802
<b>8. Mass. Ave/Albany</b>	1850	807	2210	1026
<b>9. Main/Mass./Columbia/Sidney(Lafayette Sq.)</b>	1460	762	2053	1098
<b>10. Mass/Prospect/River/Western(Central Sq.)</b>	1912	825	2285	1017
<b>11. Putnam/Western</b>	1737	1004	1801	1068
<b>12. Bishop Allen/Prospect</b>	1488	1008	1594	1114

- Total intersection volumes increase 19-51% (avg 27%)
- Broadway/Third closest to threshold

# Critical Sums by Intersection

	2010		2030 Buildout		2030 Buildout		2030 Buildout	
	Existing Conditions		Existing Zoning		K2C2		K2C2 w/TDM	
	Total Volume	Critical Sum	Total Volume	Critical Sum	Total Volume	Critical Sum	Total Volume	Critical Sum
<b>1. Broadway/Galilei</b>	2292	768	2732	897	3022	1045	2906	999
<b>2. Broadway/Third</b>	1964	1111	2437	1333	2787	1510	2641	1440
<b>3. Main/Galilei/Vassar</b>	1764	711	2183	986	2389	1069	2285	1007
<b>4. Binney/Third</b>	2007	742	2597	982	2929	1112	2768	1044
<b>5. Binney/First</b>	1311	590	1983	682	2182	749	2024	722
<b>6. Binney/Land</b>	2382	654	3019	917	3162	967	3018	903
<b>7. Memorial Drive / Wadsworth</b>	1361	680	1638	802	1677	812	1615	785
<b>8. Mass. Ave/Albany</b>	1850	807	2210	1026	2159	1013	2110	978
<b>9. Main/Mass./Columbia/Sidney(Lafayette Sq.)</b>	1460	762	2053	1098	2180	1145	2063	1082
<b>10. Mass/Prospect/River/Western(Central Sq.)</b>	1912	825	2285	1017	2385	1069	2309	1027
<b>11. Putnam/Western</b>	1737	1004	1801	1068	1812	1079	1800	1067
<b>12. Bishop Allen/Prospect</b>	1488	1008	1594	1114	1571	1091	1558	1078



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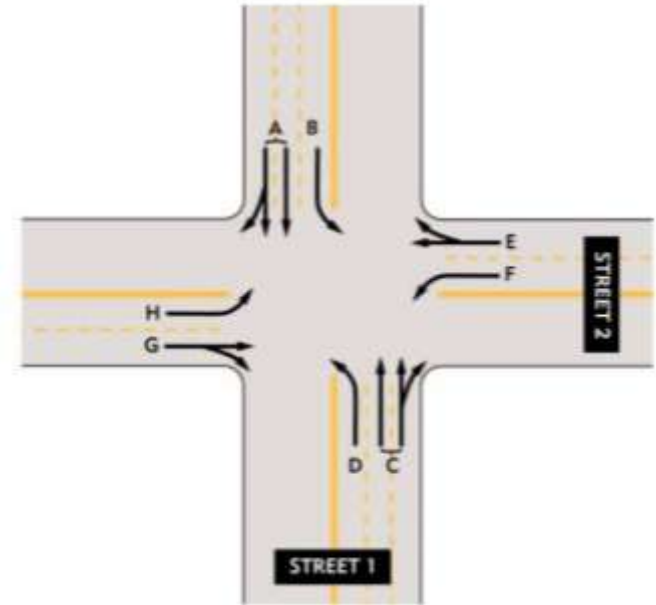
**Preferred Scenario**



# Conclusion



- Critical sums is a planning tool
- Used to compare future build-out scenarios
- Future development projects subject to:
  - Traffic study/traffic mitigation requirements in Zoning Ordinance
  - Parking and Transportation Demand Management (PTDM) Ordinance





# Red Line Transit Capacity Projections Update September 12, 2012

A background map of the Kendall Square area in Cambridge, Massachusetts. The map shows various streets, including Kendall Square, and landmarks like the Cambridge Electric Light Co. and Stone Yard. The title 'K2C2 Red Line Transit Capacity Projections' is overlaid on the map in a large, bold, blue font.

# K2C2 Red Line Transit Capacity Projections

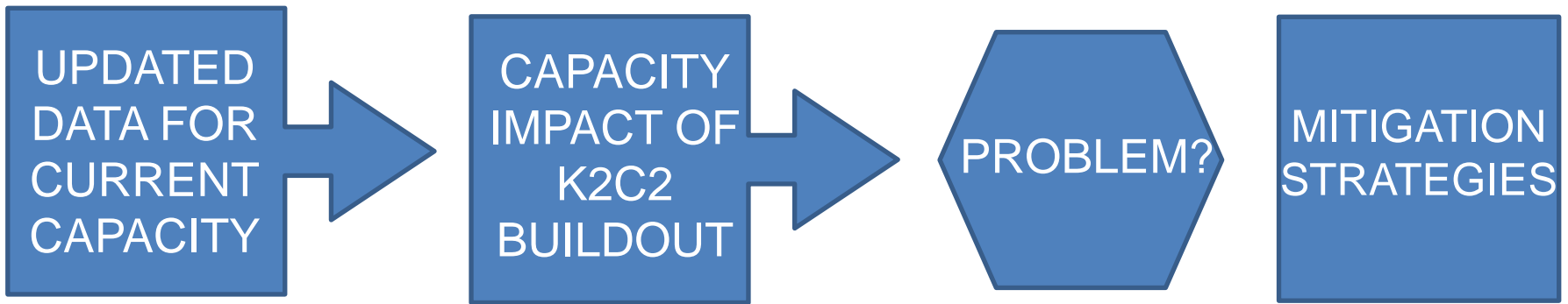
Transit is critical to the success of development in the Greater Boston region, with Kendall Square being no exception. The past decade of development in Kendall Square has shown that smart growth is attainable, with a significant increase in jobs and housing minimal traffic impacts. Transit is one of the keys to this success.

