

Presentation To  
**HRTPO Steering Committee**  
Agenda Item #1



**HRTPO Strategic Campaign  
and Vision Plan for  
Passenger Rail**



Presentation By

*TEMAS*

Transportation Economics & Management Systems, Inc.

March 17, 2010

# Study Timeline

		PHASE 1: Preliminary Vision Plan					
Tasks		Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
<b>Step 1. Study Databank</b>							
Task 1	Study Design	-----					
Task 2	Data Assembly						
	Market Database	-----					
	Stated Preference Survey	-----					
	Sensitivity Data	-----					
	Engineering Database	-----					
	Technology Database	-----					
<b>Step 2. Service Scenarios</b>							
Task 3	Service Scenarios	-----					
<b>Step 3. Interactive Analysis</b>							
Task 4	Interactive Analysis						
	Demand Analysis			-----			
	Sensitivity and Risk Analysis			-----			
	Rail Service Analysis			-----			
<b>Step 4. System Forecasts and Outputs</b>							
Task 5	Ridership and Revenue Forecasts		-----				
Task 6	Operating and Capital Costs		-----				
Task 7	Financial and Economic Feasibility Analysis						
	Financial Analysis				-----		
	Economic Analysis of User / Non-User Benefits				-----		
<b>Step 5. Institutional and Financing Framework</b>							
Task 8	Financing and Funding Arrangements				-----		
Task 9	Institutional Framework	-----			-----		
Task 10	Allocation of Costs and Revenues				-----		
<b>Step 6. Vision Plan</b>							
Task 11	Implementation Plan				-----		
Task 12	Preliminary Vision Plan					-----	
Task 13	Final Vision Plan						
	<b>MEETINGS</b>		●		●		●
	<b>PRESENTATIONS</b>		▲		▲		▲
	<b>MONTHLY PROGRESS REPORTS</b>		■		■		■

