Presentation To

HRTPO Steering Committee

Agenda Item #2

HRTPO Strategic Campaign and Vision Plan for Passenger Rail

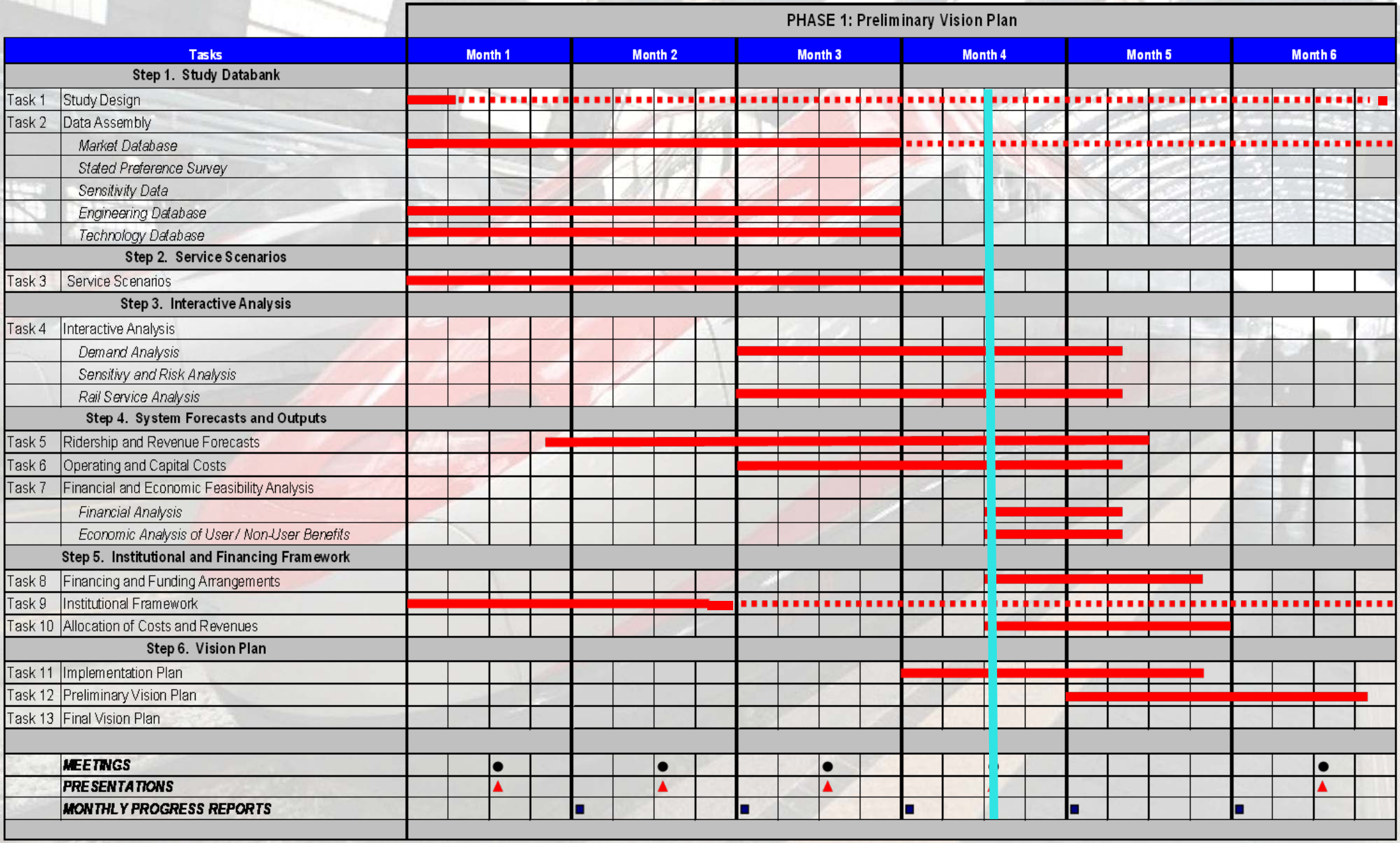
Presentation By

TEMS

Transportation Economics & Management Systems, Inc.

May 19, 2010

Study Timeline



Vision Plan Phase 1: Study Objectives

1. **Hampton Roads Transportation Planning Organization – Resolution 2009-05**

   The Hampton Roads TPO endorses –

   - **designation of a "High-Speed Rail" corridor along the Norfolk Southern/Route 460 corridor.**
   - **enhancement of the intercity passenger rail service along the CSX/I-64 corridor.**

2. **USDOT FRA Public/Private Partnership Potential –**

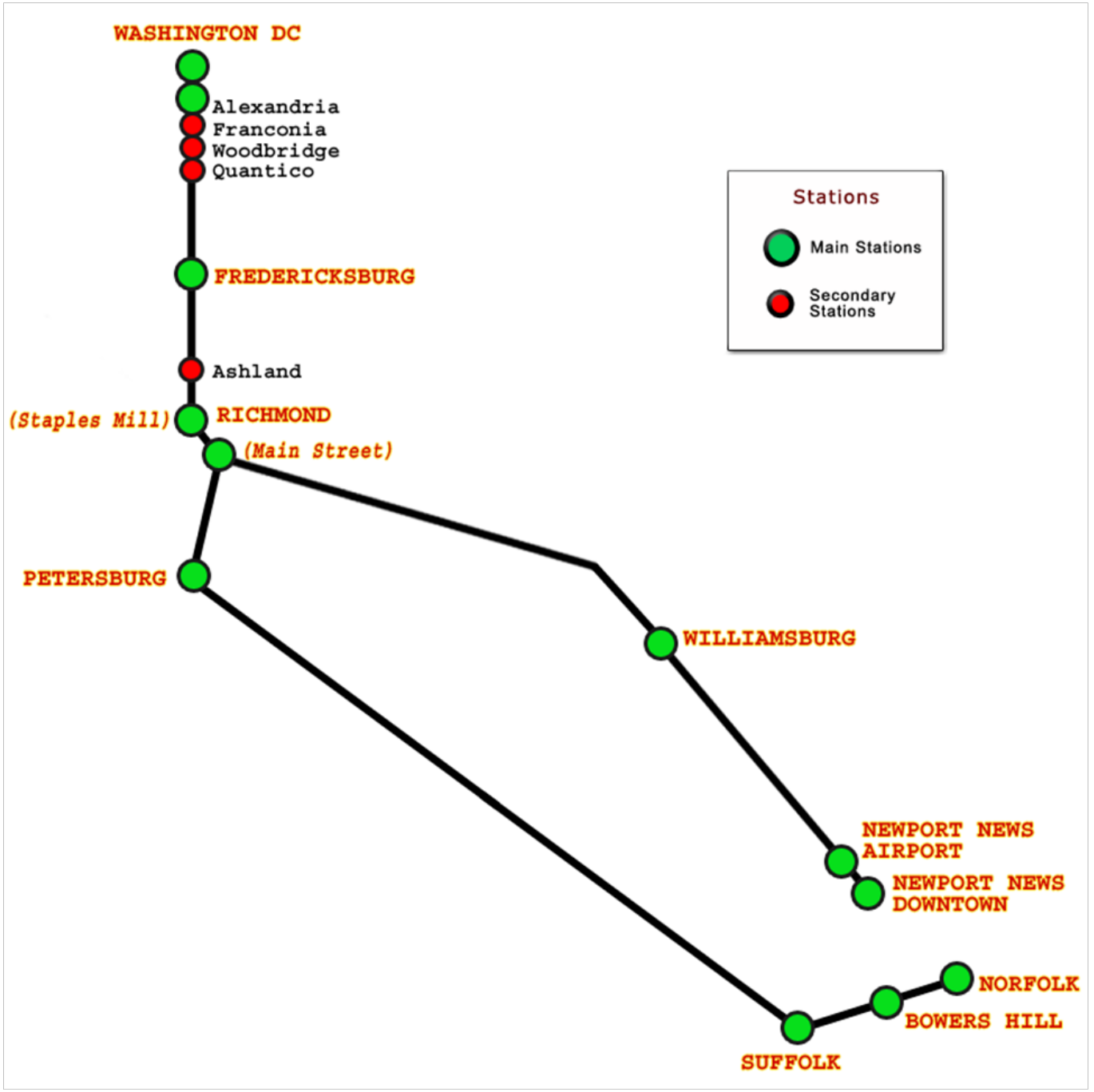
   - **POSITIVE OPERATING RATIO**
   - **POSITIVE COST BENEFIT RATIO**

Development Steps

Steps	Route	Max Speed	No. of Trains	Infrastructure	Station
Step 1	I-64/CSXT	79 mph	2	Shared Track Schedule Enhancement	Main Street Newport News (existing)
	Route 460/ Norfolk Southern	79 mph	1-3	Shared Track NS	Staples Mill Only Norfolk
Step 2 (DEIS Alt 1)	I-64/CSXT	79 mph	3	Shared Track	Main Street Newport News (existing)
	Route 460/ Norfolk Southern	79 mph	4-6	Shared Track	Main Street
Step 3	I-64/CSXT	90 mph	4-6	Shared Track	Main Street Newport News Downtown/Airport
	Route 460/ Norfolk Southern	110 mph	8-12	Dedicated Track V Line	Main Street Bowers Hill
Step 4	I-64/CSXT	110 mph	6-9	Dedicated Track	Main Street Newport News Downtown/Airport
	Route 460/ Norfolk Southern	150 mph	12-16	Dedicated Electric Track V Line	Main Street Bowers Hill

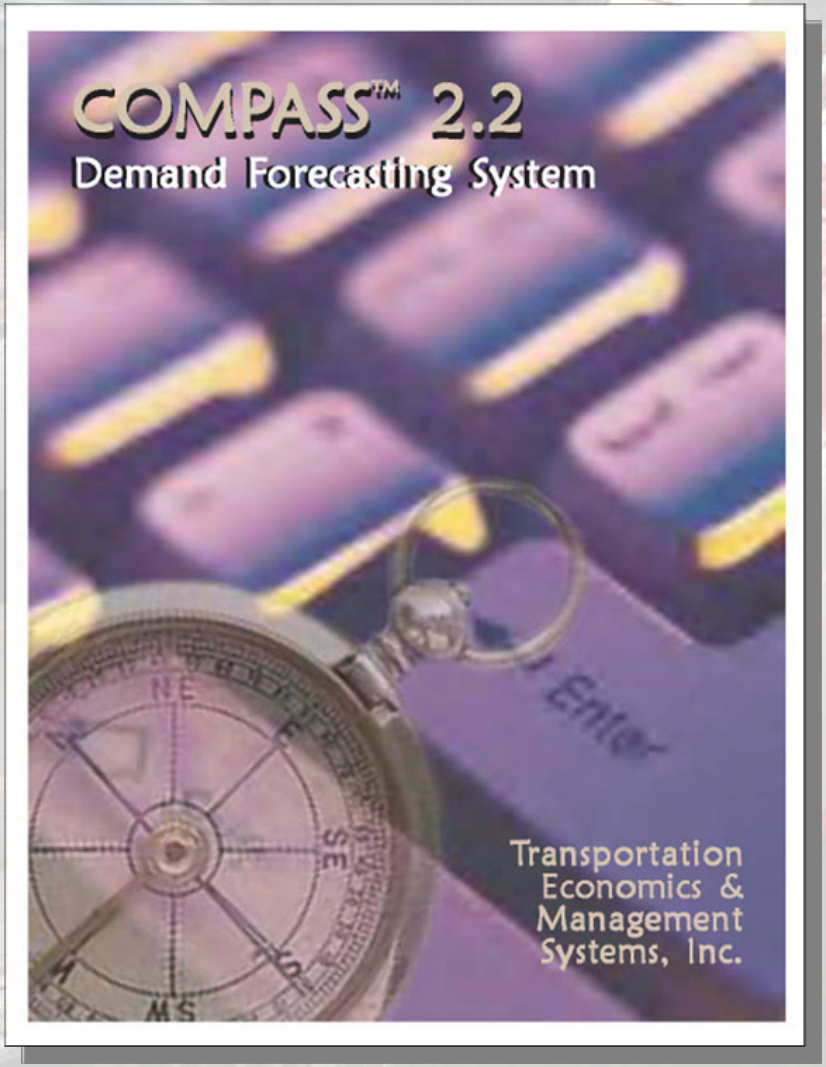
Vision Plan:

Station Concept Map



Ridership

COMPASS™ was used to develop the Ridership and Revenue Forecasts



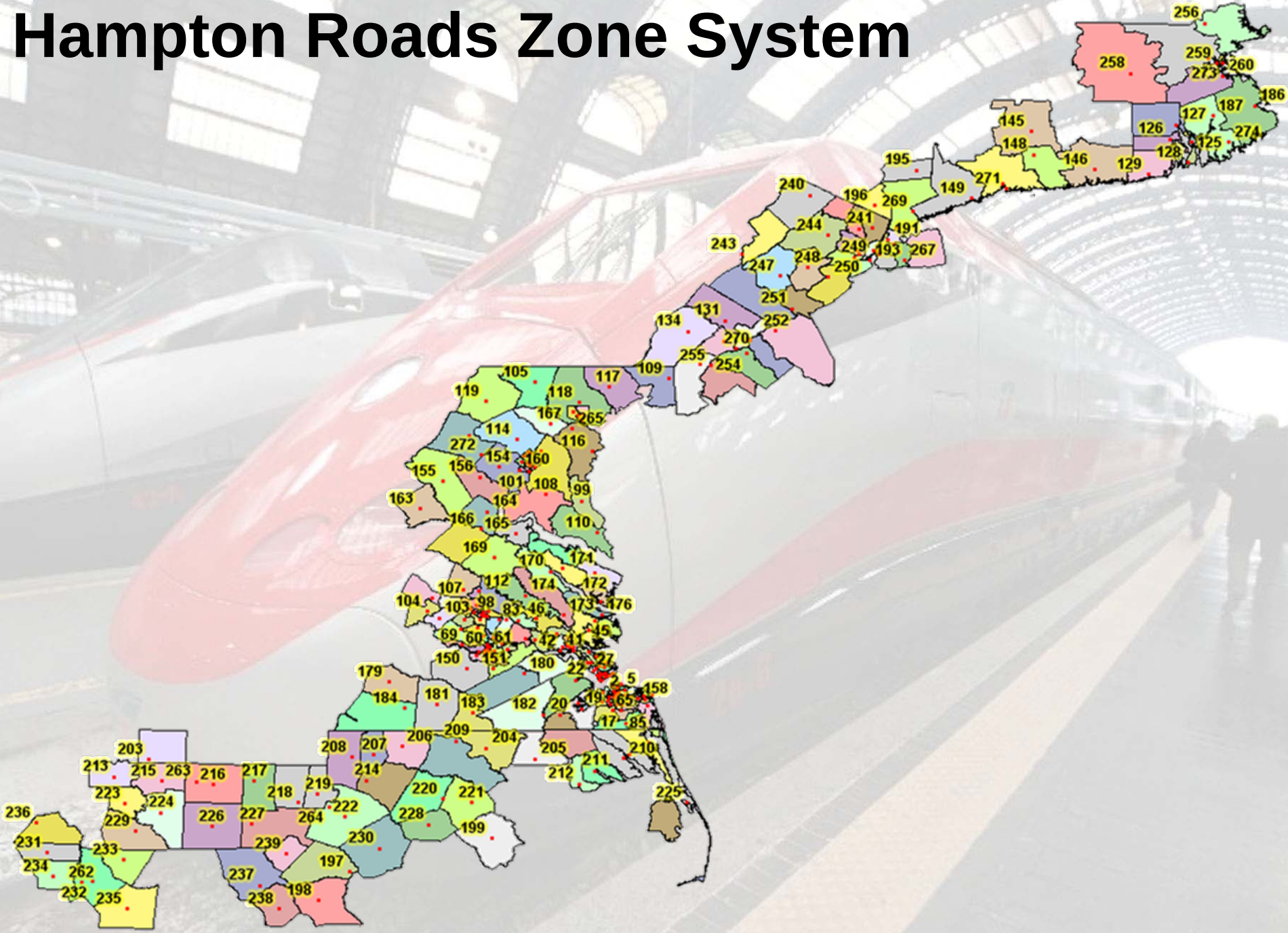
COMPASS™ is a comprehensive strategic policy planning tool to assist rail, highway, air, and transit management in planning their systems. It generates ridership and revenue forecasts for any set of socioeconomic, network, and competitive mode conditions. Outputs include traffic forecasts; revenue estimates; and rail, highway, air, and transit market shares over a given timeframe for a variety of conditions.