This presentation includes:

1. Present-day ridership data for the subway and bus systems in Central Square, updating data that has been presented previously to show the remaining capacity that the Red Line has to serve additional users during the peak hour.
2. An analysis that shows that the projected development in Kendall and Central Squares by 2030 contribute minimally to using the excess capacity of the Red Line. Concerns regarding Red Line capacity problems stem from the increase in ridership resulting from the expected combined development throughout the MBTA system area.
3. Mitigation strategies to increase the capacity of the Red Line during peak hours and provide mobility alternatives to the Red Line.

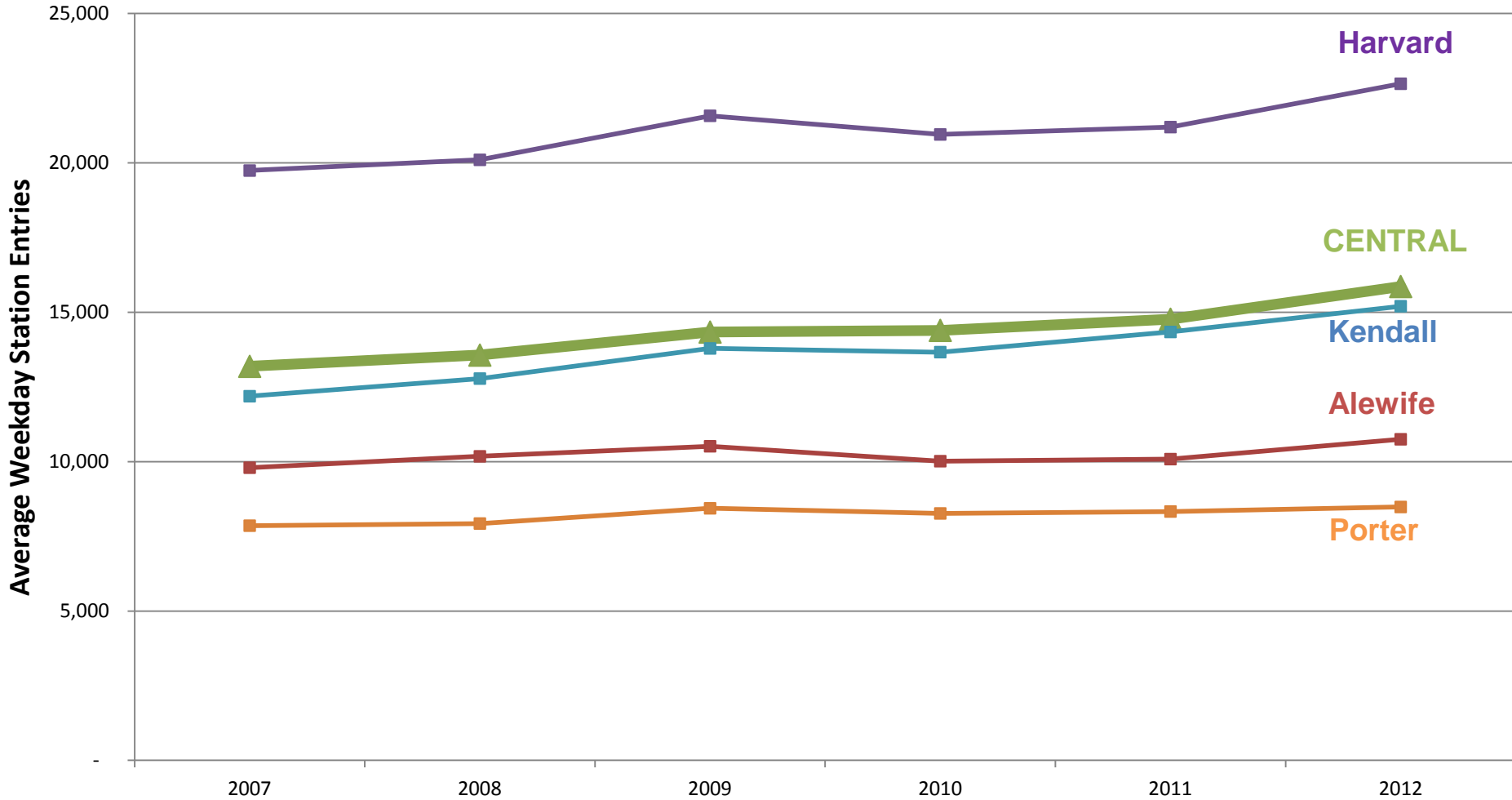


# K2C2 Red Line Transit Capacity Projections



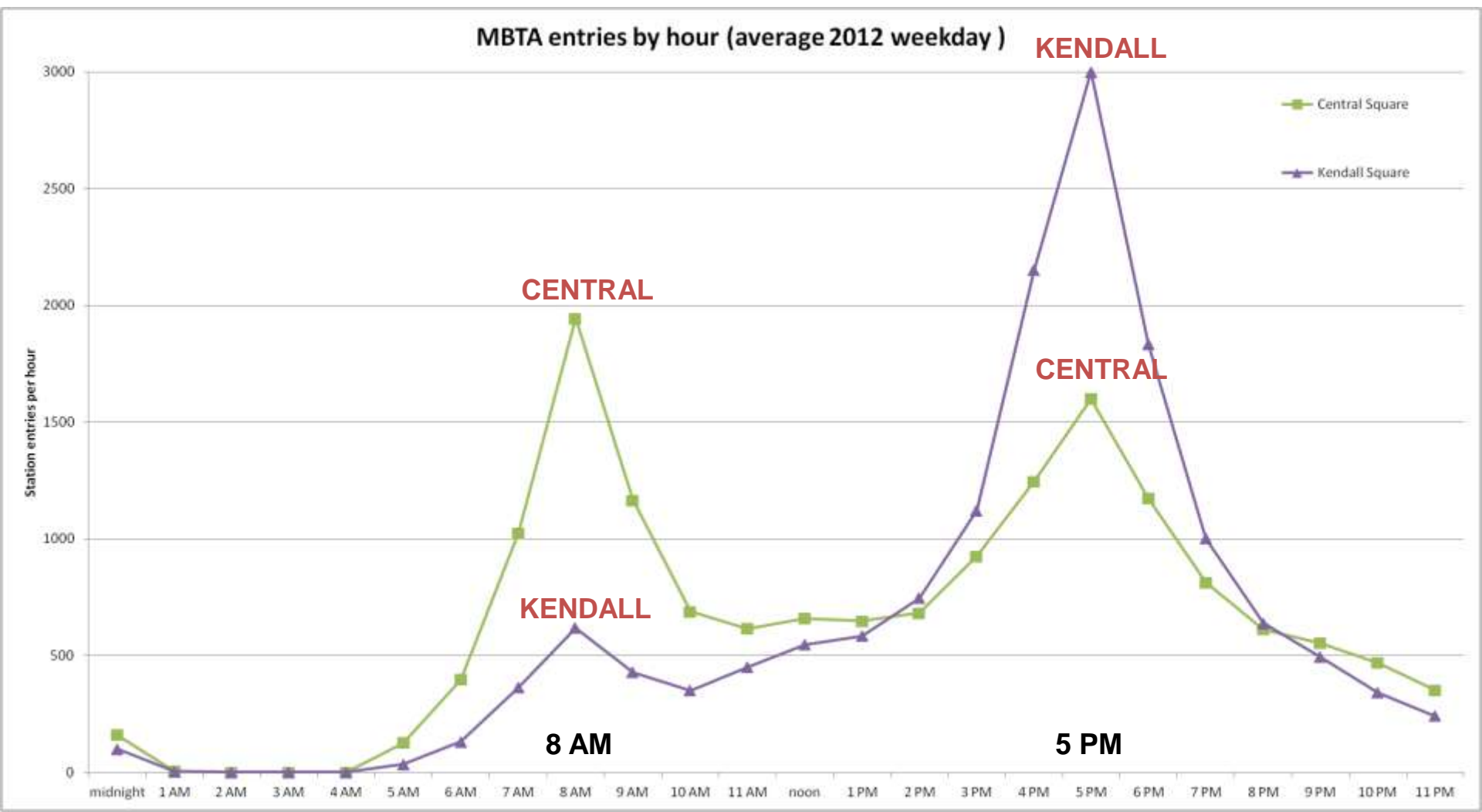
# MBTA Red Line Station Entries: 2007-2012

## MBTA Red Line Station Entries (weekday)



Source: MBTA AFC Database reports, 2007 - 2012.