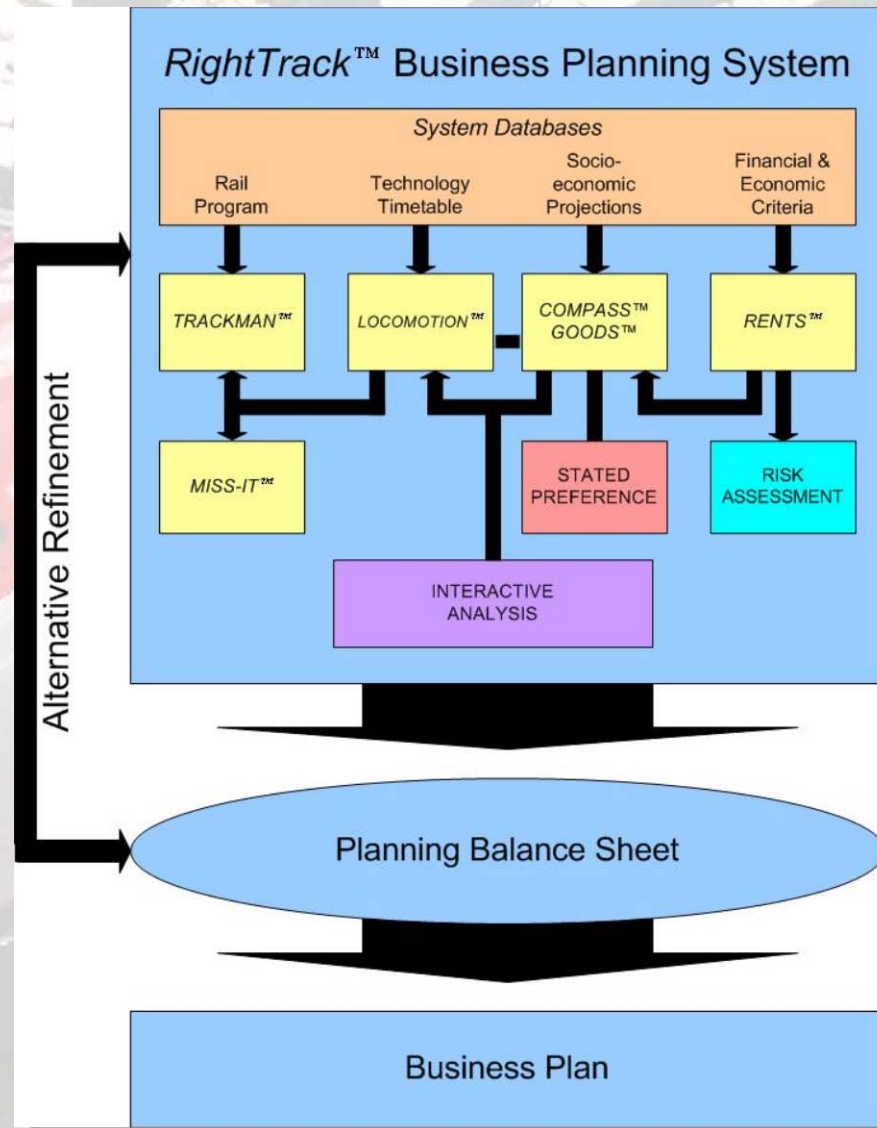
# Service Concepts

- **Base Level Service Concept:** A Higher Speed 79-mph and 90-mph service operating within the context of a “stand alone” or a “Northeast Corridor integrated” service.
- **Improved Service Concepts:** service improvements that would be associated with upgraded track and High Speed 110-mph and/or 150-mph train speeds.