The COMPASS™ model consists of a three-step analysis process that estimates:

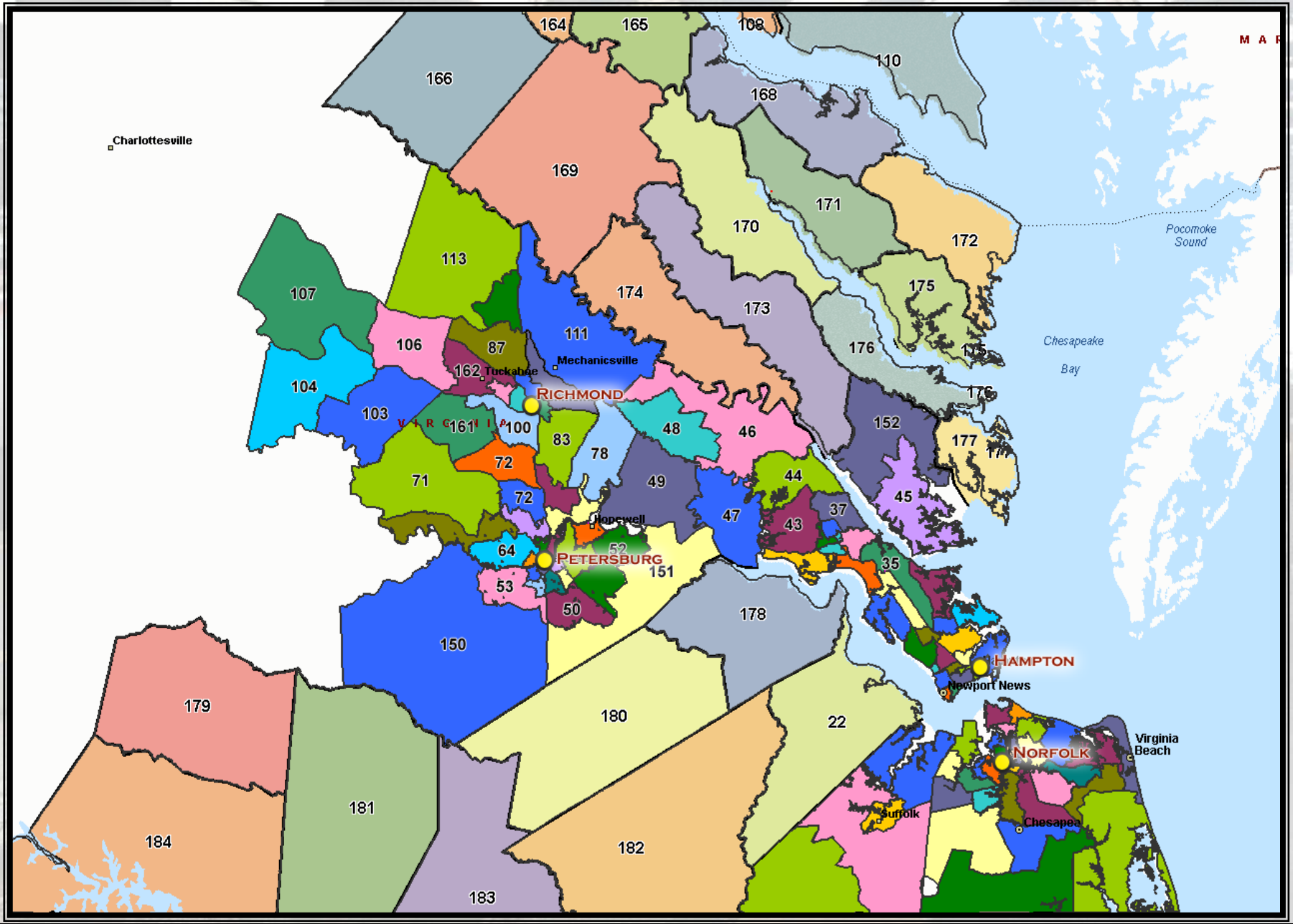
- **Total market growth by mode (air, rail, bus, auto) and travel purpose**
- **Induced demand due to changes in quality of service offered by any mode**
- **Modal Split / Route Split for estimating market or route shares using a hierarchical mode choice analysis.**

A key metric of the COMPASS™ model is "generalized cost." The generalized cost function allows time, cost, frequency, and service attributes to be combined into a single metric that can show how changes in speed, frequency, or fare will affect the use and market share of any mode.

Hampton Roads Zone System

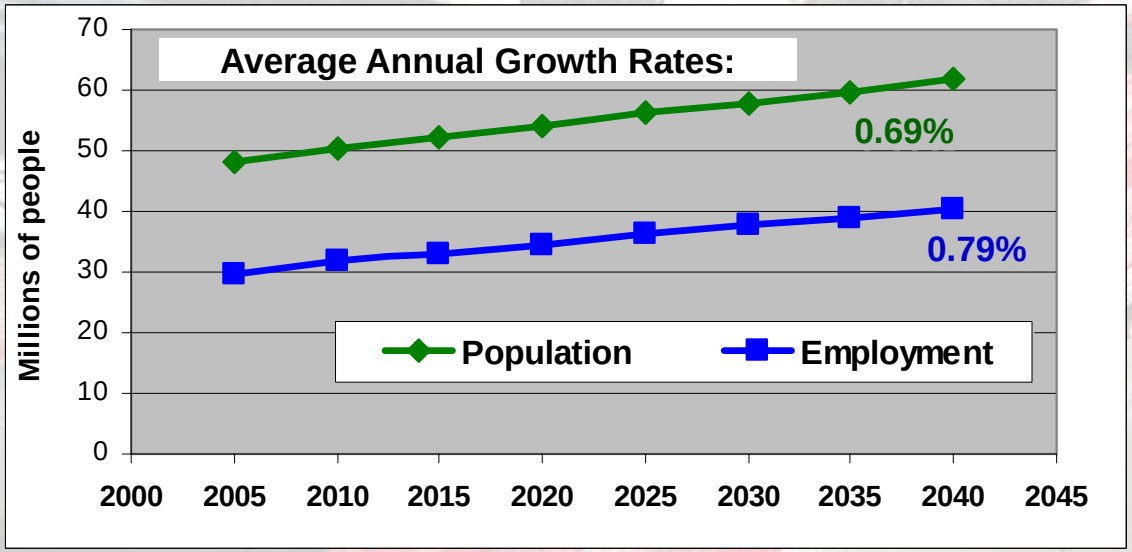


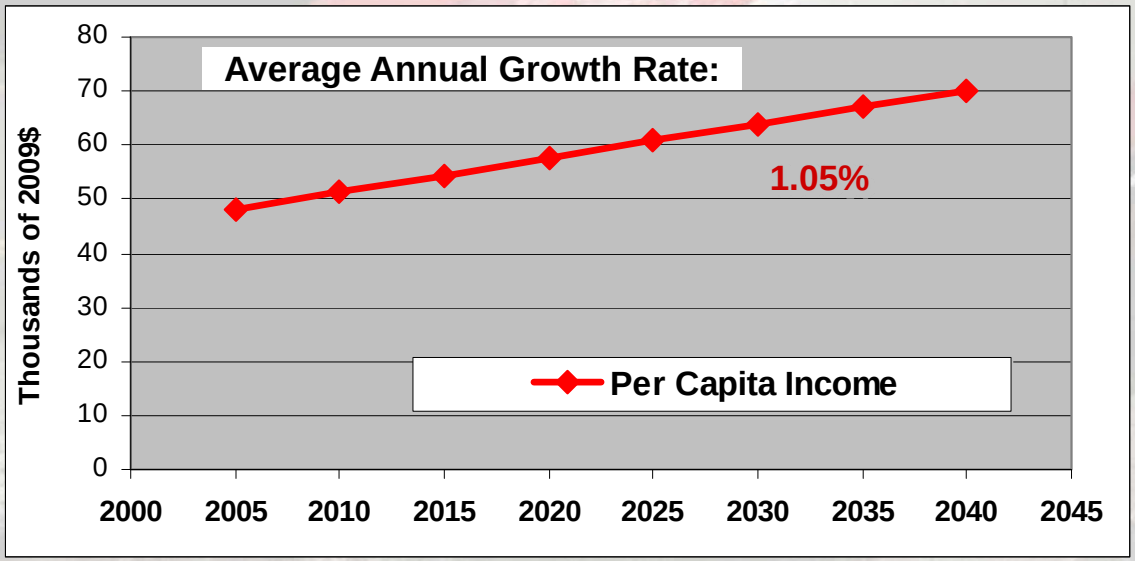
Hampton Roads Zone System – zoom-in



Socioeconomic Projections

Forecasts (2010-2040) for the Study Area:



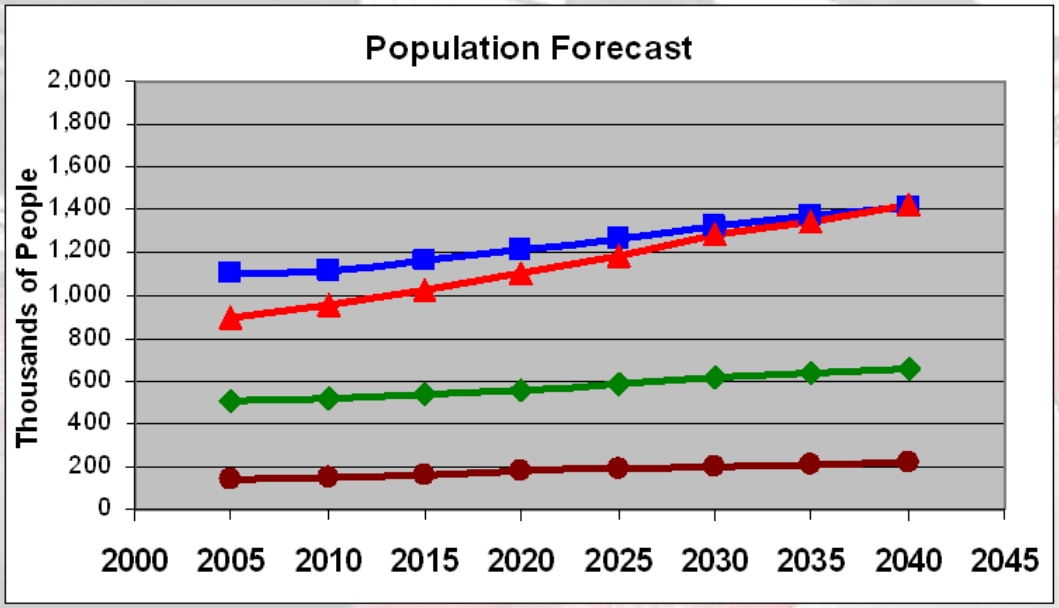


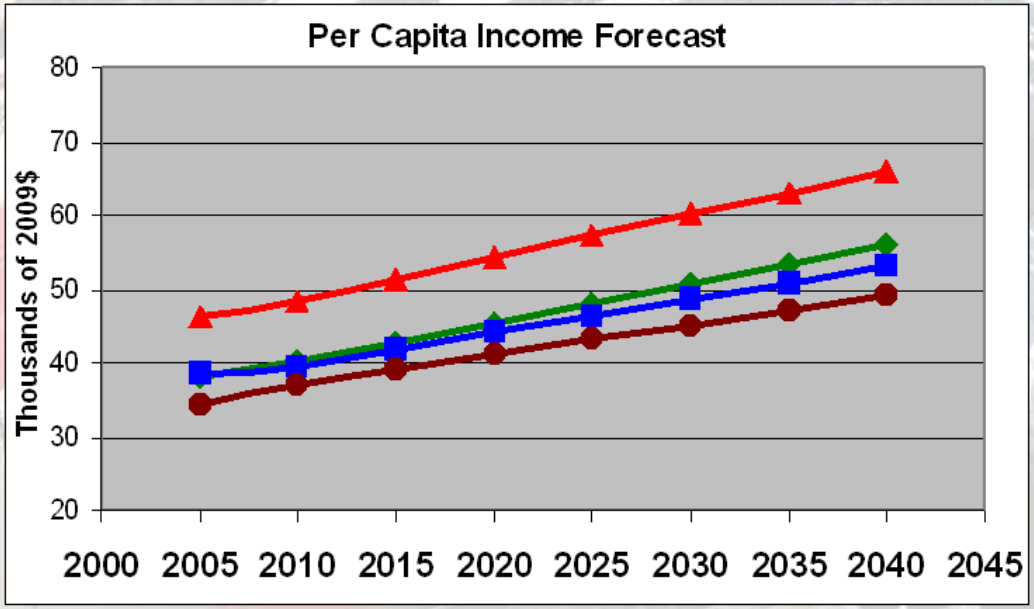
Data Sources:

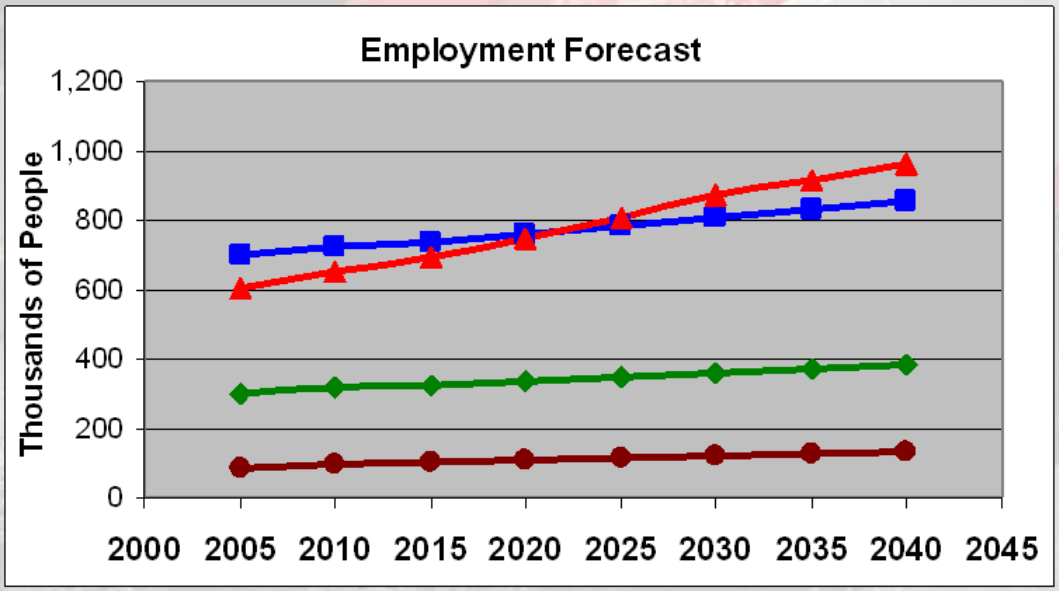
- Hampton Roads Planning District Commission
- Richmond Regional Planning District Commission
- Crater Planning District Commission
- Richmond/Hampton Roads Passenger Rail Project
- Virginia Employment Commission
- Metropolitan Washington County of Governments
- Baltimore Metropolitan Council
- State Planning Organizations (multiple)
- Bureau of Economic Analysis
- U.S. Census Bureau
- Applied Demographic Solutions

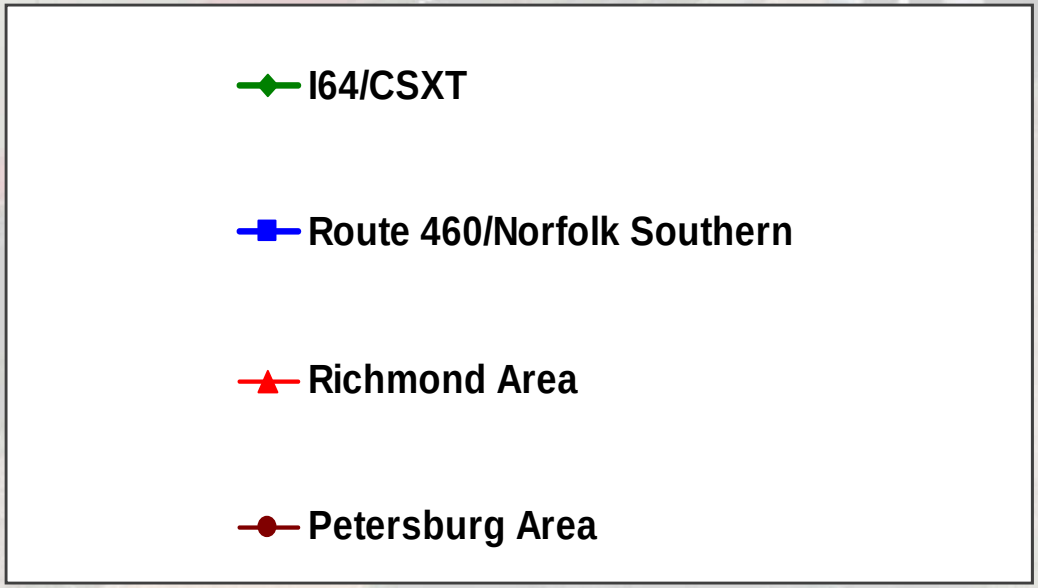
Socioeconomic Projections (cont.)