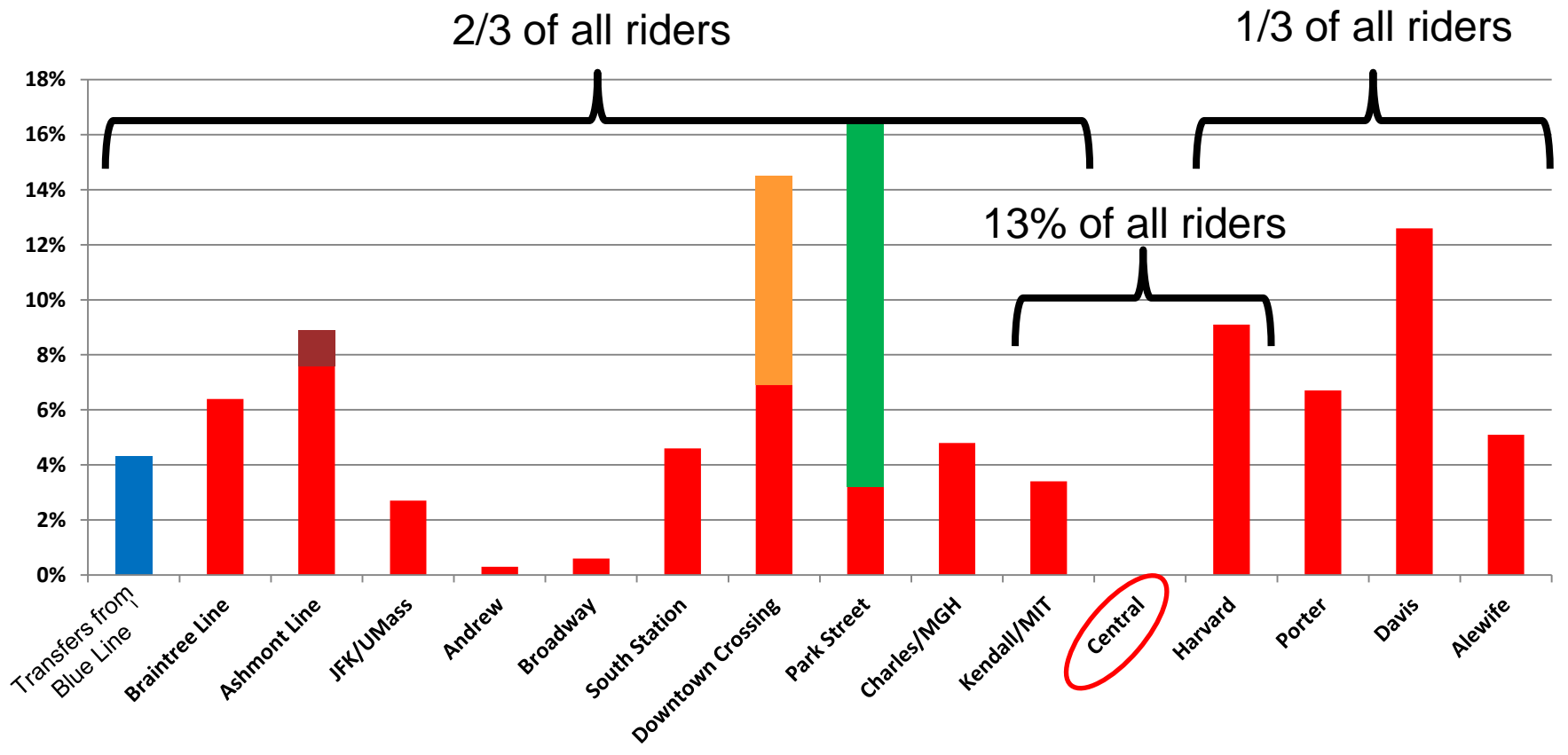
# 2012 Station Entries By Hour



Source: MBTA AFC Database reports, 2007 - 2012.



# Where are Central Riders Boarding the System?



Source: CTPS 2008-2009 Red Line and Mattapan Trolley Passenger Survey



# Where are Central Riders Boarding the System?

- The previous slide shows that of all the Red Line riders that get off at Central Square:
  - $\frac{3}{4}$  started their subway trip on the Red Line, and  $\frac{1}{4}$  on another subway line.
  - $\frac{2}{3}$  come from the Boston direction and  $\frac{1}{3}$  from the Alewife direction