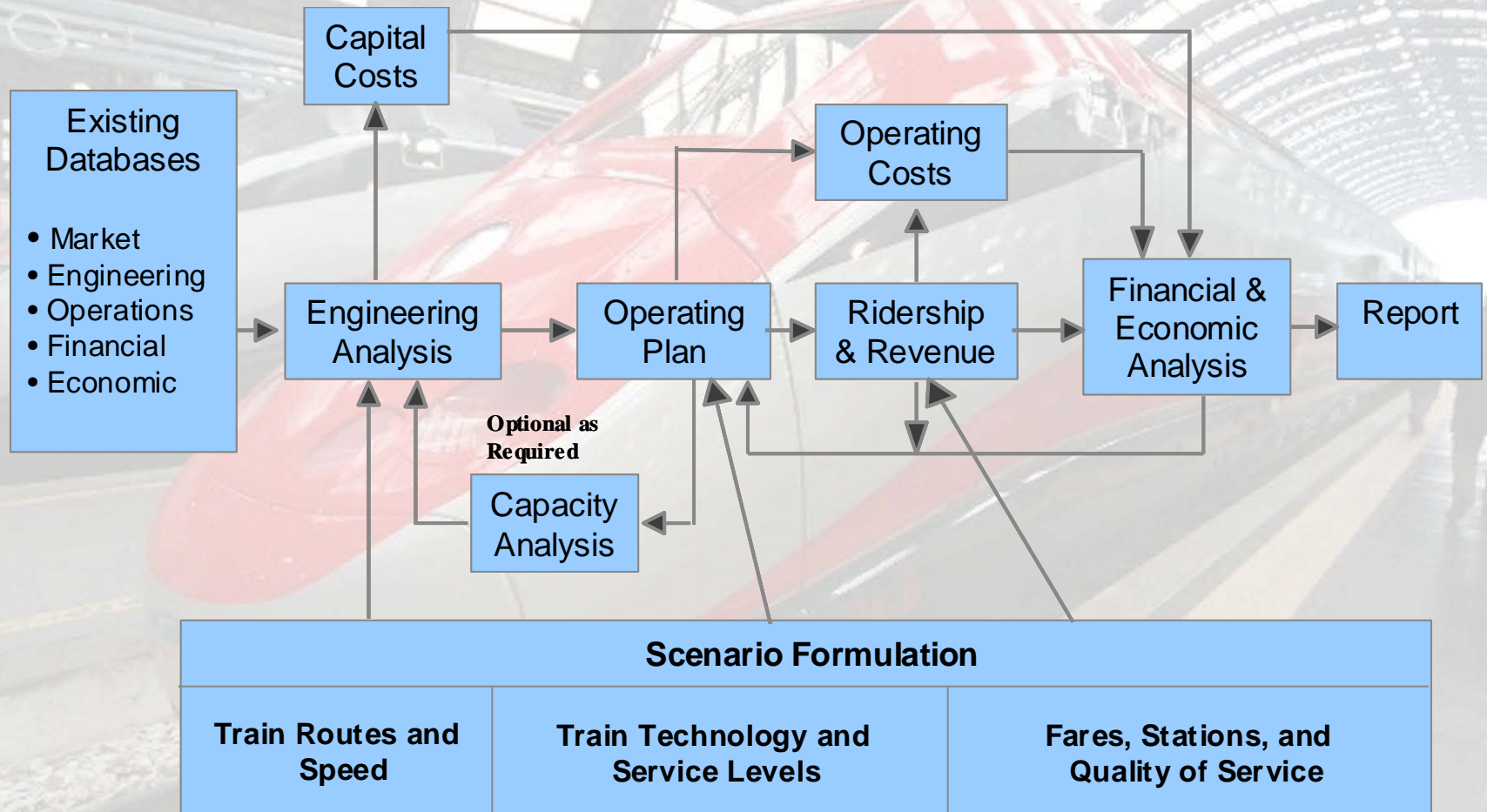
# The RightTrack™ System

## Using the RightTrack™ Business Planning System

An integrated set of programs allowing an **Interactive Analysis** of the specific requirements for any passenger rail technology