Forecasts by Region:



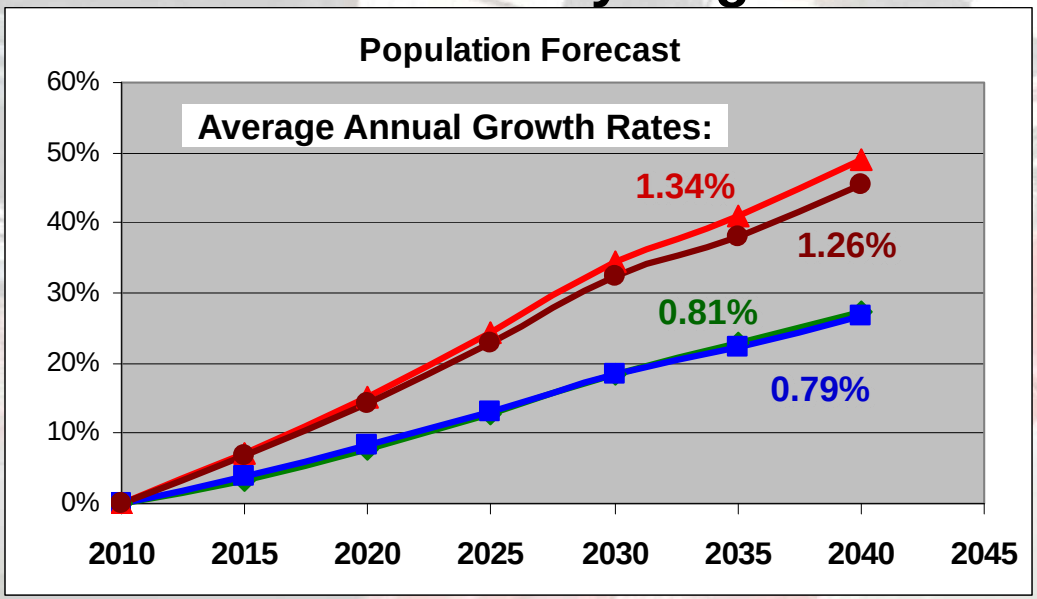


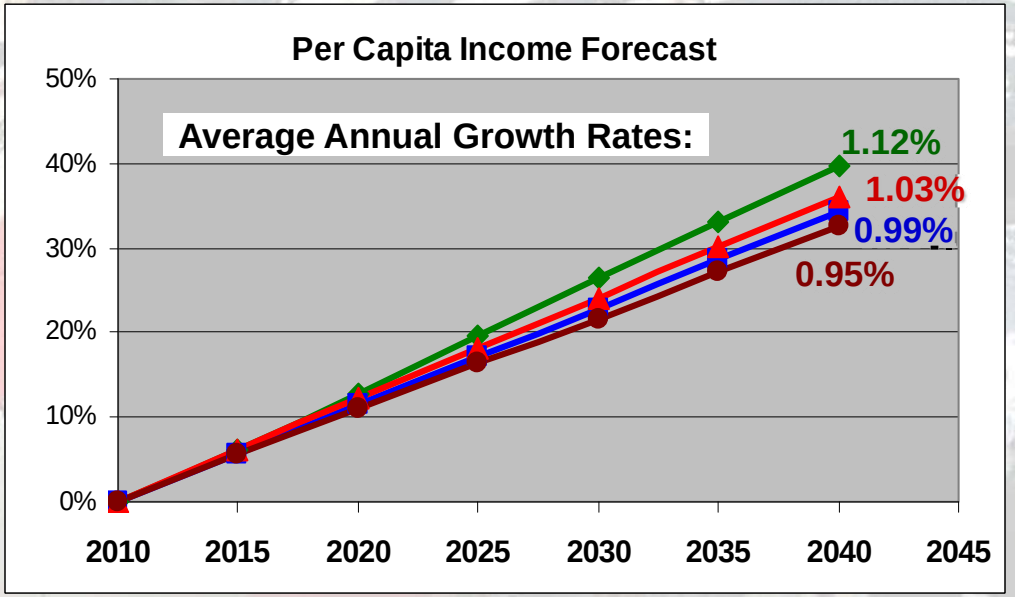


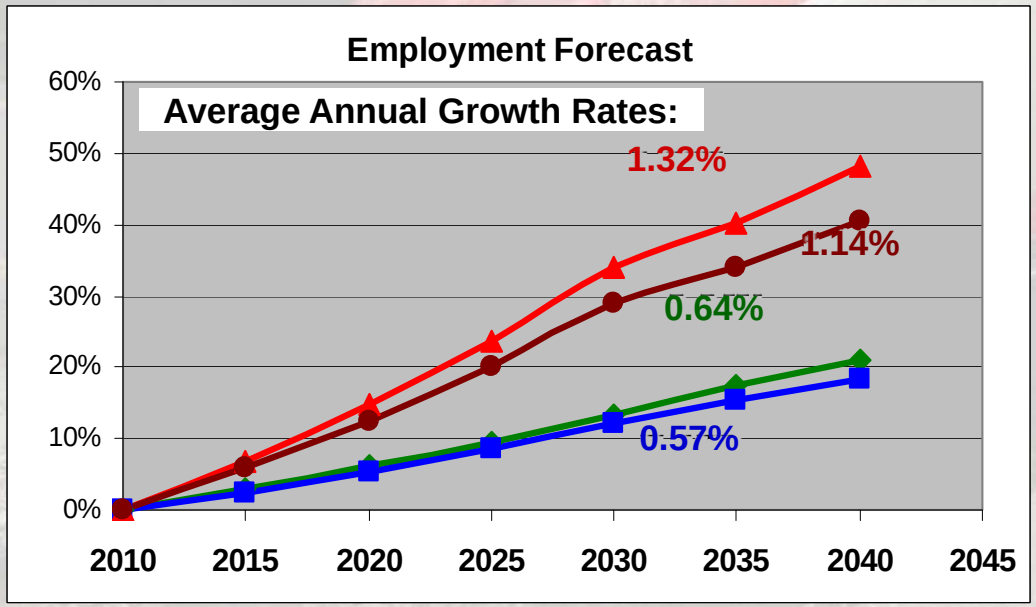


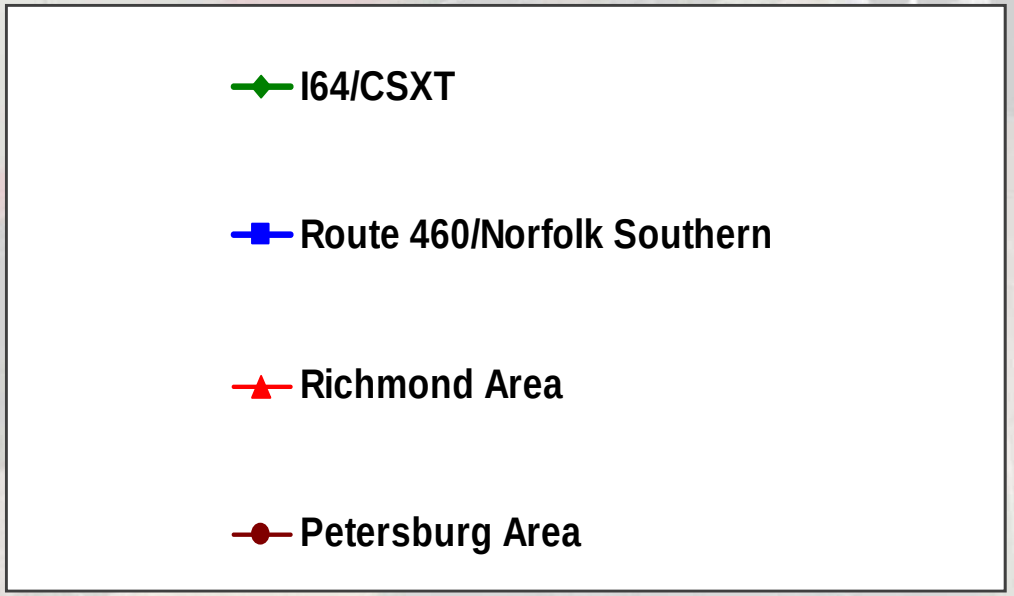
Socioeconomic Projections (cont.)

Forecasts by Region:

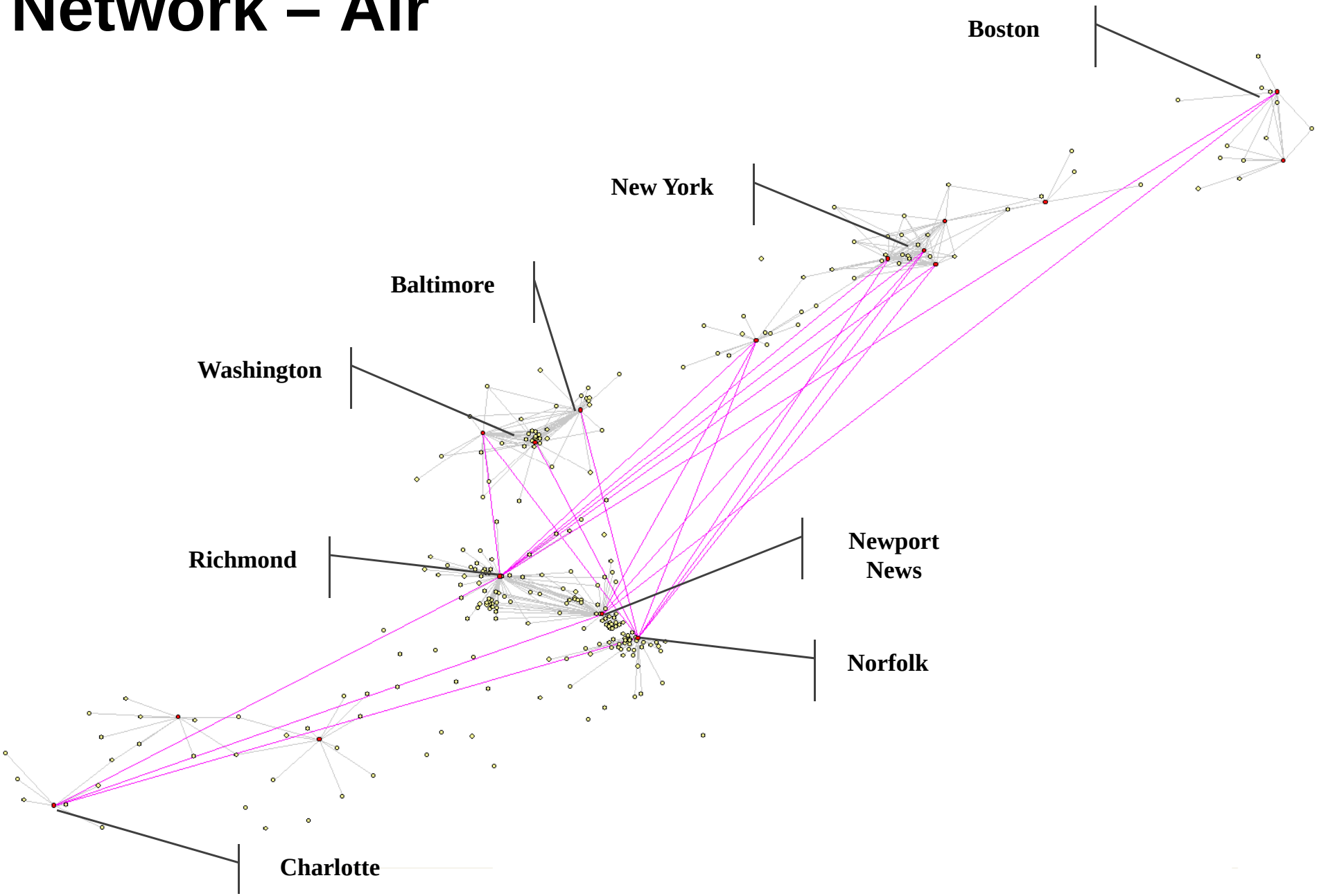




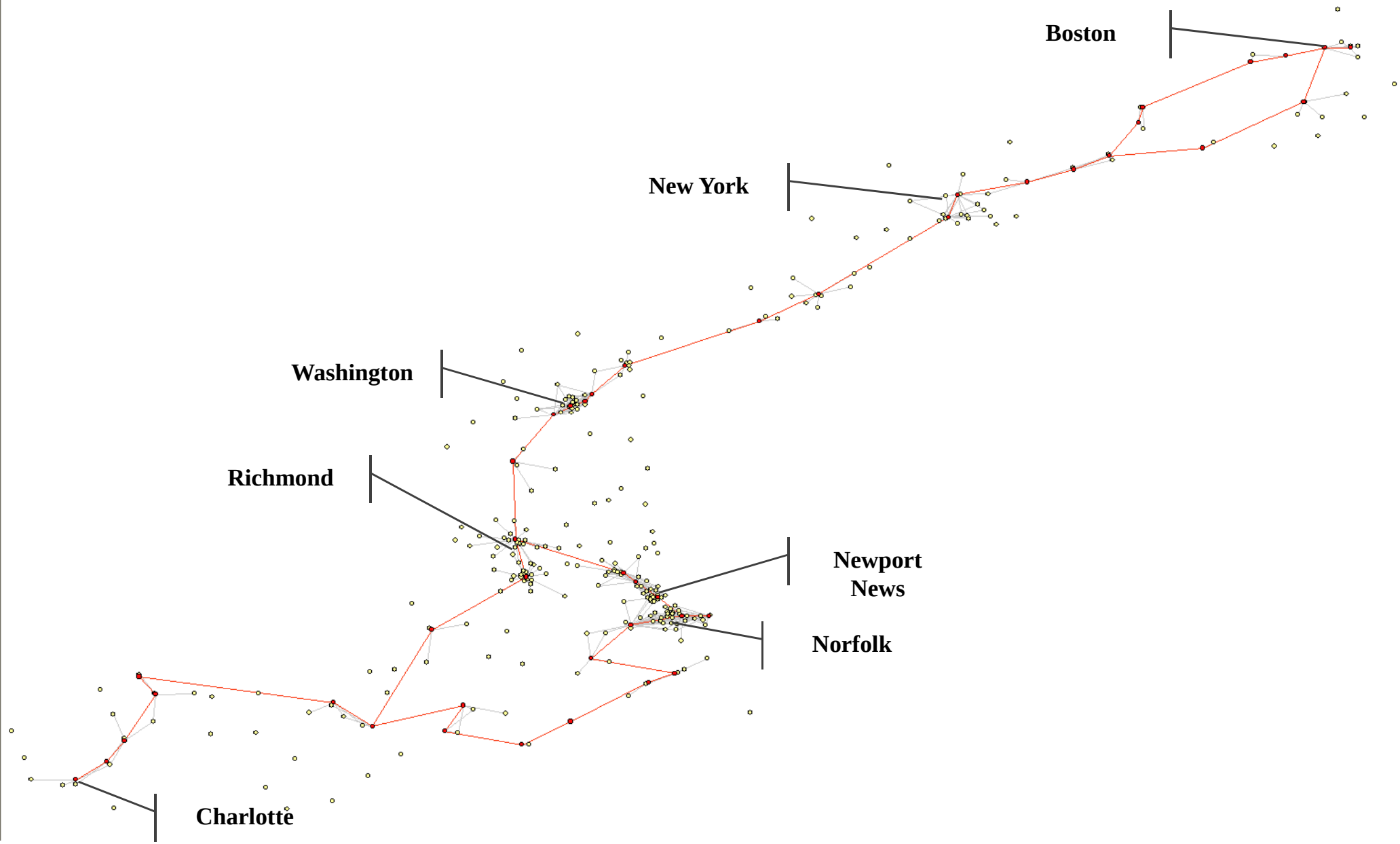




Network – Air


Boston
New York
Baltimore
Washington
Richmond
Newport News
Norfolk
Charlotte

Network – Bus


Boston
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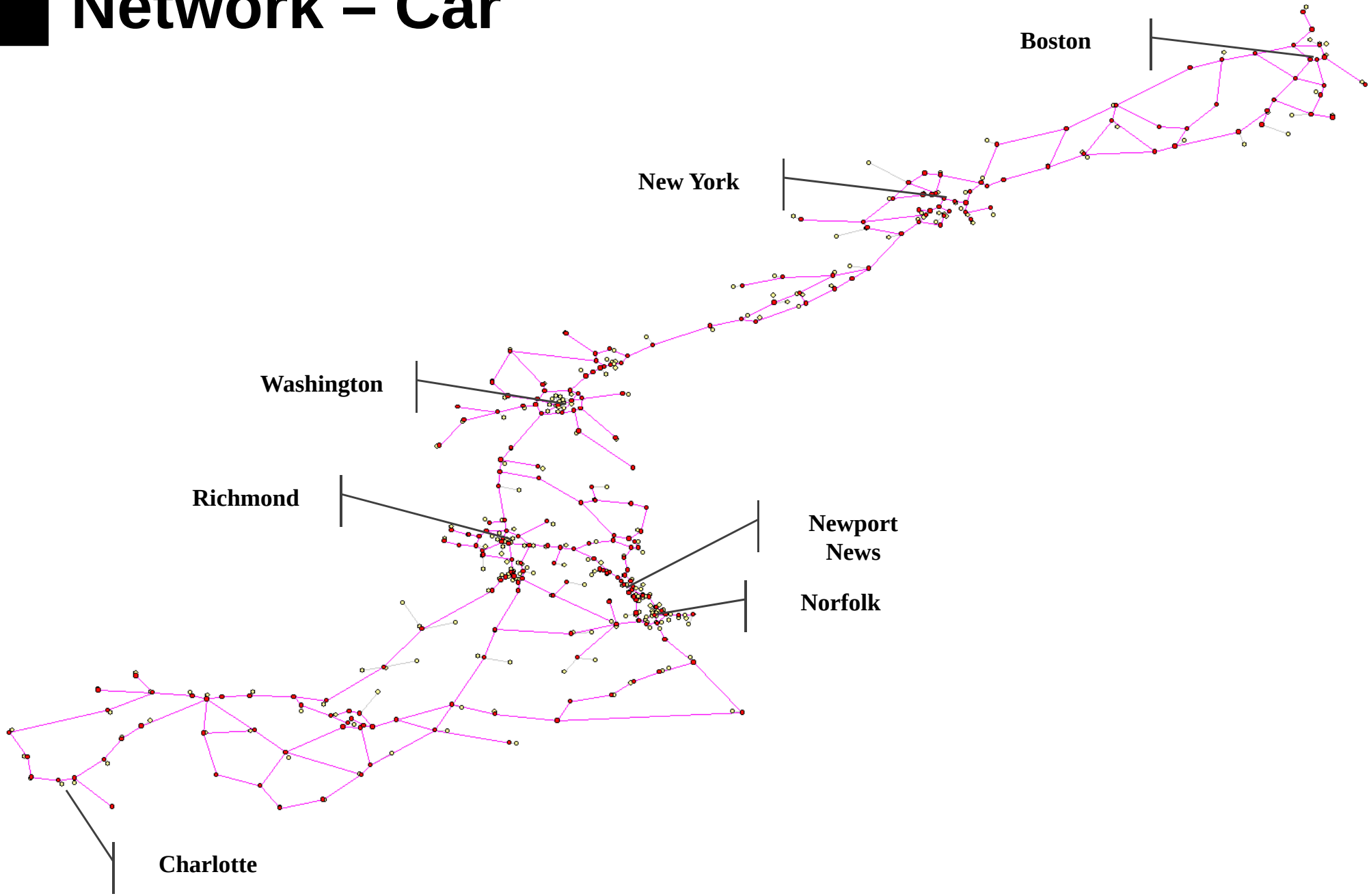
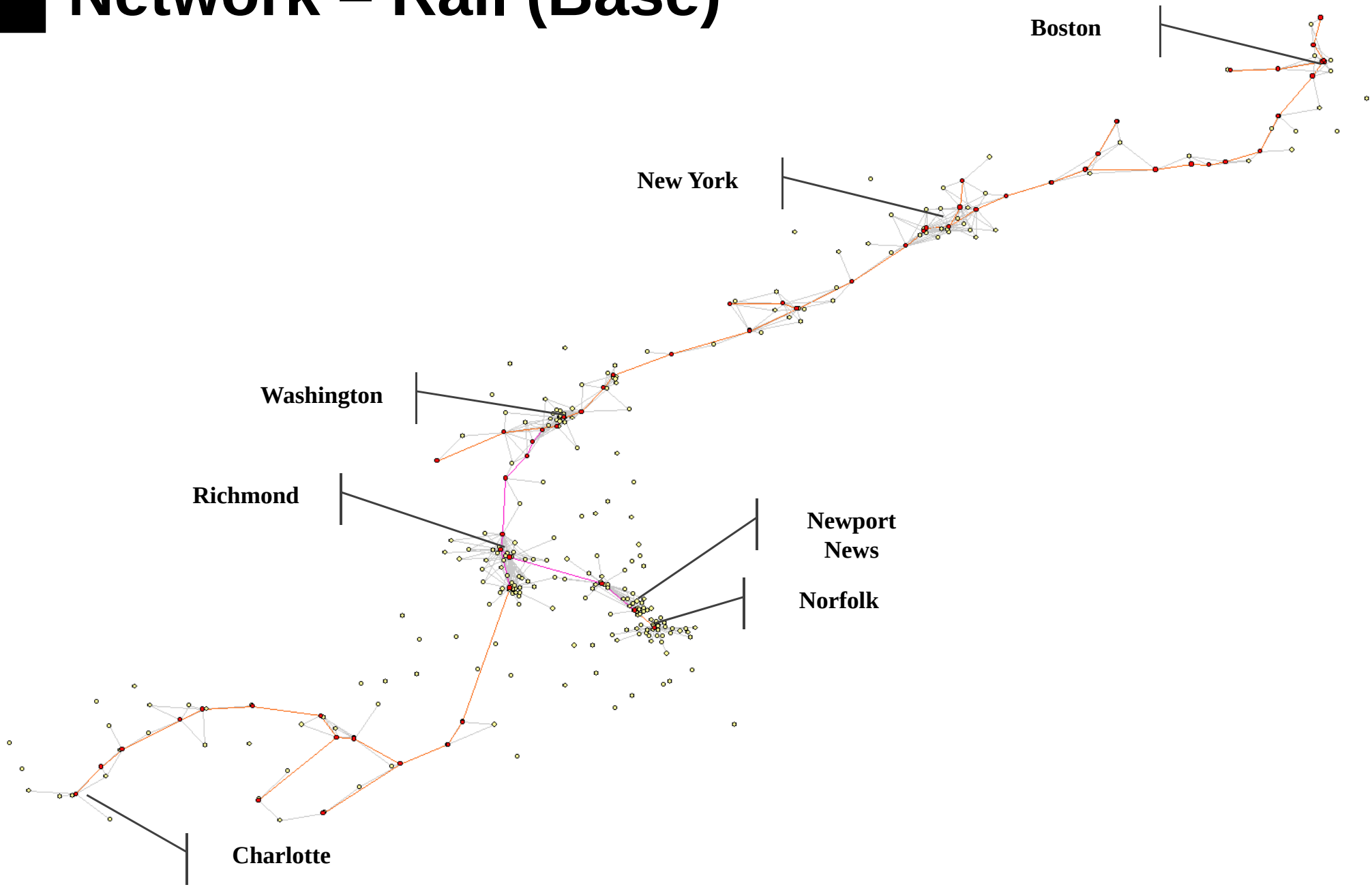
Network – Car


Boston
New York
Washington
Richmond
Newport News
Norfolk
Charlotte

Network – Rail (Base)



Origin-Destination Data

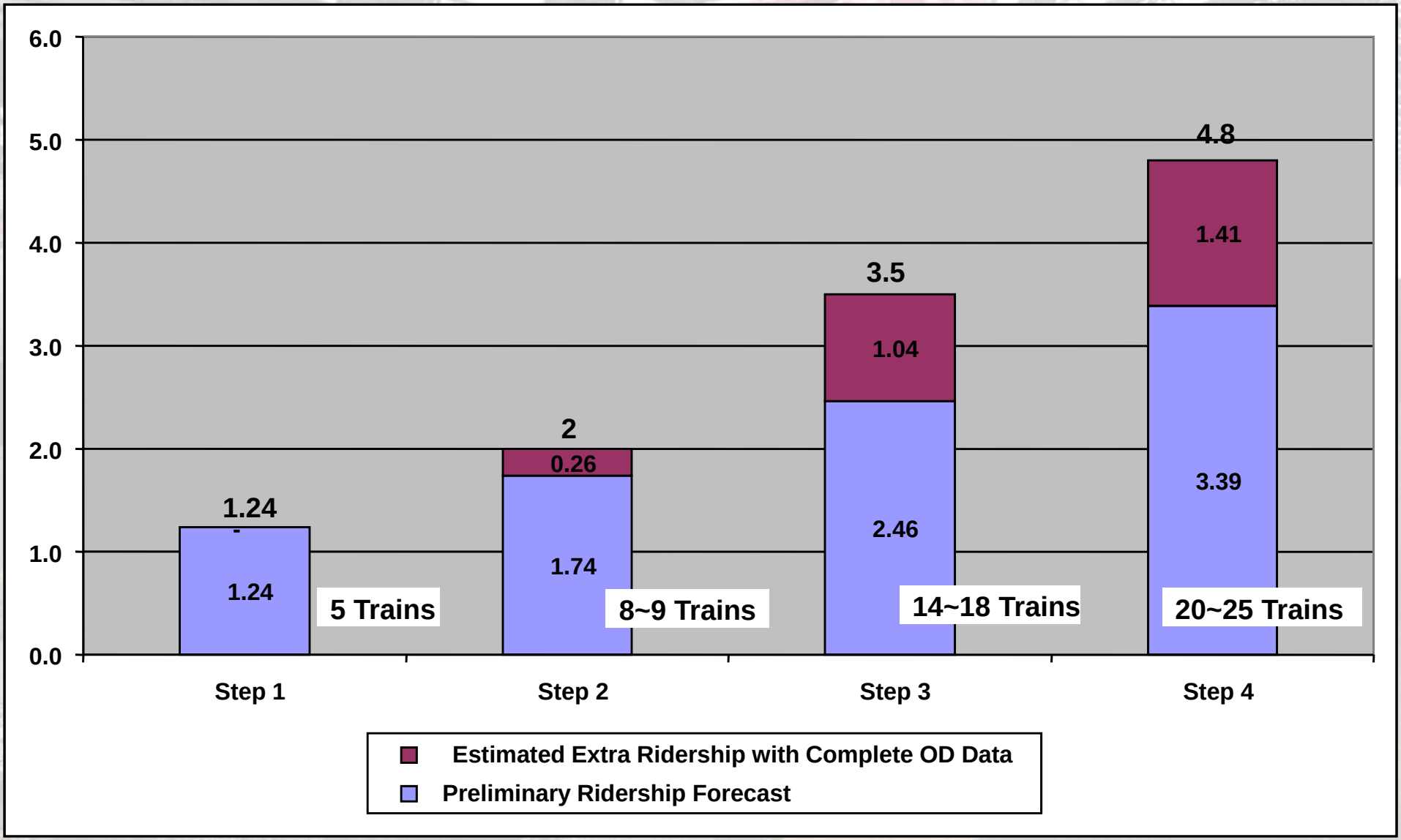
Auto OD Table	Hampton Roads	Richmond-Petersburg	Other Virginia	North Carolina	Washington DC-Maryland	Northeast Corridor
Hampton Roads						
Richmond-Petersburg						
Other Virginia						
North Carolina						
Washington DC-Maryland						
Northeast Corridor						