  - 13% got on at either Kendall or Harvard Stations

# Transit Riders Getting On /Off at Central Square

These numbers indicate how many riders during a typical weekday get on and off at a stop in the heart of Central Square

Bus Route	Daily on/off
#1	3,900
#70	3,600
#70A	1,600
#47	1,500
#83	1,100
#CT1	1,000
#91	900
#64	610
<b>TOTAL BUS</b>	<b>14,000</b>
<b>RED LINE</b>	<b>32,000</b>

**2012 estimates**

**30%**

**70%**

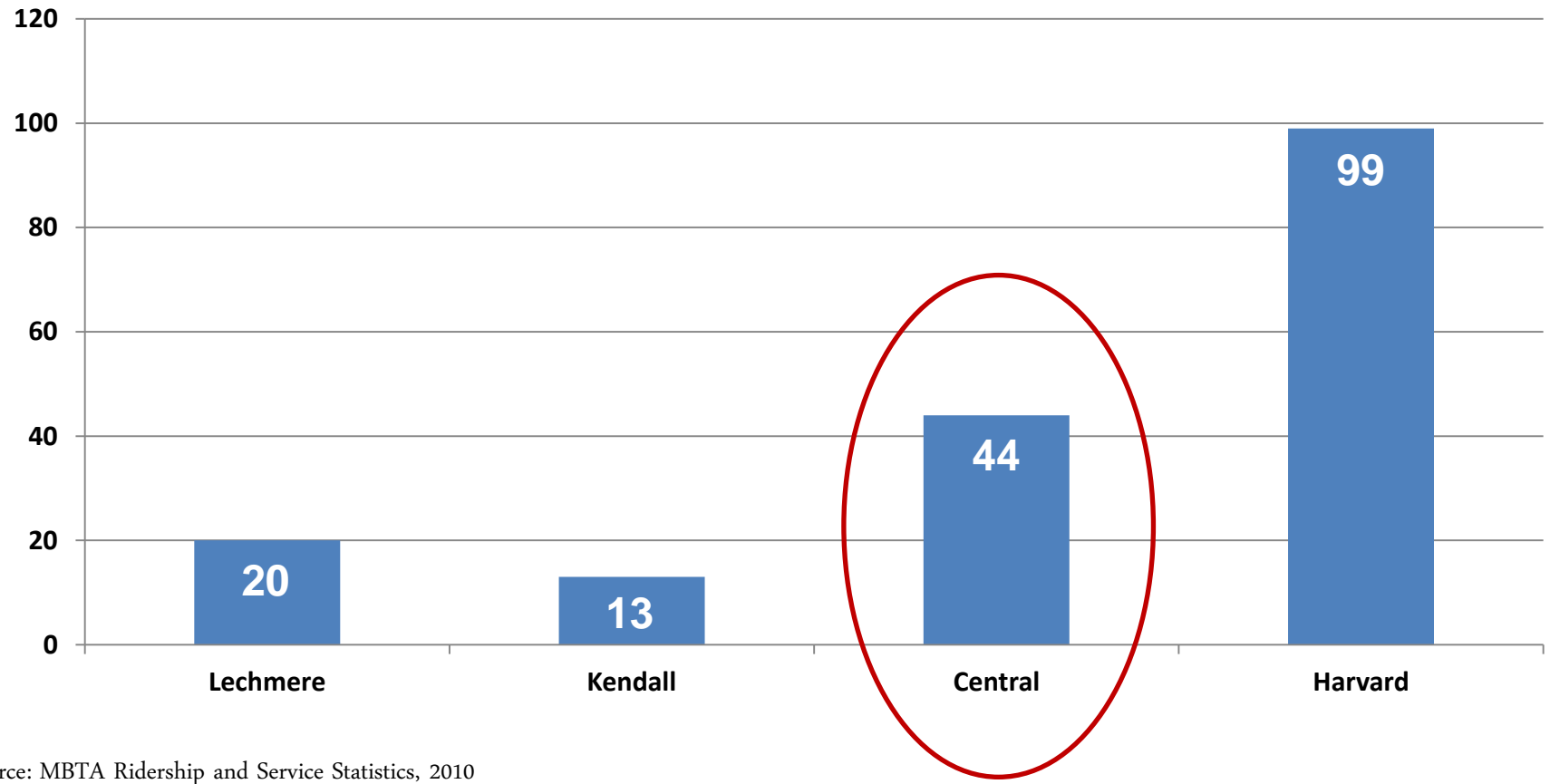
Source: MBTA Service Planning Passenger Count Reports; and Ridership and Service Statistics, 2010.