# RightTrack™ Interactive Analysis



# Phase 1 Range of Rail Technologies

## Conventional Amfleet



- 79-90 mph
- Diesel
- Non-tilting

## Virgin Voyager



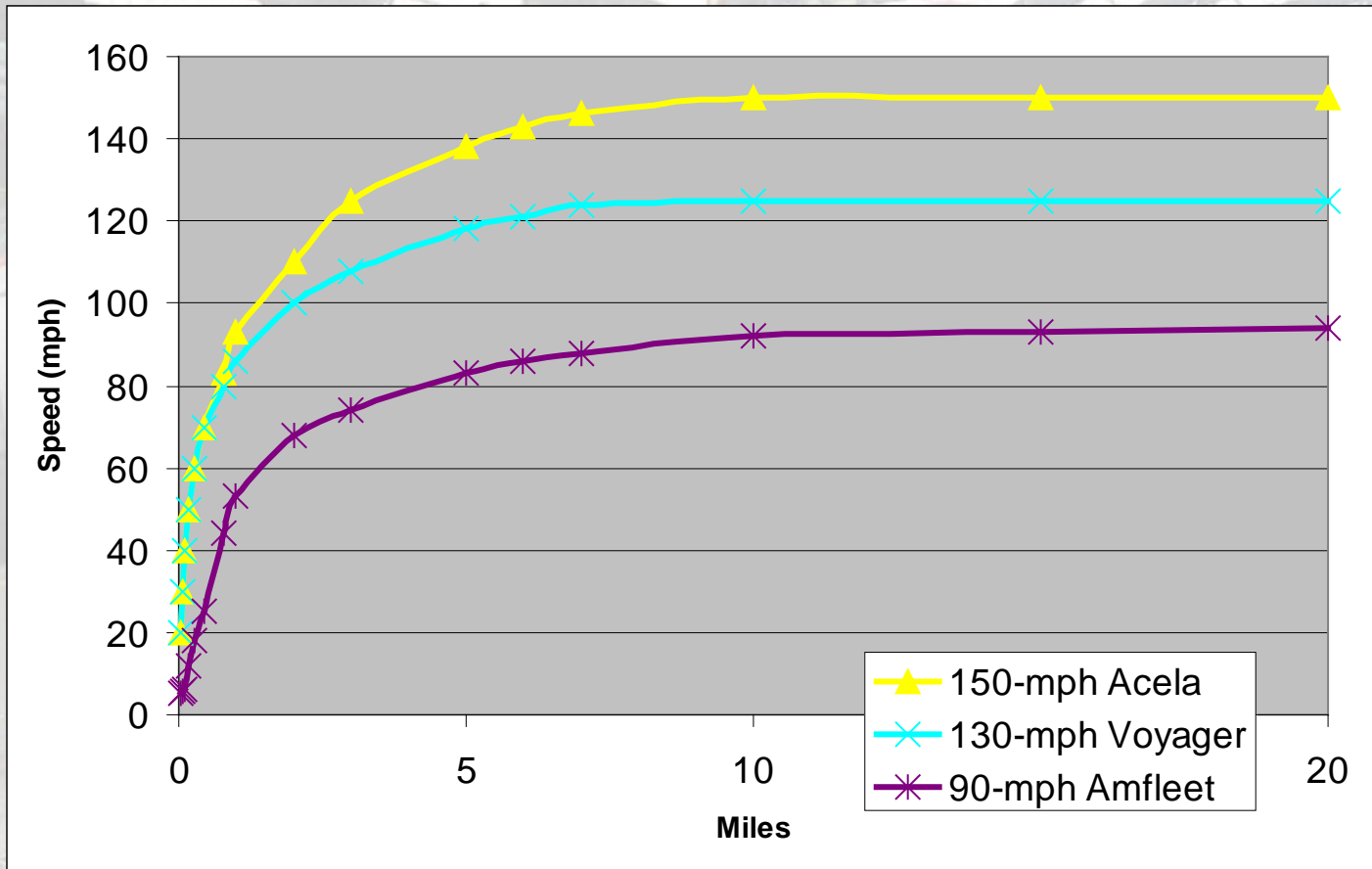