OD Data Available

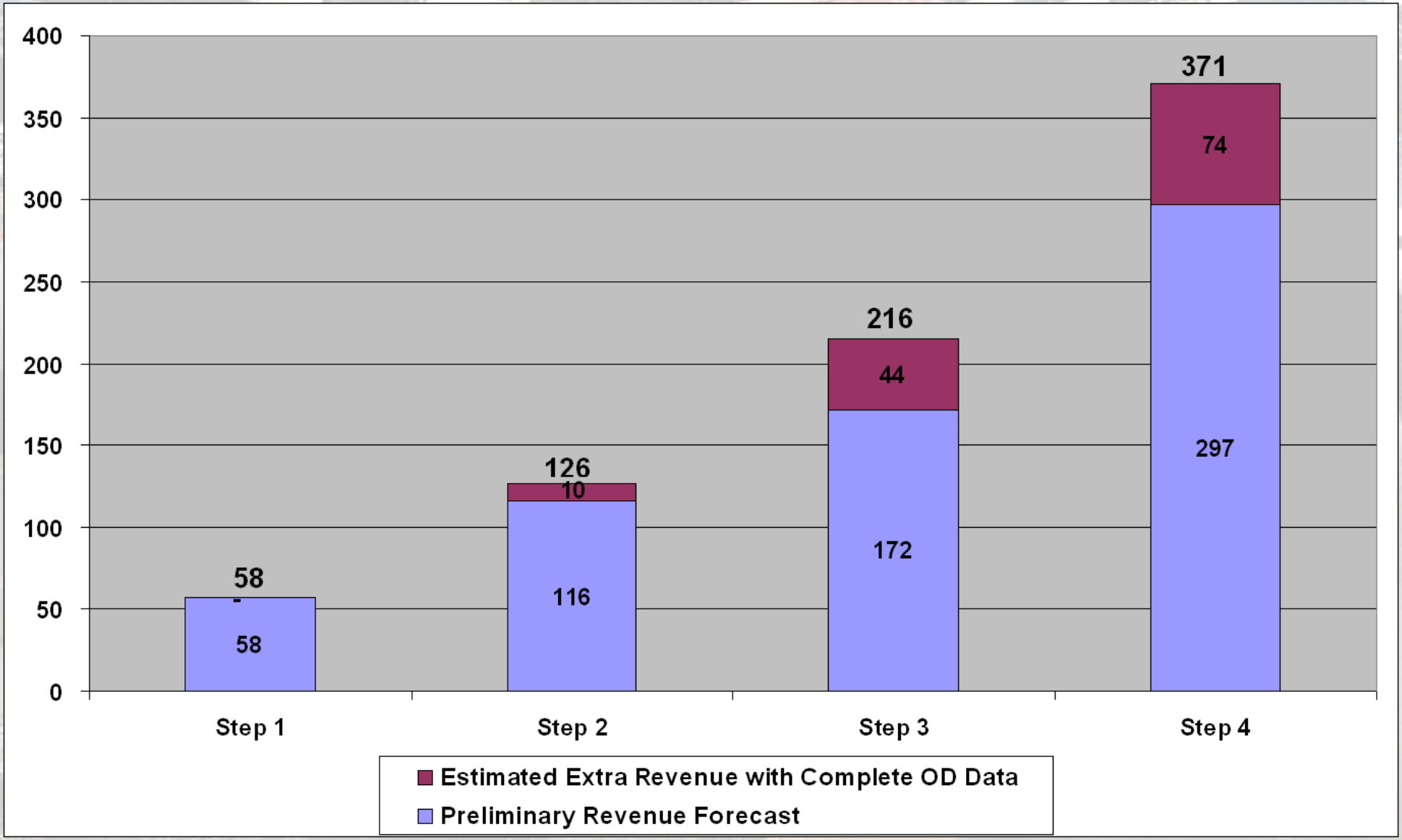
OD Data Unavailable

OD Data Irrelevant

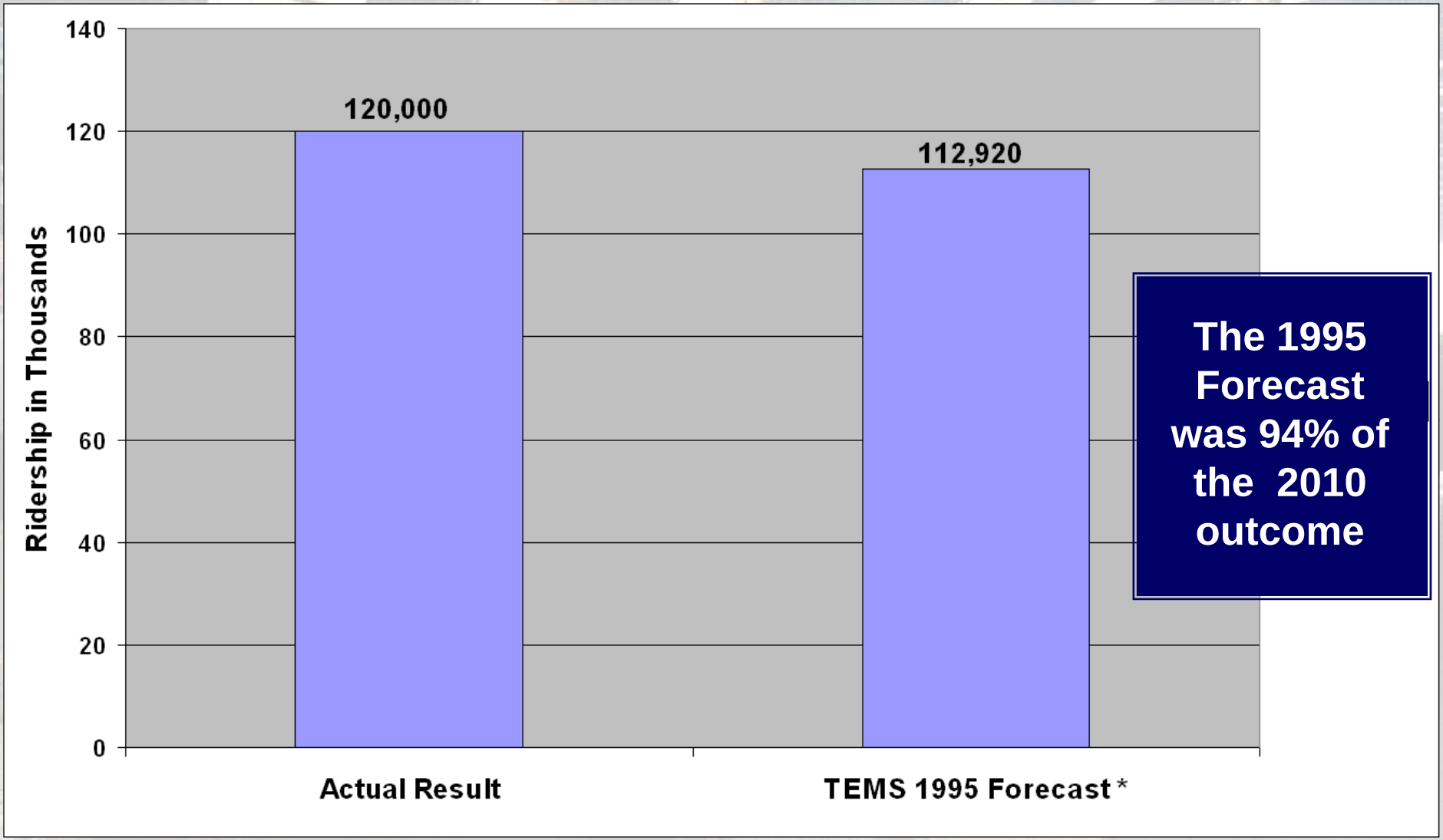
Hampton Roads/Richmond/Washington DC Corridor Preliminary 2025 Ridership Forecast (millions)



Hampton Roads/Richmond/Washington DC Corridor Preliminary 2025 Revenue Forecast (millions)



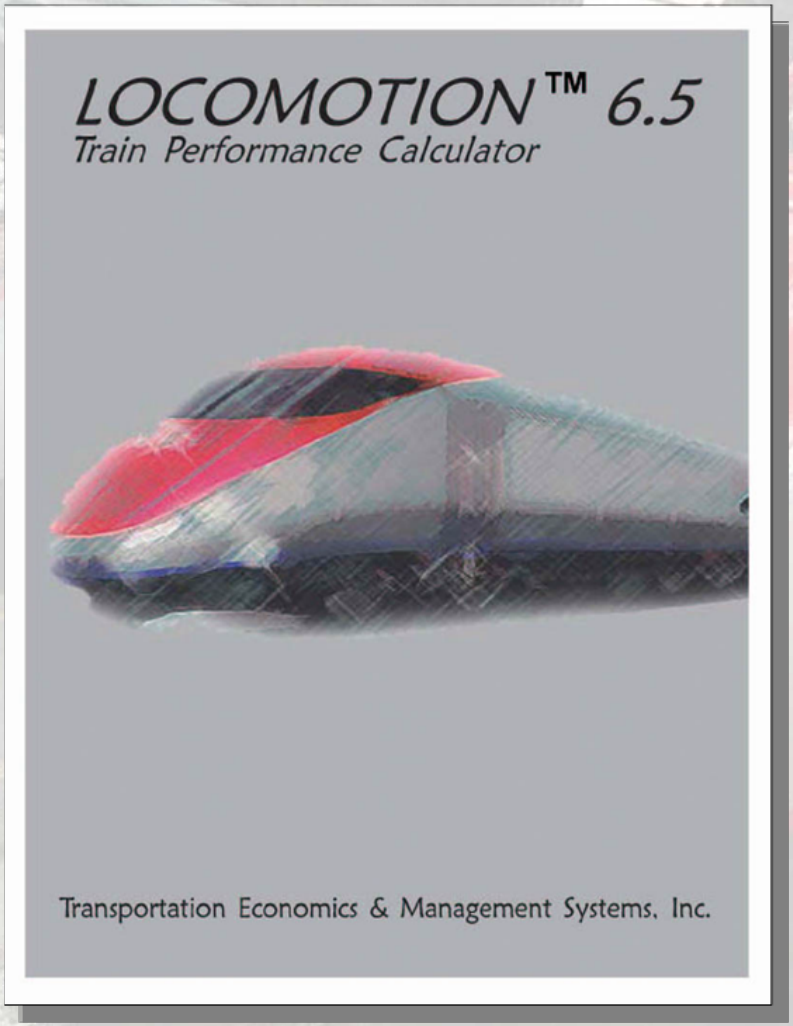
Model Validation: Comparison of Washington – Lynchburg 1995 Forecast with 2010 Outcome



* Bristol Rail Passenger Study: Final Report, May 1995

Preliminary Operating Analysis

LOCOMOTION™ was used to estimate the Train Speeds and Timetables



LOCOMOTION™ generates optimized timetables for given track infrastructure, signaling systems, and train technologies. It provides milepost-by-milepost graphic output of train performance based on track characteristics and shows the effect on timetables for improving the track, using a different technology, or changing stopping patterns. Because it takes account of other passenger and freight traffic using a right-of-way, LOCOMOTION™ can develop stringline diagrams and identify the optimum train path for a new service.

Generic Train Types

Conventional Amfleet	Diesel HST	Electric HST
		
79-90 mph	90-110 mph	150-mph

Preliminary Train Times

	Step 1		Step 2		Step 3		Step 4	
	Conventional Amfleet 	Conventional Amfleet 	Conventional Amfleet 	Diesel HST 	Conventional Amfleet 	Diesel HST 	Diesel HST 	Electric HST 
	79-mph	79-mph	79-mph	90-mph	90-mph	110-mph	110-mph	150-mph
Washington to Richmond	2:45[1]	2:15[2]	2:20[3]	2:05	2:20	1:30	1:30	1:05
Richmond to Norfolk		1:48		1:48[5]		1:10		0:55
Richmond to Newport News	1:25		1:25		1:13		0:52	
Total	4:10	4:03	3:45	3:53	3:33	2:40	2:22	2:00[4]

[1] 2:45 current Amtrak time to Main Street, 1:35 to Newport News

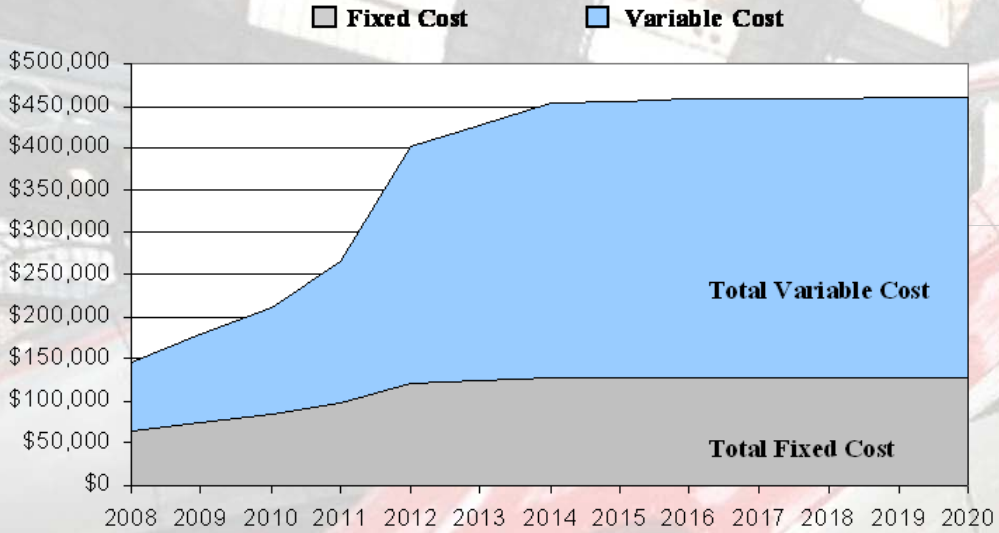
[2] 2:15 current Amtrak time to Staples Mill Road Station only, does not go to Main Street

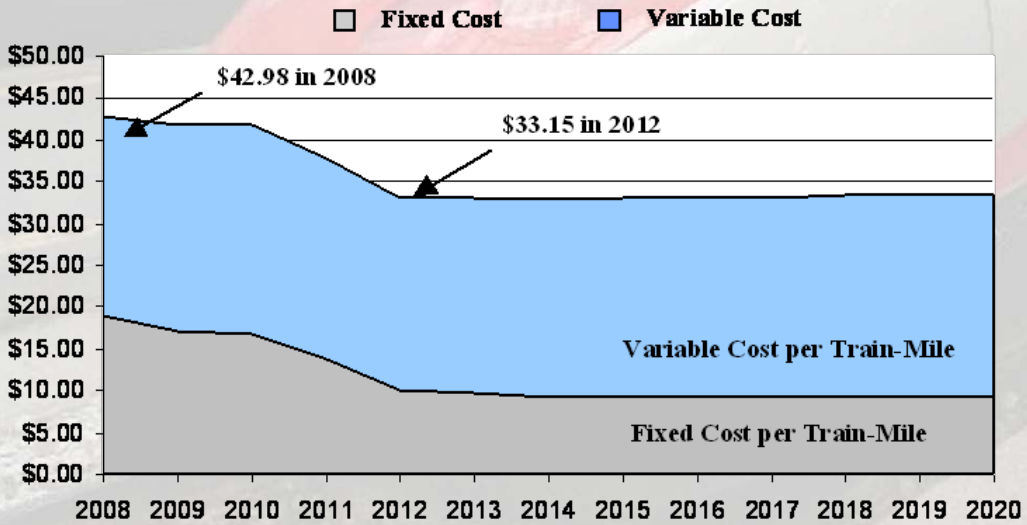
[3] 2:20 to Main Street, train operates at 90 mph north of Richmond

[4] 2:00 proposed schedule objective for HSR electric service

[5] 1:48 at 79-mph Richmond to Norfolk

Economies of Scale Relationship



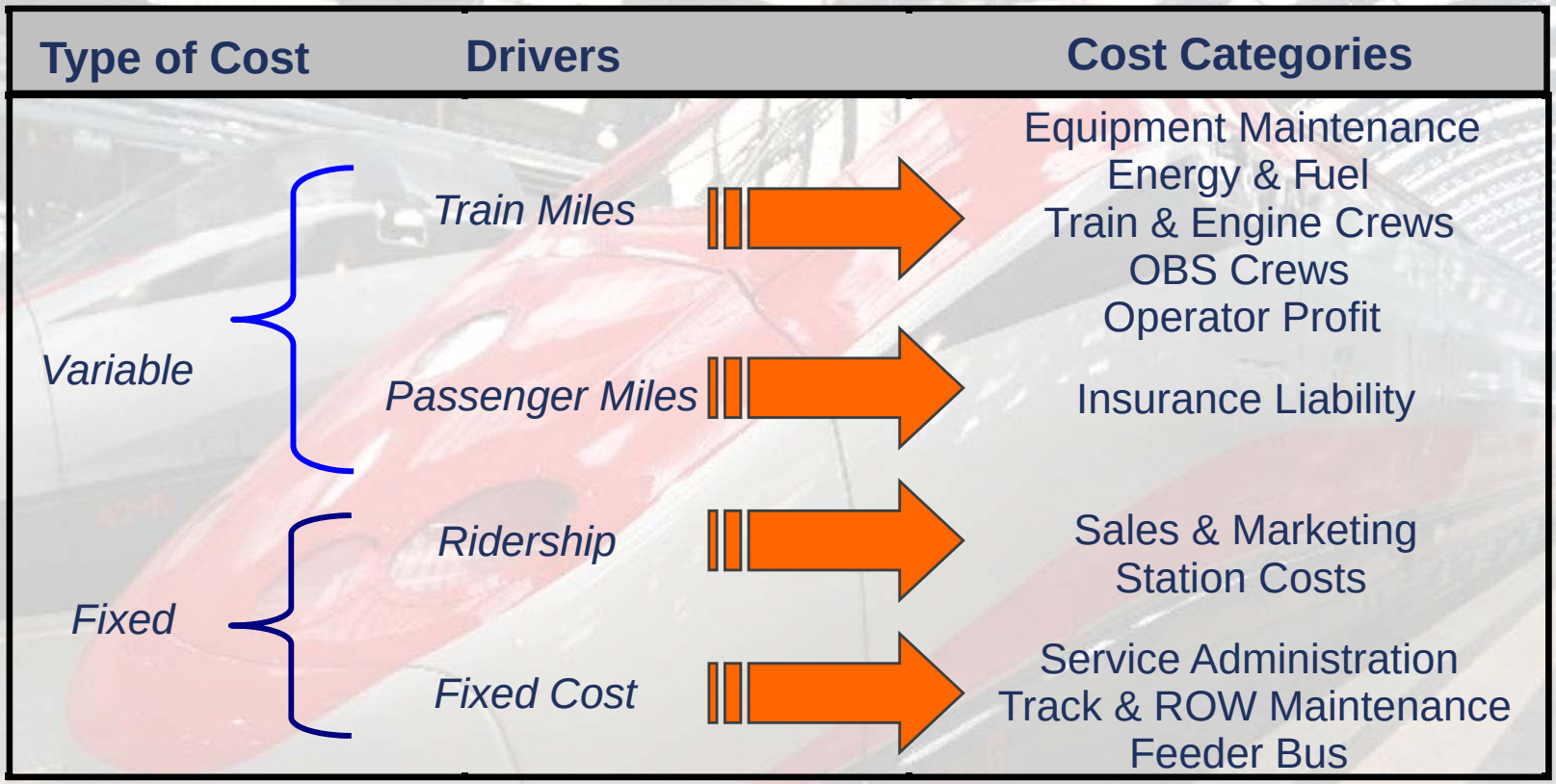


2002 MWRRS Analysis showed a 23% decline in Operating average unit costs, as Train Miles ramped up from 3.3 to 12.1 million.

Starting from a much lower base less than 0.5 million train miles, clearly the economies of scale relationship for Hampton Roads service will be even stronger

Exhibits 10-20 and 10-21 from MWRRS Report, in $2002. Fixed and variable operating costs do not include capital costs, interest or depreciation expense. Only direct operating expenses that are included in the Operating Ratio calculation, as defined by the FRA *Commercial Feasibility Study* are included.