# Existing Conditions: Buses at AM peak

## Central has nearly 3.5 times more bus service than Kendall

*# Of Buses Serving each Station - Weekday AM Peak*



Source: MBTA Ridership and Service Statistics, 2010

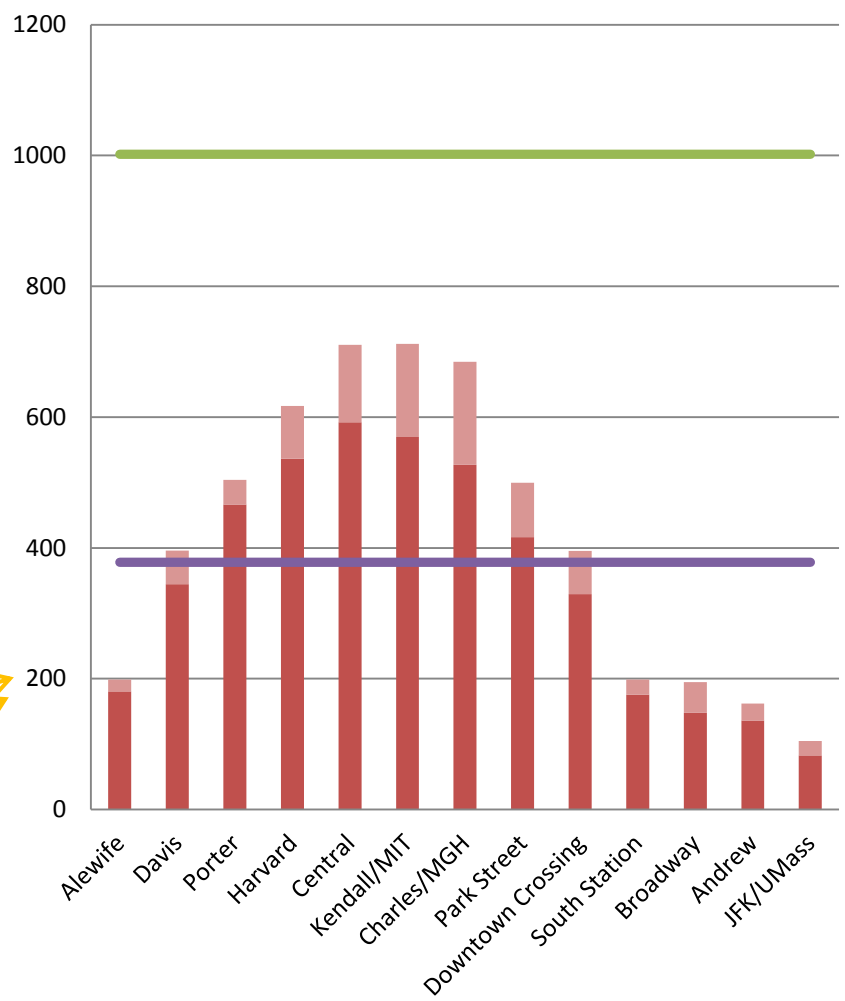
# Average Train Load – AM peak toward Boston