- 110-130 mph
- Diesel
- Tilting

## Amtrak Acela



- 150 mph
- Electric
- Tilting

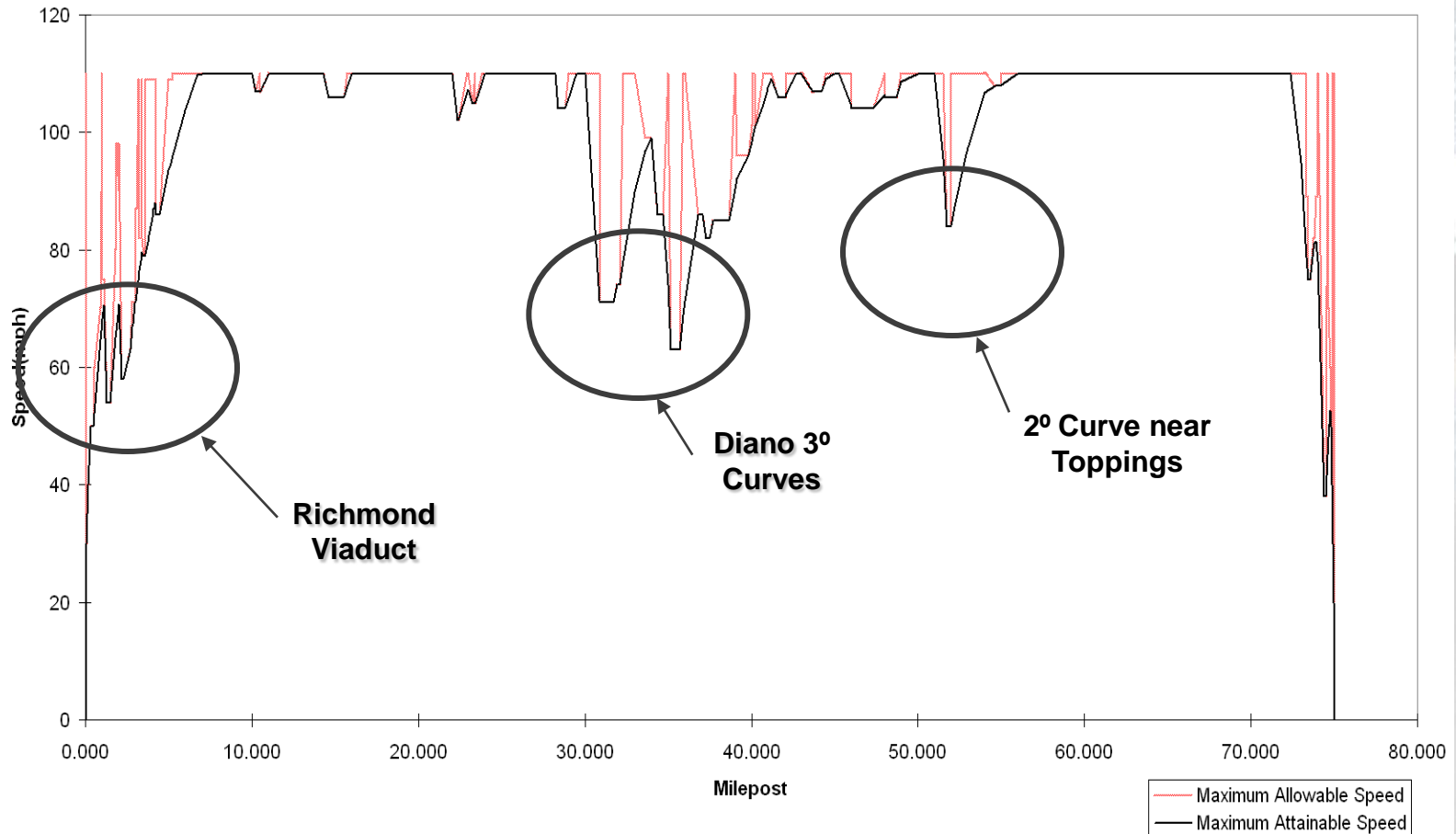
# Comparative Train Acceleration Curves



# Locomotion™ Result: CSX Peninsula Sub