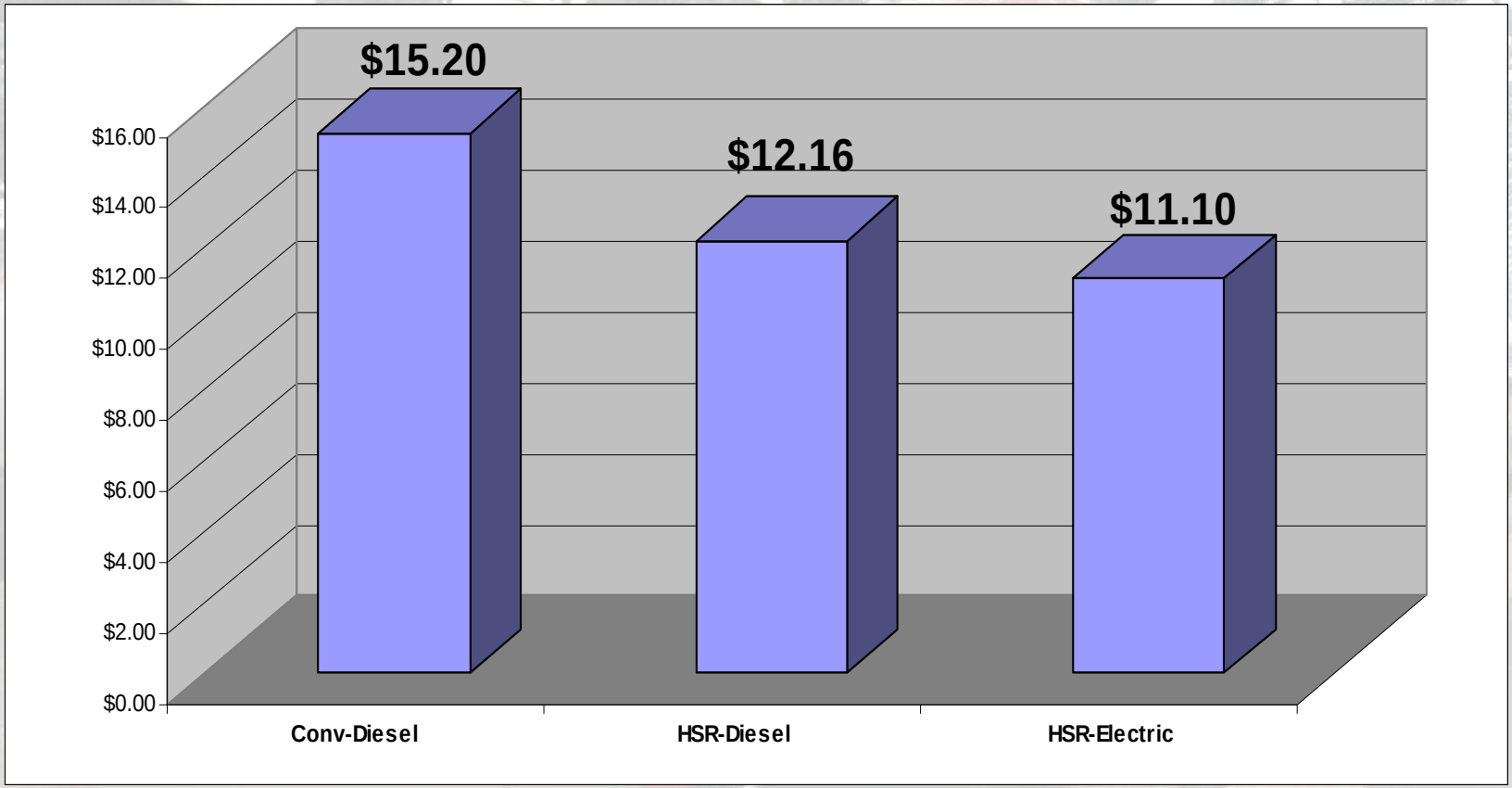
Operating Cost Categories



- **Costs were developed for three rail technologies**
  - 79-mph and 90-mph conventional diesel
  - 90-mph and 110-mph high speed diesel
  - 150-mph high speed electric

Variable Cost Items – Equipment

Equipment Maintenance – Cost per Mile ($2010)

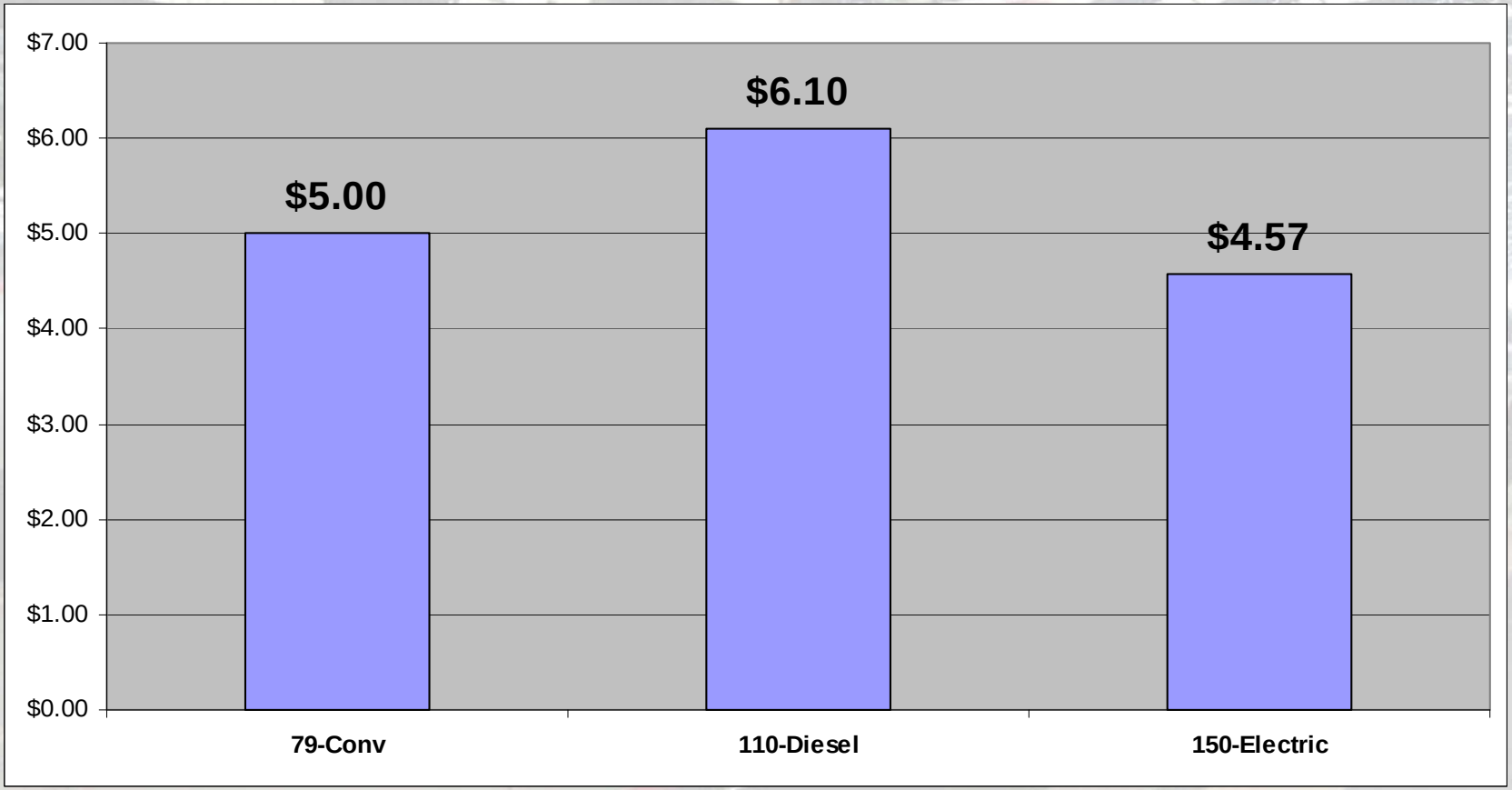


- **Sources:**
  - Midwest Regional Rail Plan
  - Ohio Hub Study
  - Florida Vision Plan
  - FOX Rail Study
  - RTD FasTracks

- **Notes:**
  - HSR Diesel and Electric costs reflect economies of scale for higher-frequency options as reflected in the evaluation scenarios

Variable Cost Items – Energy and Fuel

Energy and Fuel – Cost per Mile ($2010)



- **Sources:**
  - Midwest Regional Rail Plan
  - Baltimore/Washington Maglev Study
  - Colorado Maglev Study
  - RTD FasTracks Presentations
  - VEPCO Energy Tariffs

- **Notes:**
  - Electric costs include Peak Usage charge
  - Electric costs include energy recovery from regenerative braking.
  - Diesel prices reflect $2.52 per gallon

Variable Cost Items –Train Crews

- **Amtrak staffing rules for conservatism in rail costs**
  - Baseline train crews consist of an engineer, conductor and assistant conductor subject to hours-of-service regulations
- **Staffing practices and costs**
  - Crew costs depend upon the level of utilization, largely influenced by the structure of crew bases, length of routes, and level of train frequencies. $2010 costs:
    - $4.53 per train mile for electric rail, assuming efficient round trips with few overnight accommodations.
    - $4.85 per train mile for 110-mph assuming more overnight layovers are needed as frequencies are reduced.
    - $6.49 per train mile for 79-mph and 90-mph because of poorer utilization in these lower frequency scenarios.

- **Sources:**
  - Midwest Regional Rail Plan
  - Ohio Hub Study

Variable Cost Items – OBS Crews

- **OBS crews**
  - $2.52 cost per train mile ($2010) for labor and commissary support for 79-mph service, declining to $1.76 per train mile because of higher frequencies in electric rail scenarios.
  - Cost of goods sold = 50% of OBS revenue.
- **Key to OBS profitability is selling enough product to recover labor cost**
  - Trolley cart service boosts revenue by 50-100% due to added customer convenience.
  - Cost of dedicated bistro can only be supported by large trains (> 300 seats).
  - Trolley cart comes close to a “break even” proposition or a slight profit, because its main value is to enhance the customer’s rail travel experience.

- **Sources:**
  - Midwest Regional Rail Plan
  - Ohio Hub Study

Variable Cost Items – Insurance Liability

- **Insurance liability**
  - 1.38¢ per passenger-mile (from MWRRS inflated to $2010).
  - FELA (employee injury) costs not included here but are included as part of the labor rate in the respective categories.
  - Strong economies of scale/institutional issues with respect to ability to obtain insurance at a reasonable cost.
  - Amtrak reform and accountability act of 1997 (§161) limits passenger liability claims of $200 million per event, which enables passenger operators to satisfy freight railroad requirements for full indemnification.

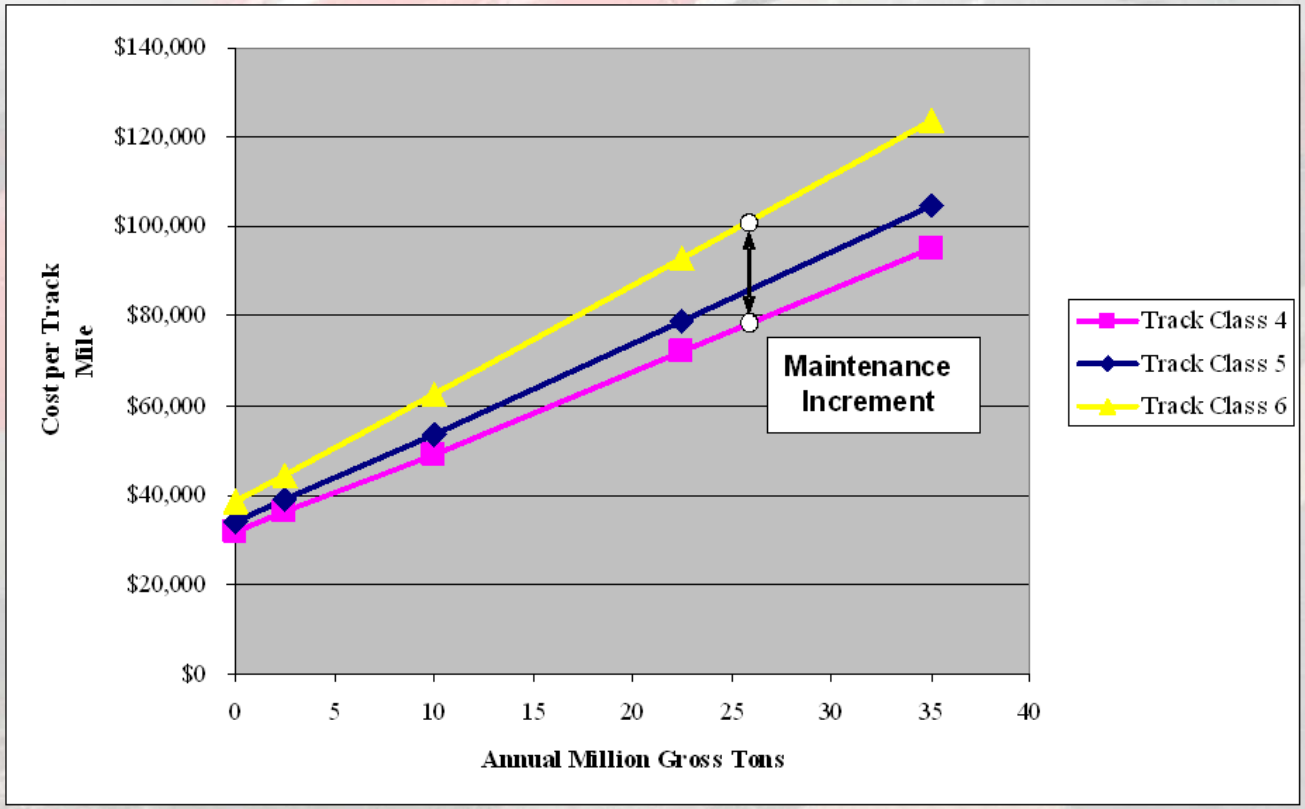
- **Sources:**
  - Midwest Regional Rail Plan
  - Ohio Hub Study

Fixed Cost Items – Station Costs

- **Station costs**
  - Rail system provides basic rail facilities such as platform and tracks, community provides the rest of the station.
  - Station costs assume a simplified fare structure, heavy reliance upon electronic ticketing and avoidance of a reservation system will minimize station personnel requirements. Station costs include personnel, ticket machines and station operating expense. Costs (in $2010):
    - Unstaffed station $79,400 per year.
    - Staffed station $635,000 per year.

Fixed Cost Items – Track Maintenance

- **Track and ROW Maintenance**
  - Follows Zeta-Tech methodology inflated to $2010, cost for shared track depends heavily on Track Class and Gross Tonnage.
    - $48,000 per year for dedicated 79-mph track
    - $53,000 per year for dedicated 110-mph track
    - Plus $26,500 per track-mile for Electrification maintenance



Fixed Cost Items – Administration, Sales and Marketing

Management, Administrative and Call Center Costs were further refined by splitting them into Fixed and Variable Cost Components.