Standing Capacity →

Seated Capacity →

2012 estimates  
2007 estimates

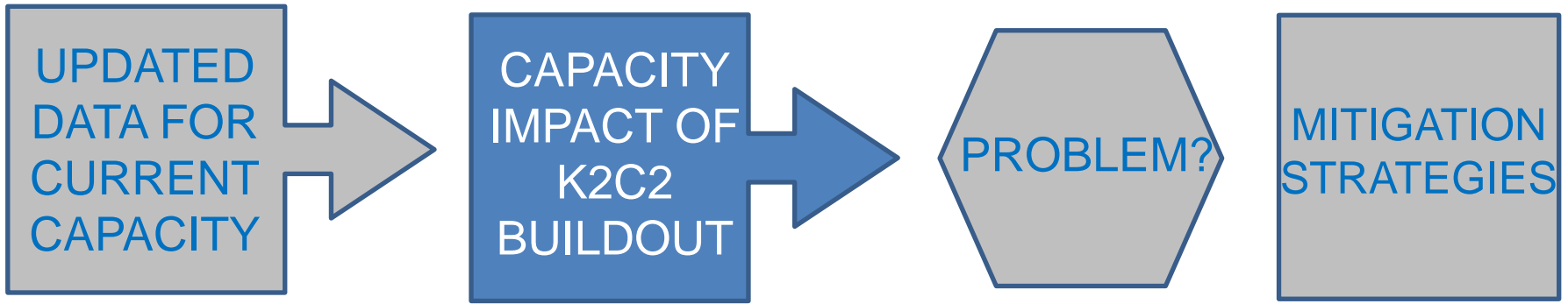


Total Red Line growth has been 20% from 2007 to 2012 (4% /year)

Source: MBTA analysis, 2007; and AFC Database Report, 2007-2012.

Note: Downtown Crossing and Park St includes all entering passengers.

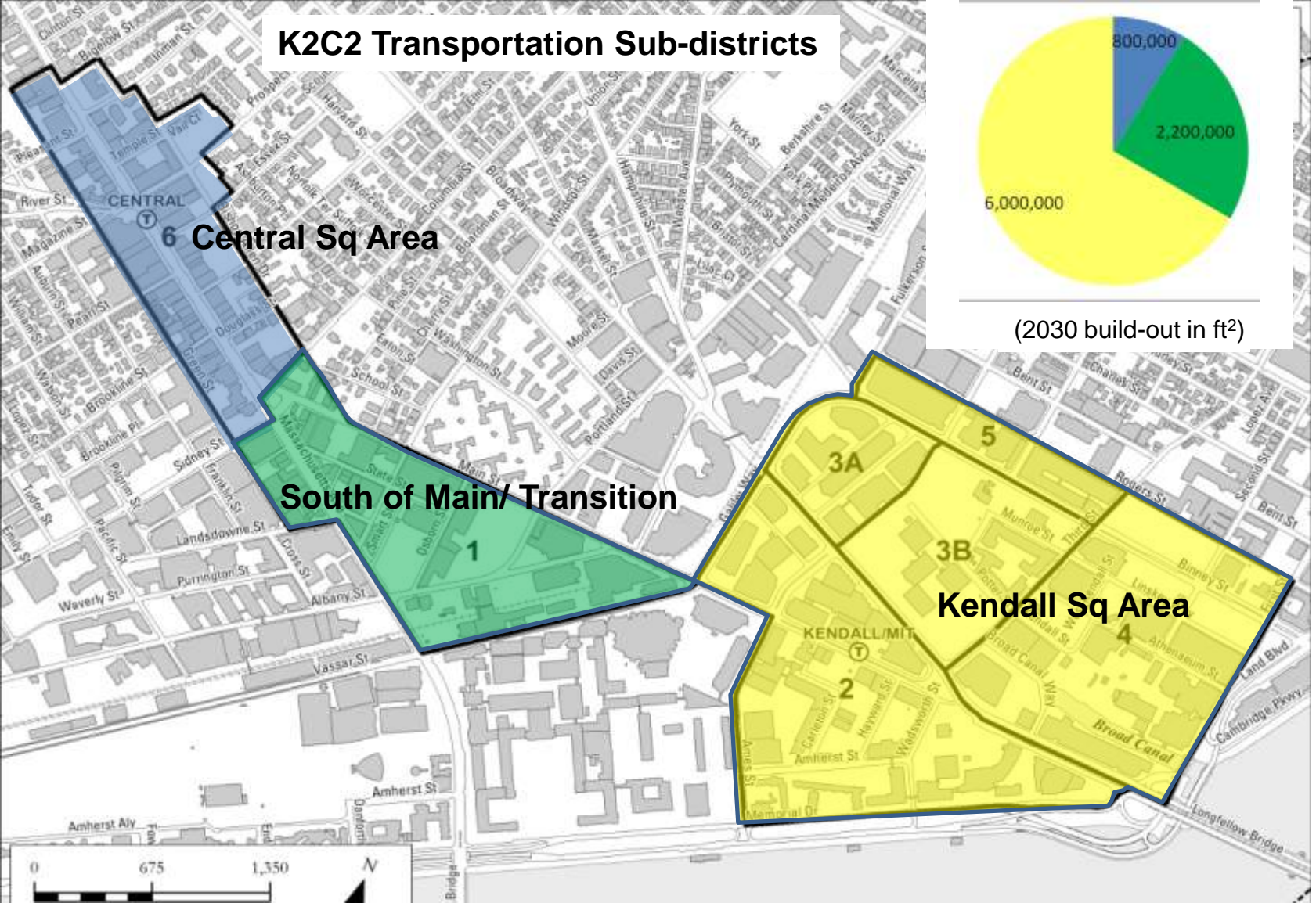
# K2C2 Red Line Transit Capacity Projections