Unconstrained Performance reflecting Curve Speed Limits Only, 110-mph Max

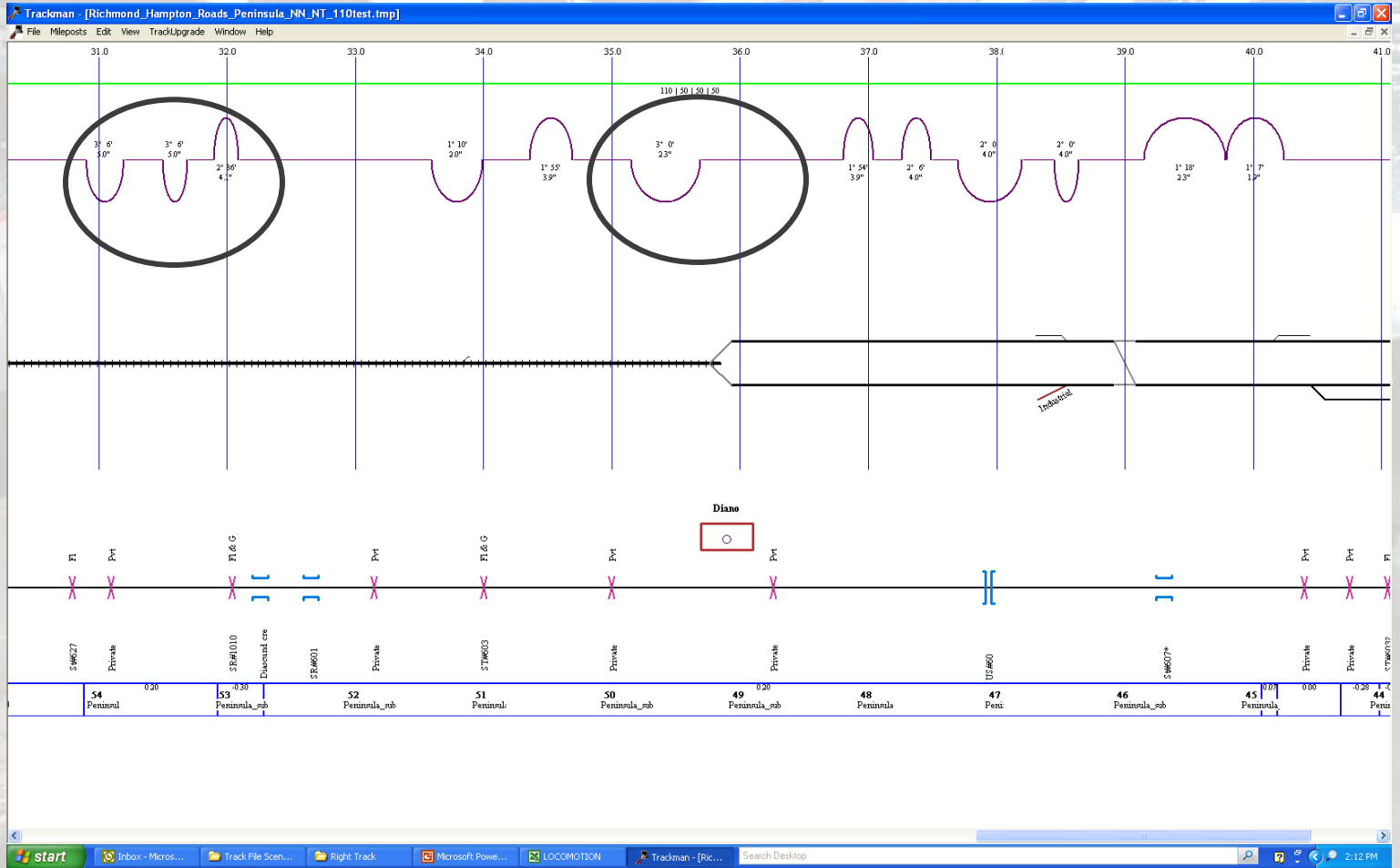
Speed Profile - {Rivanna JCT} to {Proposed Newport News Station} - MWRRS-Bscales