Pink- Fixed *Blue- Variable by Train Miles*

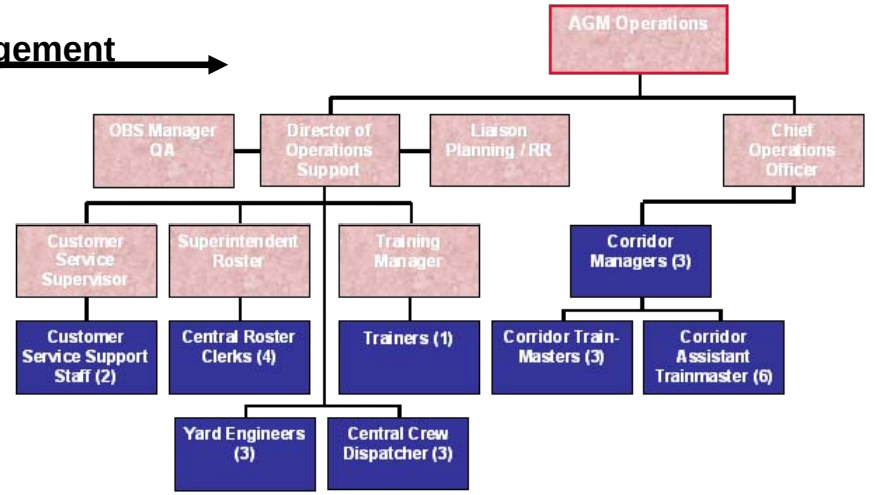
RESULTING FIXED COST ($2010):

Call Center: $2.9 Million
Management + Admin: $10.9 Million

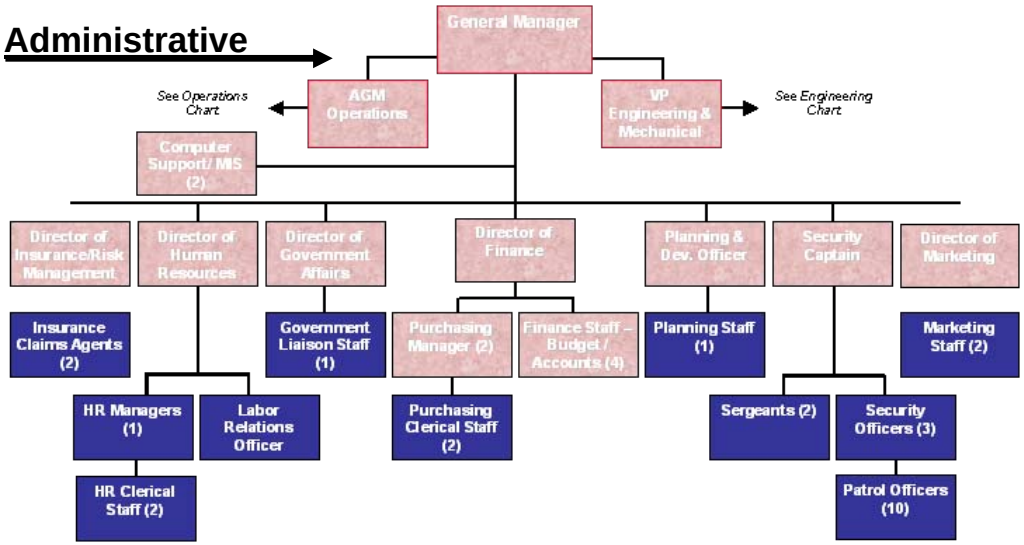
Variable Components:

$1.62 per Train-Mile Admin, 70¢ per Rider Call Center, 1.8% Revenue for Credit Card Commissions, 1% Revenue Sales Commissions

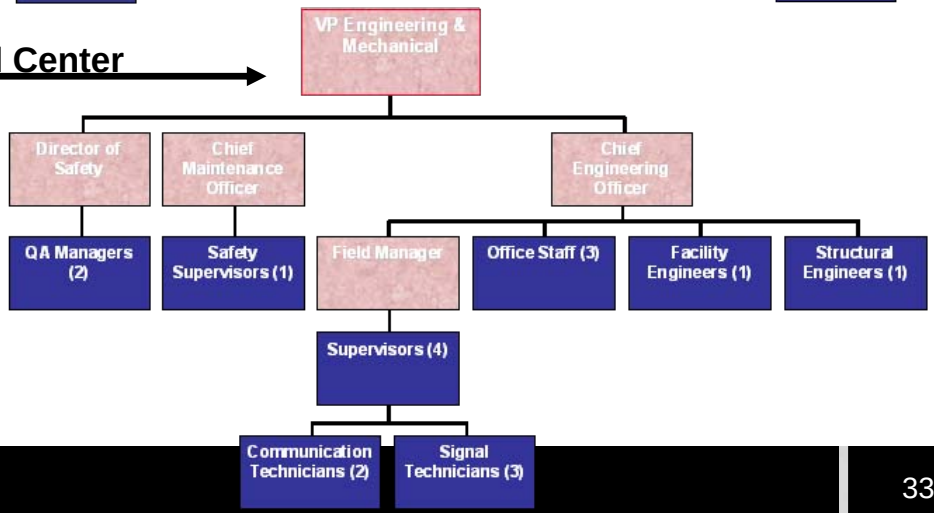
Management



Administrative



Call Center

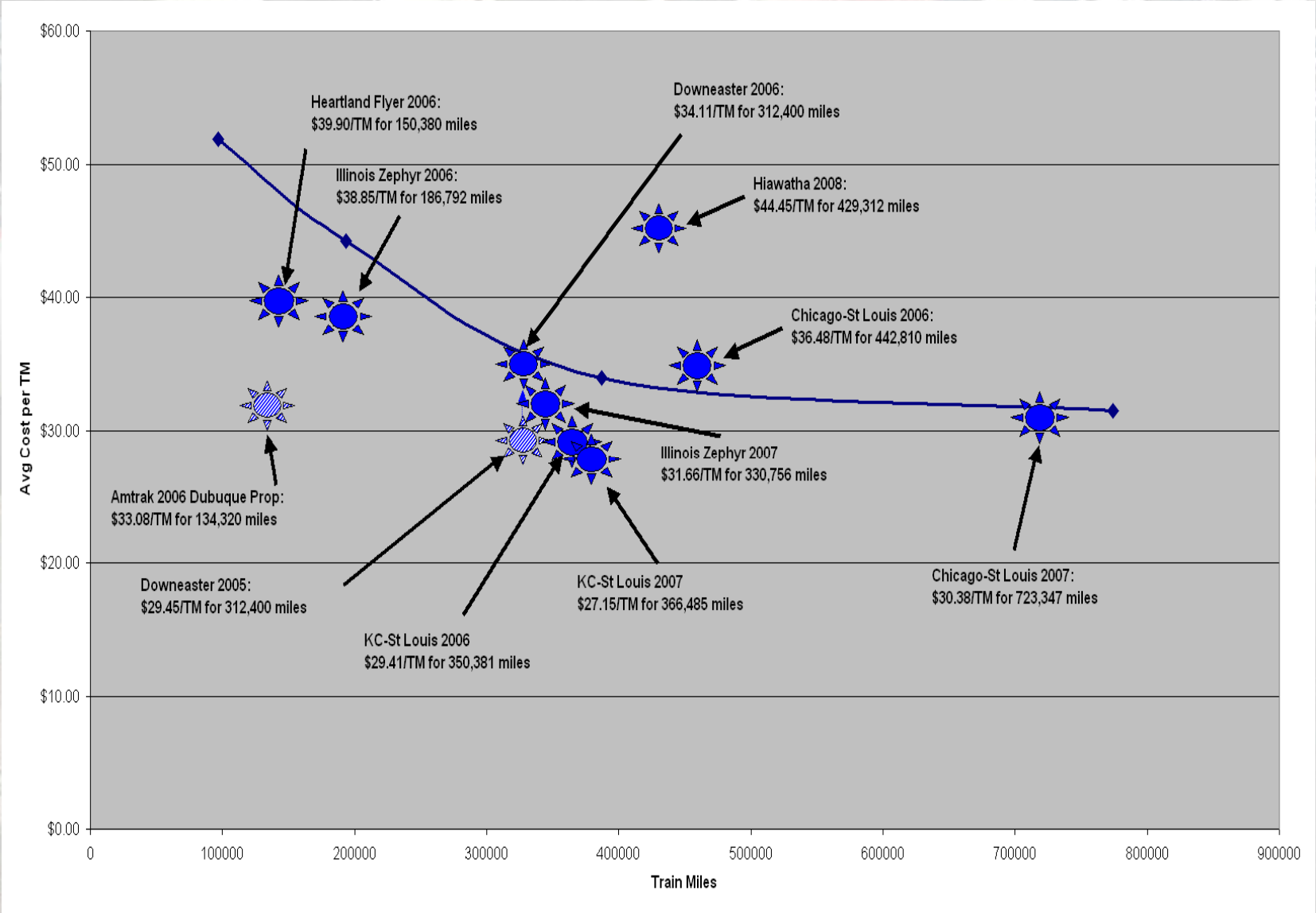


Operator Profit

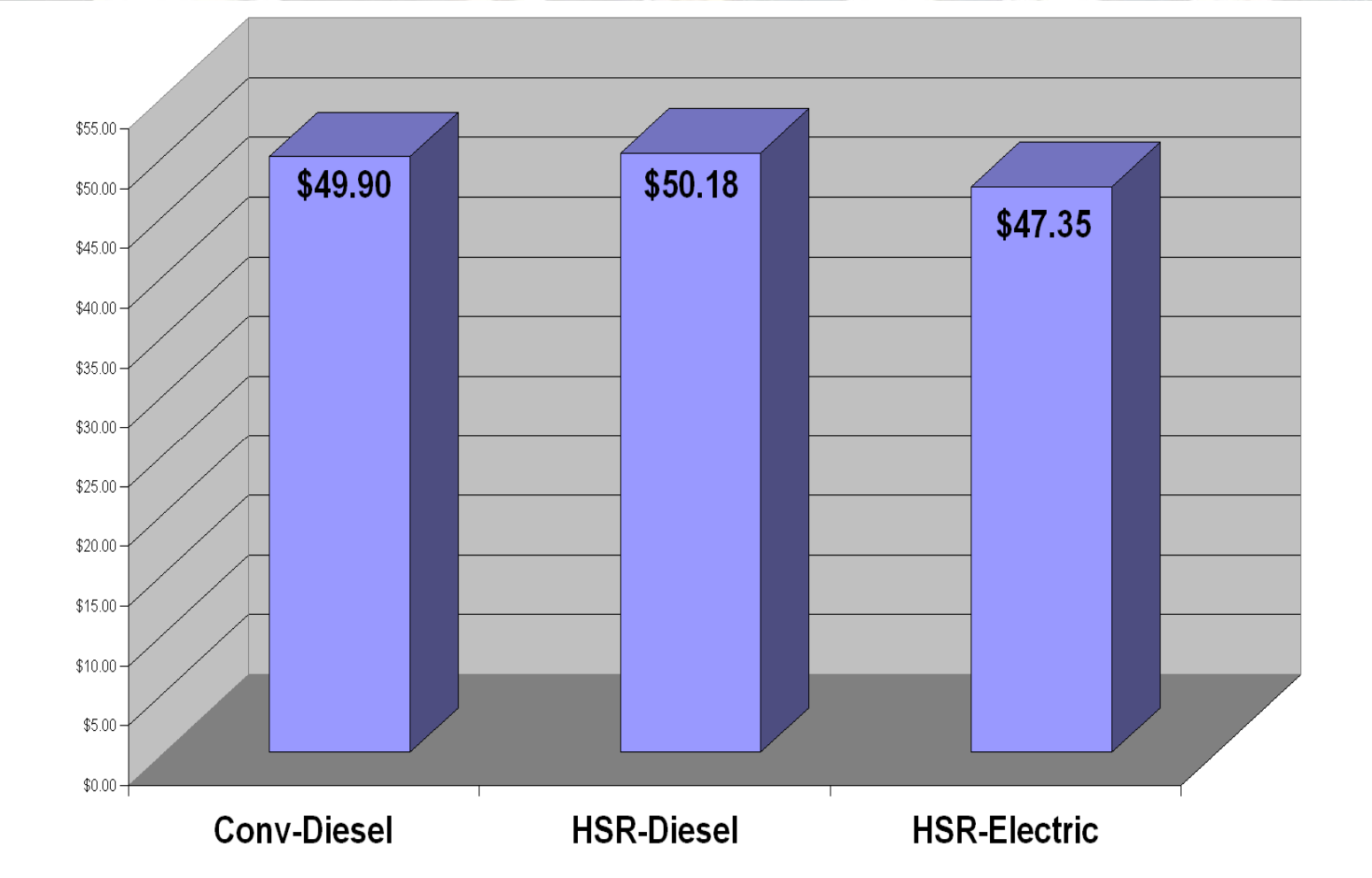
- For planning purposes, the MWRRS allocated a gross operator profit based upon 10 percent of directly-controlled costs, including:
  - Insurance, station, sales and marketing, service administration, train crew, and energy and fuel.
- All other costs, such as train equipment maintenance, are assumed to be out-sourced. These costs for externally contracted services are excluded from the operator's profit margin, and are assumed to each include their own 10 percent profit margin.
- Gross operator profit is allocated to the operator as a performance incentive.
- For small systems the operator profit is assumed to be embedded in the $5 per train mile allowance (now inflated to $5.50 in $2010) that was derived from a corridor benchmarking analysis.

Amtrak Benchmark

Compares TEMS Bottom Up Costs to RPS– Amtrak reported $2006 costs in $30-40 Range for State-Supported Services, in 2010 about 10% higher



Preliminary Costs per Train Mile ($2010)



Higher Costs for Dedicated Track, Electrification Maintenance and a dedicated Management structure in the HSR scenarios; offset by economies of scale efficiencies