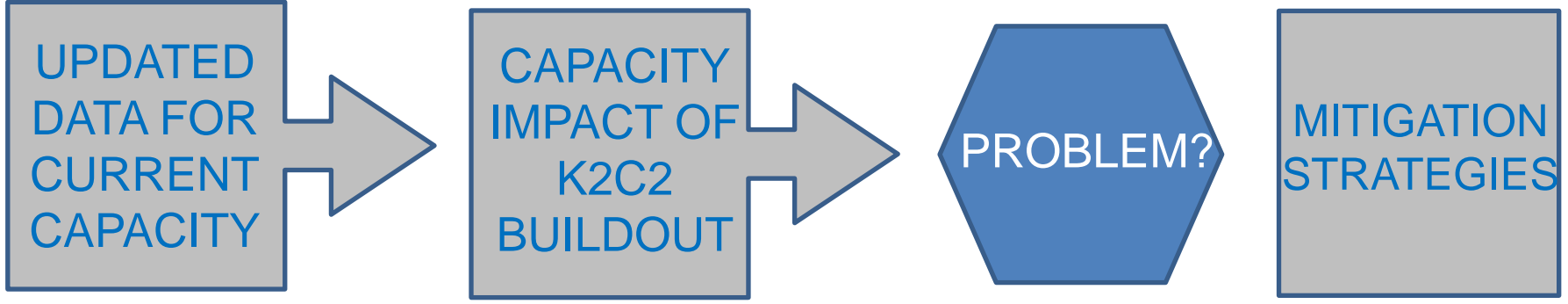


# Overall Land Use Growth (K2C2 Scenario)

## K2C2 Transportation Sub-districts



# K2C2 Red Line Transit Capacity Projections



# Additional Daily Trips From K2C2 Buildout (2030)

**680 new transit riders coming and going in Central Square AM peak hour**

**Source:**  
Trip generation model



**228 new riders boarding Red Line at Central Square traveling inbound in AM peak hour (current boardings = 1,555/hr)**

**Assume:**  
60% on & 40% off  
70% Red Line & 30% Bus  
80% inbound & 20% outbound



**On average, 16 new riders boarding each inbound Red Line train at Central Square in peak AM hour (current boardings = 112/train)**

**Assume:**  
14 trains per hour

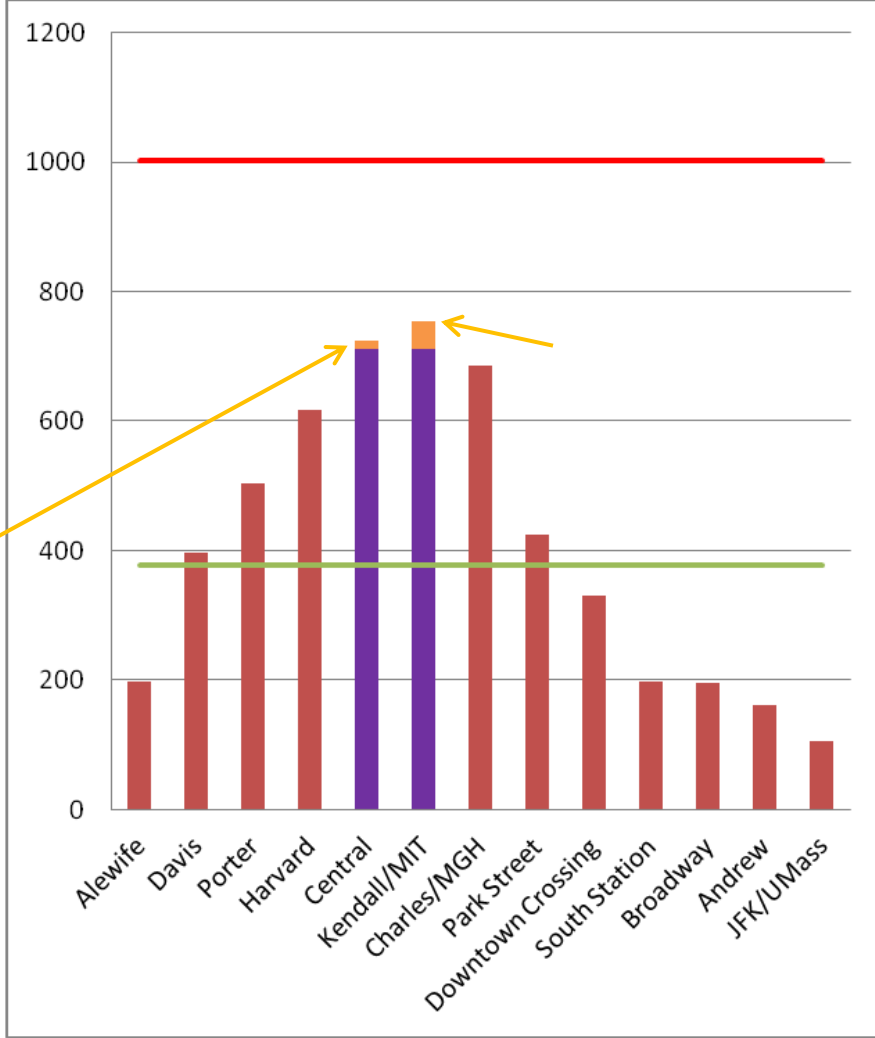
# Average Train Load – AM peak toward Boston