# Trackman™ Chart: CSX Peninsula Sub

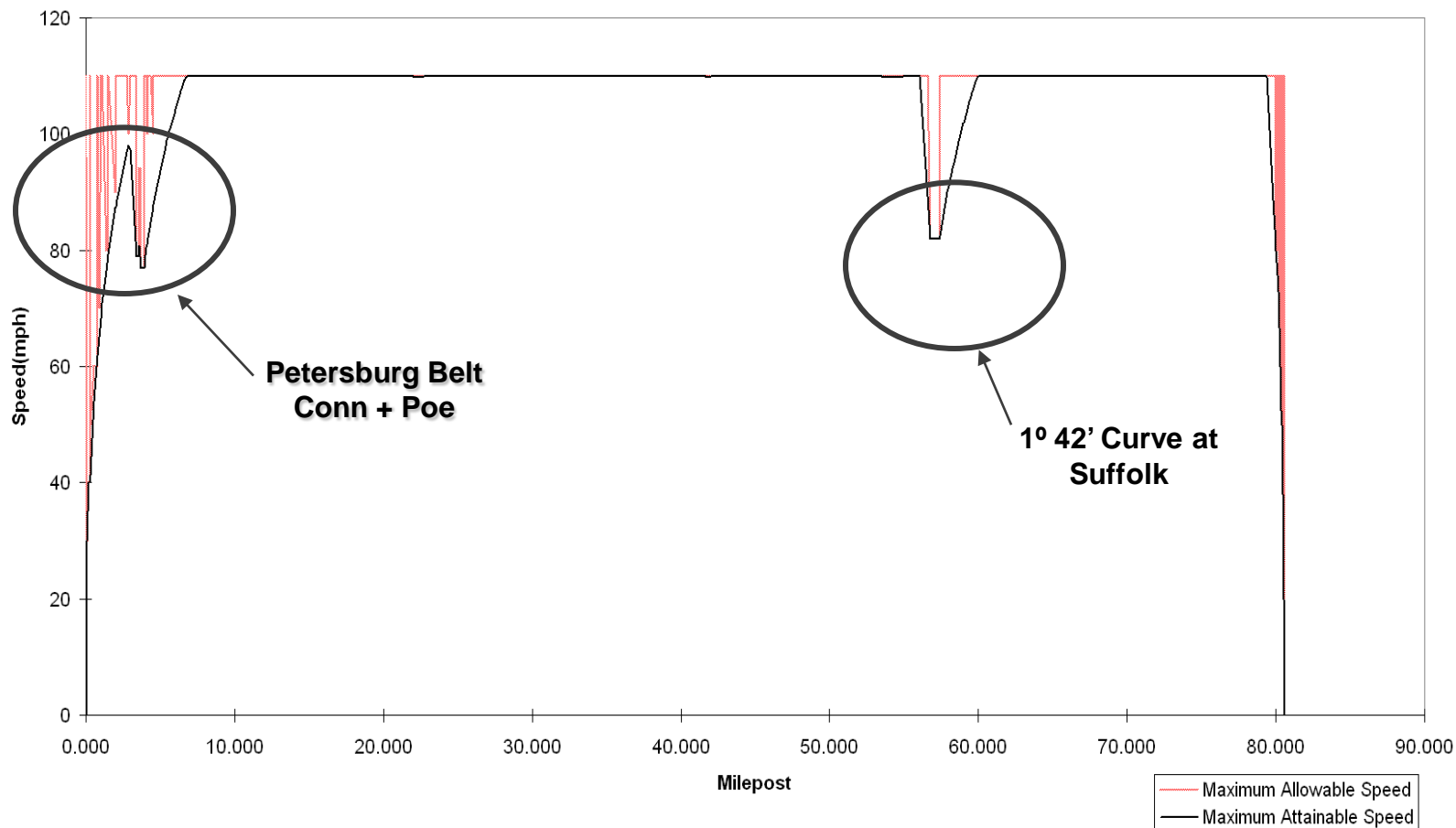
## Showing 3° Curve Cluster at Diano



# Locomotion™ Result: NS Southside

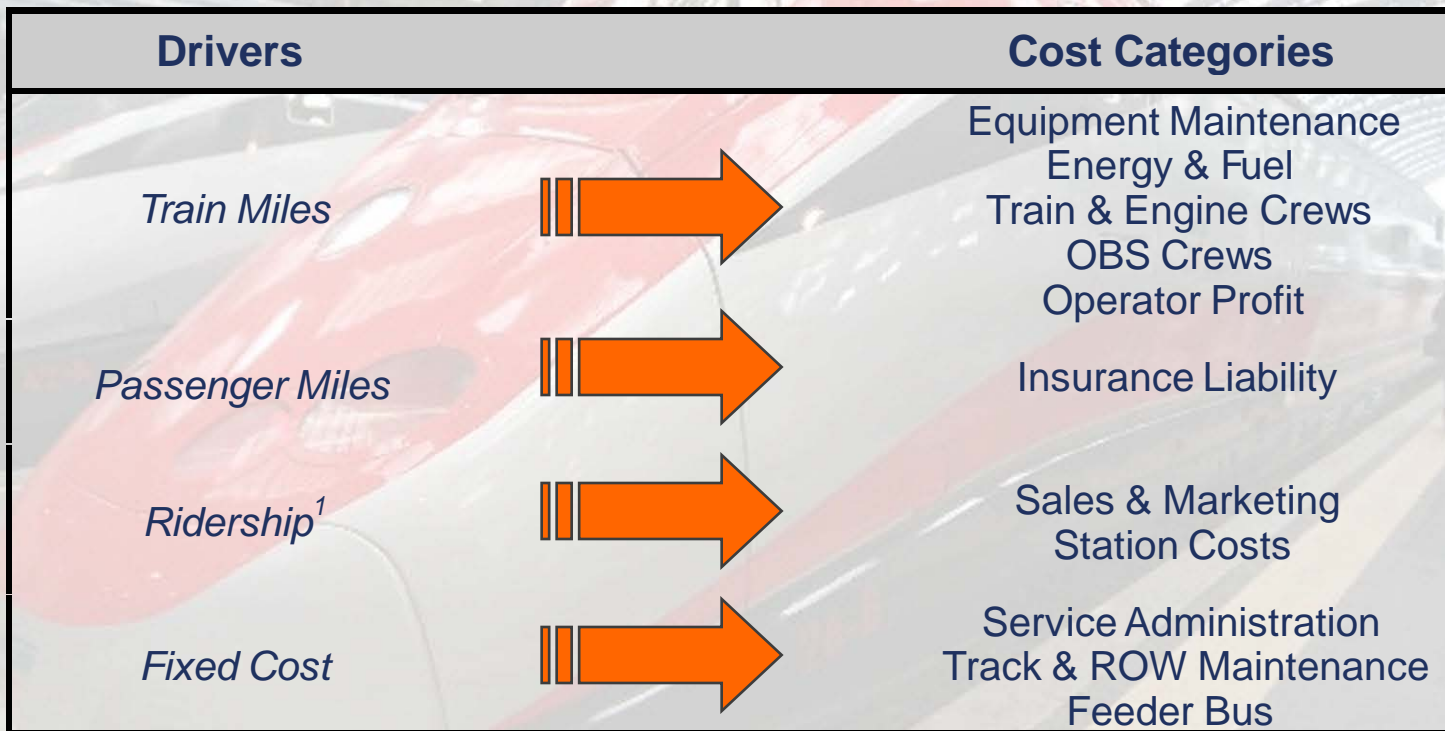
Unconstrained Performance reflecting Curve Speed Limits Only, 110-mph Max