Benchmark – Amtrak Fully Allocated Costs

$1997 Costs Inflated to $2010

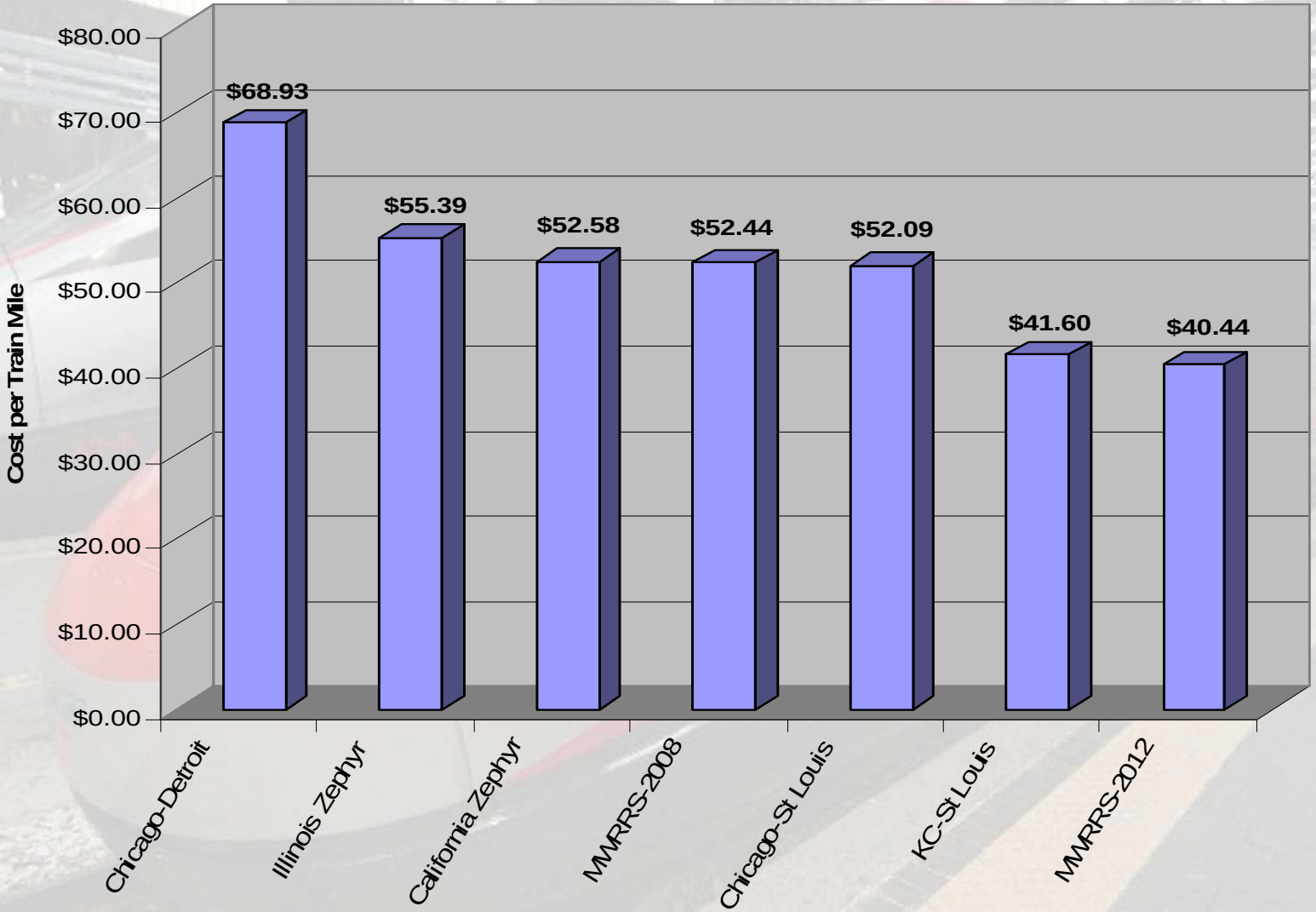
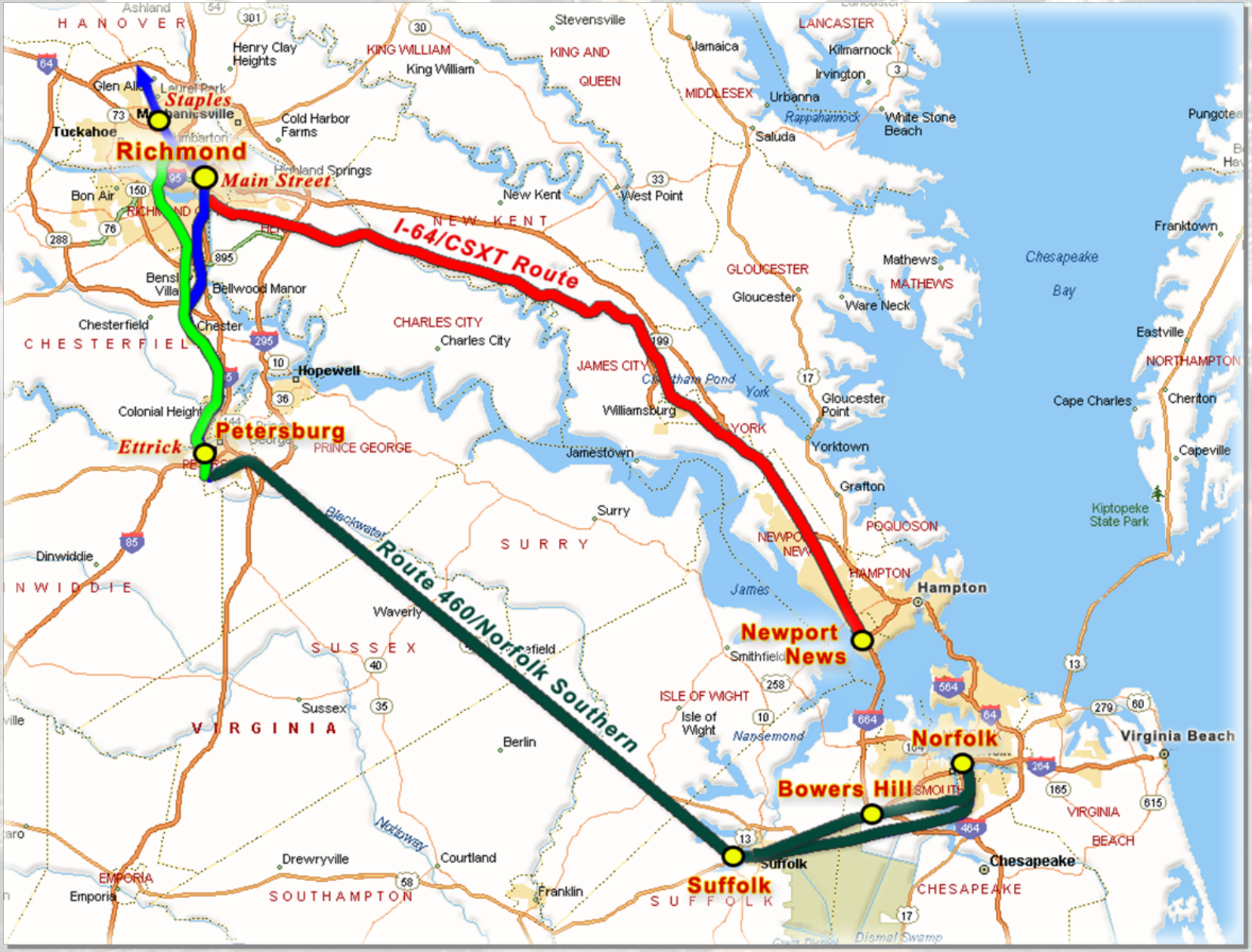


Exhibit 10-22 from MWRRS Report: 1997 Amtrak costs adjusted for inflation to 2002, ***excluding interest and depreciation.***
Source*: Intercity Passenger Rail: Financial Performance of Amtrak's routes*, U.S. General Accounting Office, May 1998.

Capital Costing Considerations

Routes Database



Design Standard Assumptions

Item	79-mph Service	90-mph Service	110-mph Service	150-mph Service
Track	Use Existing Class 4	Upgrade to Class 5 - where required	Construct Class 6	Construct Class 8
Speed Restrictive Geometry	Existing Geometry	Adjusted where feasible	New Geometry and adjusted where feasible	New Geometry
Crossings	Current Protection	Enhanced Protection	All Updated to Quadgates	Grade Separations
Speed Restrictions - Communities	Retained	Retained	Raised to higher levels	Speed Restrictions in Urban Areas
Movable Bridges	Retrofitted for 60 mph	Retrofitted for 60 mph	Retrofitted to 60 mph	Retrofitted to 60 mph
Corridor Protection	No Special Requirements	No Speed Requirements	Corridor is sealed and totally fenced	Corridor is seated and totally fenced
Signal Systems	Existing, Conventional Wayside Block	Replaced and Upgraded CAB or PTC	All New PTC	All New PTC
Double Tracking	As Required	As Required	Dedicated Single Track	All Dedicated Double Track - Electrified
Grade Separation	No new separations considered	No new separations considered	Sealed Corridor	All Grade Separated

Corridor Protection

- **79-90 mph Operation**

  Enhanced Protection

Warning Signs

2 Quadrant Gates

- **110-mph Operation**

  Sealed Corridor

4 Quadrant Warning

Long Arm Gates

- **150-mph Operation**

  Grade Separated

Grade Separated Crossing

Closed Crossing

Library of HSR Unit Costs

- **Extensive development for RMRA (Rocky Mountain) and MWRRI (Midwest)**
- **Peer Reviewed**
  - ✔ Peer Panels
  - ✔ Freight Railroads
  - ✔ Contractors
- **Validation**
  - ✔ Washington, DC to Richmond, VDRPT, 2006

CAPITAL COST CATEGORIES

- **Land and right-of-way**
- **Sub-grade, structures and guideway**
- **Track**
- **Rolling stock**
- **Signals and communications**
- **Electrification**
- **Demolition**
- **Stations**
- **Maintenance and facilities**
- **Highway and railroad crossings**
- **Farm and animal crossings**
- **Pedestrian crossings**
- **Fencing**

Adjust Unit Prices to Regional Conditions and Escalate from 2009 to 2010

- From ENR CCI Analysis, Denver to Hampton Roads is 97%
- Unit Prices developed in 2009 Costs
- Colorado Cost Indices 2009/10 = 1.02
- Regional Adjustment and escalate to 2010

Regional Adjustment Factor = 0.97

Escalation Factor = 0.97 * 1.02 = 0.99

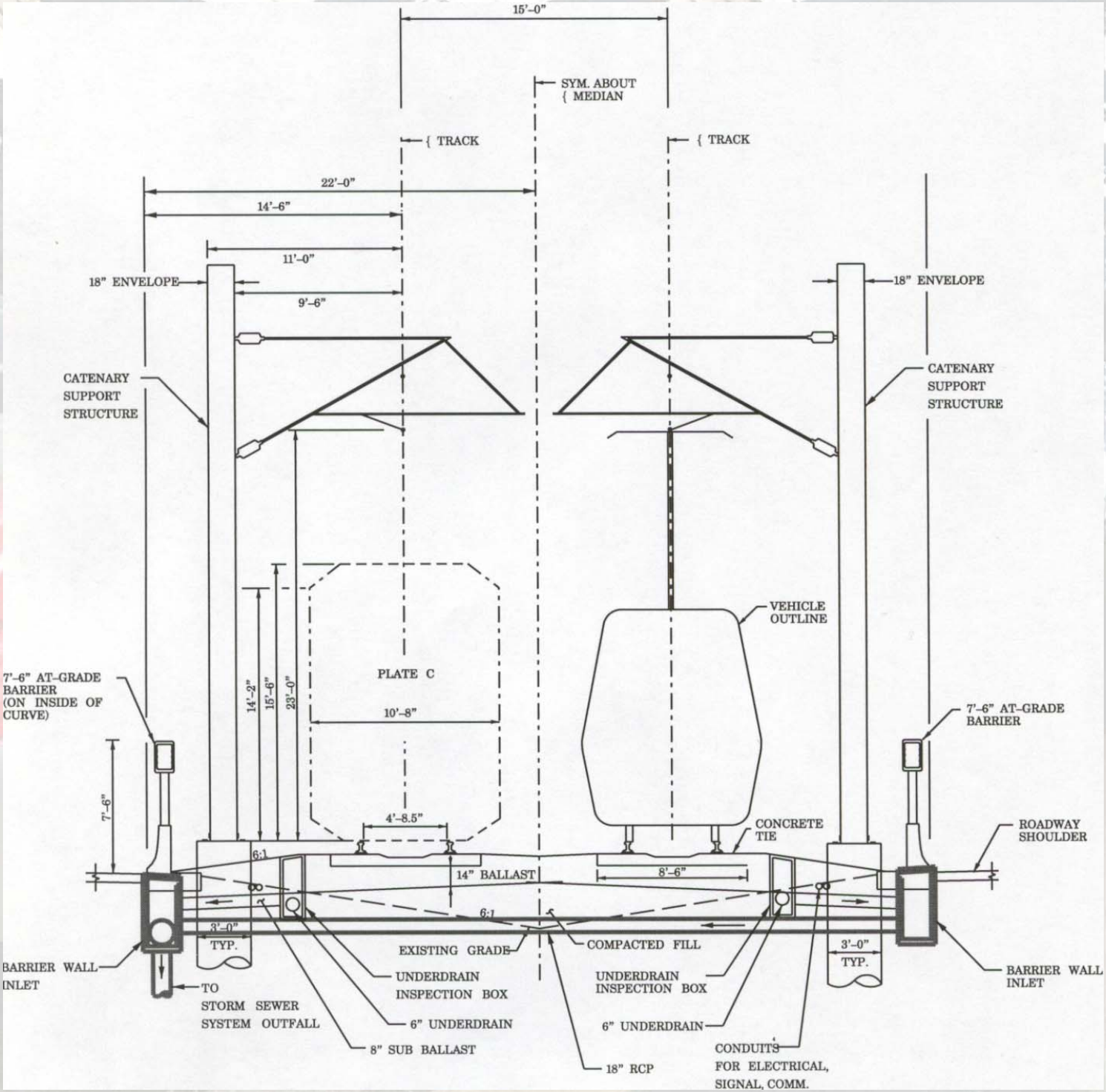
Double Track on Existing Right-of-Way

$3.1 M/mi

Rail Section

Double Track Electrification
$3.1 M/mi

Signals, Communication & Dispatch
$1.5 M/mi



Source: ***Tampa to Miami Feasibility Study***, **Florida High Speed Rail Authority, March, 2003**

Greenfield Rail Corridor

Rural – Flat $18.7 M/mi
Rural – Hilly $35 M/mi

Double Track Retained Earth

$16.5 M/mi

Source: Reinforced Earth Company

Approach Embankment for Double Track

$34.0 M/mi

Source: Reinforced Earth Company

Rail Elevated Structure for Double Track

$41.8 M/mi

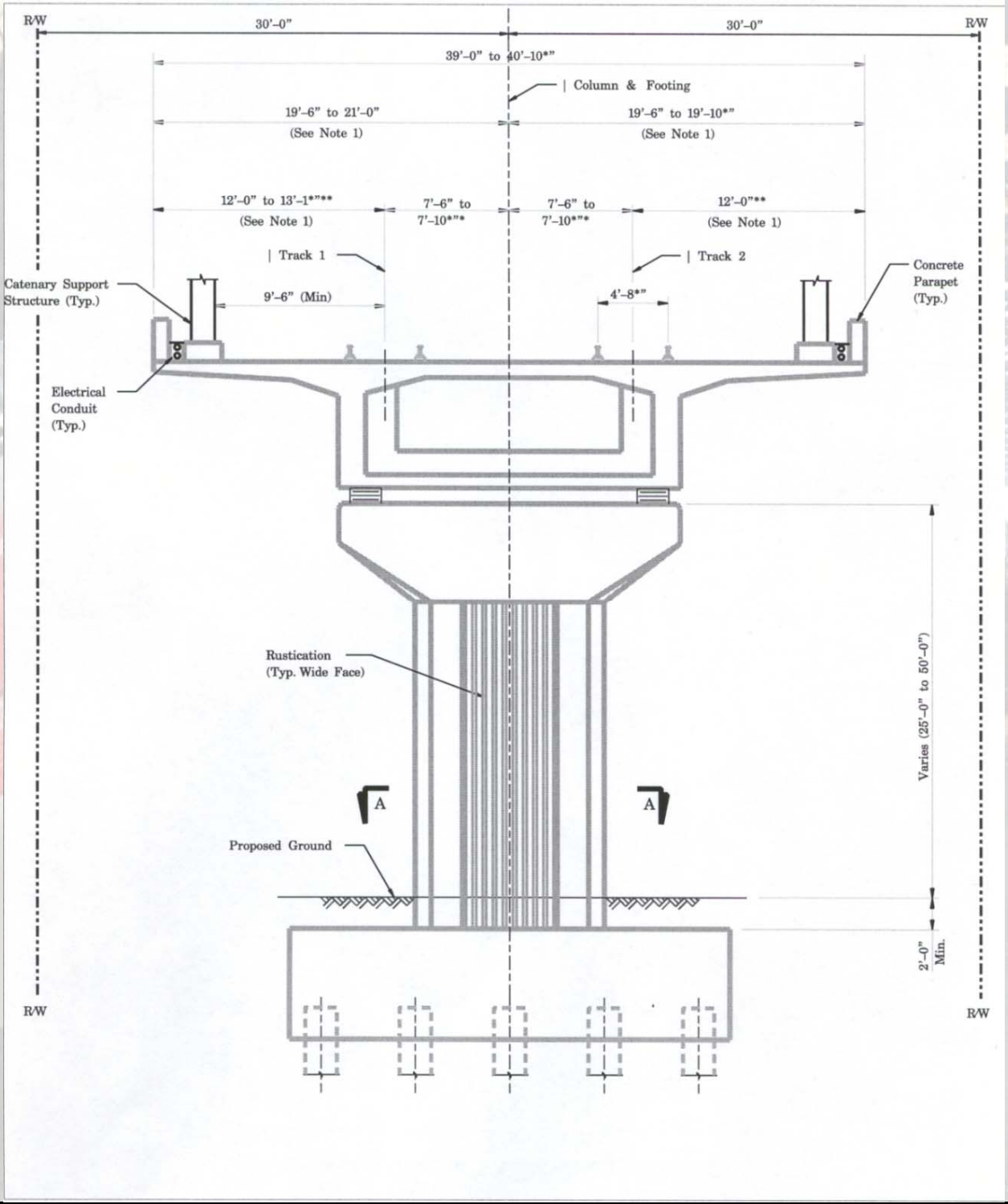
Source: Reinforced Earth Company

Rail Section

High Level Structure

For Double Track

High Level
$75.2 M/mi



Source: ***Tampa to Miami Feasibility Study***, Florida High Speed Rail Authority, March, 2003

Crossing Drivers (< 110-mph) ($M/each)

- **Four Quadrant Gates** **$0.338**
- **Precast Panels & Road Impr** **$0.175**

Cost per crossing **$0.513**

- **Grade separation for speeds greater then 110 mph is required.**
- **Cost of grade separations, in most cases, is greater then $10M.**

Land Acquisition and Utilities Assumptions

- **Rural - $0.25 M/mi**
- **Rural/Suburban Low Density - $0.5 M/mi**
- **Outlying Business/Suburban High Density - $0.6 M/mi**
- **Central Business District - $1.0 M/mi**

❖**Potential Issues**

✓Railroad Rights of Way

✓Property takes

- **Consistent with VDOT Planning Guidelines**

Contingency and Soft Costs – 58%

- Design and Construction Contingency 30%
- Design Engineering 10%
- Insurance and Bonding 2%
- Program Management 4%
- Construction Management & Inspection 6%
- Engineering Services During Construction 2%
- Integrated Testing and Commissioning 2%
- Erosion Control and Water Quality Mgt 2%

Thank You