Standing Capacity →

Seated Capacity →

**Additional ridership from full K2C2 buildout**



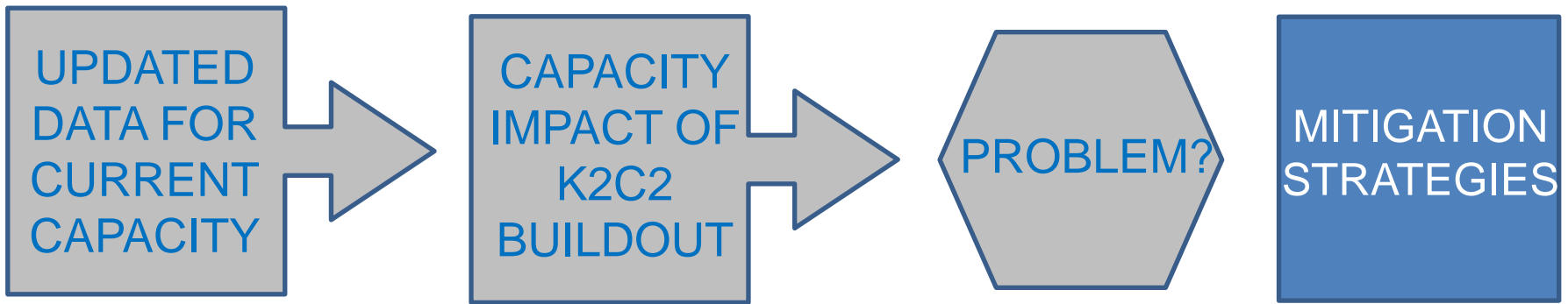
Source: MBTA analysis, 2007; and Ridership and Service Statistics, 2010.



# Average Train Load – AM peak toward Boston

- The previous slide shows that if all projected K2C2 development is built by 2030, there is a minimal impact on Red Line boardings during the peak hour. For the sake of understanding the relative impact of the K2C2 buildout on Red Line Capacity, it was assumed that there was no other development throughout the MBTA system.
- But there are legitimate concerns regarding future projected Red Line capacity problems, but these concerns stem from the increase in ridership resulting from the expected combined development throughout the MBTA system area.

# K2C2 Red Line Transit Capacity Projections



# Red-Line Capacity Mitigation strategies

## #1 Shift riders to other modes

- Shift to existing bus routes (increase frequency to ensure capacity; NextBus information)
- Shift short-distance riders to bicycling (need to improve quality of bicycling infrastructure);  
Hubway
- Shift riders to new transit lines
  - Extend 70, 70A, and 64 to Kendall Square
  - Expand EZ-Ride bus service
  - New bus routes
  - Urban Ring or other new rapid transit service

# Red-Line Capacity Mitigation strategies

## #2 Ensure the Red Line runs at existing capacity

- Maintain existing cars (\$275 million / 10 years)
  - Replace 1969 Red Line cars (\$370 million)
  - Upgrade switching systems
- 
- The MBTA can barely ensure 168 Red Line trains are available each day; fewer means degraded peak hour service
  - Disabled trains and inadequate switching systems degrade peak hour service





# Red-Line Capacity Mitigation strategies

## #3 Increase the capacity of the Red Line

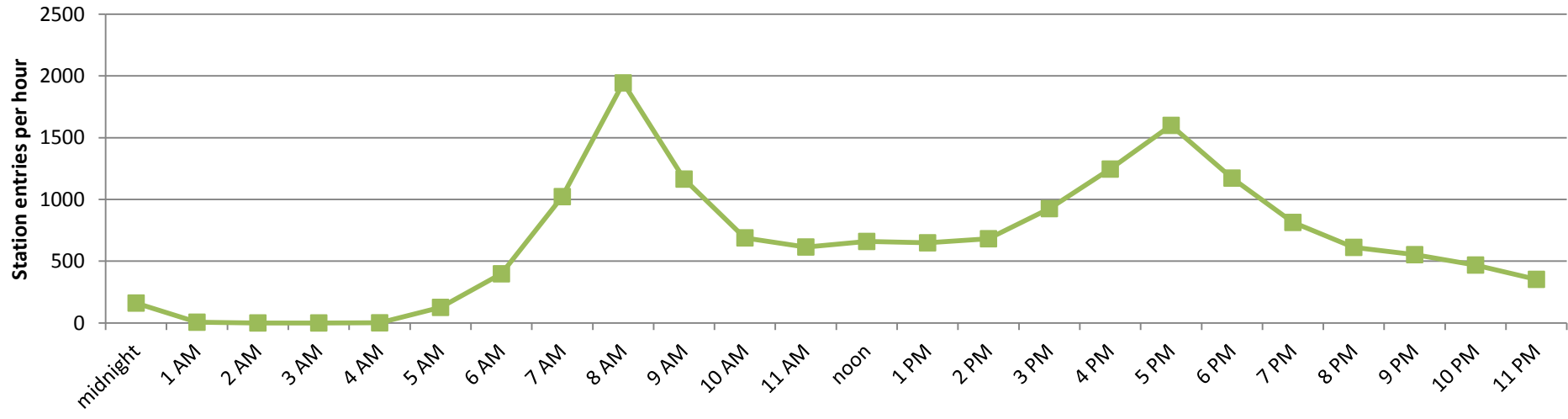
- Upgrade of entire Red Line power system to allow an estimated additional 15% capacity during peak hours
- One “Big Red” car with minimal seats used on a six-car train will increase capacity by 27 passengers = 10% (MBTA customers have expressed opposition)

# Red-Line Capacity Mitigation strategies

## #4 Shift riders off of the peak hour

- Workplace policy that allows flexible hours (e.g., during Big Dig, MGH shifts were modified to reduce rush hour impacts)
- Peak hour pricing on transit

Central Square Station entries by hour (average 2012 weekday )



A historical map of Cambridge, Massachusetts, showing streets, buildings, and landmarks. The map is in black and white with some blue highlights. The text "For more information:" is overlaid in blue on the left side of the map.

**For more information:**

**<http://cambridgema.gov/K2C2>**

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