Speed Profile - {Walnut Hill} to {Norfolk (proposed)} - MWRRS-Bscales



# We will estimate Rail Operating Costs

*Framework resulted from previous multi-year, multi-state planning efforts (e.g., MWRRI and Florida Business Plans)*



<sup>1</sup> Station costs as well as sales and marketing are only affected weakly by ridership, so these two costs can be considered fixed for practical purposes.

# We will estimate Rail Capital Costs

## ➤ Capital Costs by Technology/Route

- Land and Right-of-Way
- Sub-grade, Structures, and Guideway
- Track
- Rolling Stock
- Signals and Communications
- Electrification
- Stations
- Maintenance and Facilities
- Highway and Railroad Crossings
- Farm and Animal Crossings
- Pedestrian Crossing
- Fencing

# Demand Model Components

- **Total Demand: Socioeconomic Growth**
- **Induced Demand: Transport Conditions**
- **Mode Choice: Comparative Performance**

# Travel Utility

$$U_{ijp} = f(GC_{ijp})$$

Where

$GC_{ijp}$  = Generalized cost of travel between zones i and j for purpose p

$$GC_{ijmp} = TT_{ijm} + \frac{TC_{ijmp}}{VOT_{mp}} + \frac{VOF_{mp} OH}{VOT_{mp} F_{ijm} C_{ijm}} + \frac{VOR_{mp} \exp(-OTP_{ijm})}{VOT_{mp}}$$

Where

$TT_{ijm}$  = Travel time between zones i and j for mode m (in-vehicle time + waiting time + delay time + connect time + access/egress time + interchange penalty), with waiting, delay, connect and access/egress time multiplied by two to account for the additional disutility felt by travelers for these activities

$TC_{ijmp}$  = Travel cost between zones i and j for mode m and purpose p (fare + access/egress cost for public modes, operating costs for auto)

$VOT_{mp}$  = Value of Time for mode m and purpose p

$VOF_{mp}$  = Value of Frequency for mode m and purpose p

$VOR_{mp}$  = Value of Reliability for mode m and purpose p

$F_{ijm}$  = Frequency in departures per week between zones i and j for mode m

$OH$  = Operating hours per week

$OTP_{ijm}$  = On-time performance for travel between zones i and j for mode m

# Total Demand

$$T_{ijp} = e^{B_{0p}} (SE_{ijp})^{B_{1p}} (U_{jp})^{B_{2p}}$$

Where

$T_{ijp}$  = Volume of trips between zones i and j for purpose p

$SE_{ijp}$  = Socioeconomic variables for zones i and j for purpose p

$U_{ijp}$  = All mode generalized cost of travel for zones i and j for purpose p

$B_{0p}, B_{1p}, B_{2p}$  = Calibration parameters for purpose p

# Modal Split Model

Only two choices exist at each level of the modal split hierarchical structure, a Binary Logit Model is used, as shown in Equation 1:

Equation 1:

$$P_{ijmp} = \frac{\exp(U_{ijmp} / \rho)}{\exp(U_{ijmp} / \rho) + \exp(U_{ijnp} / \rho)}$$

Where,

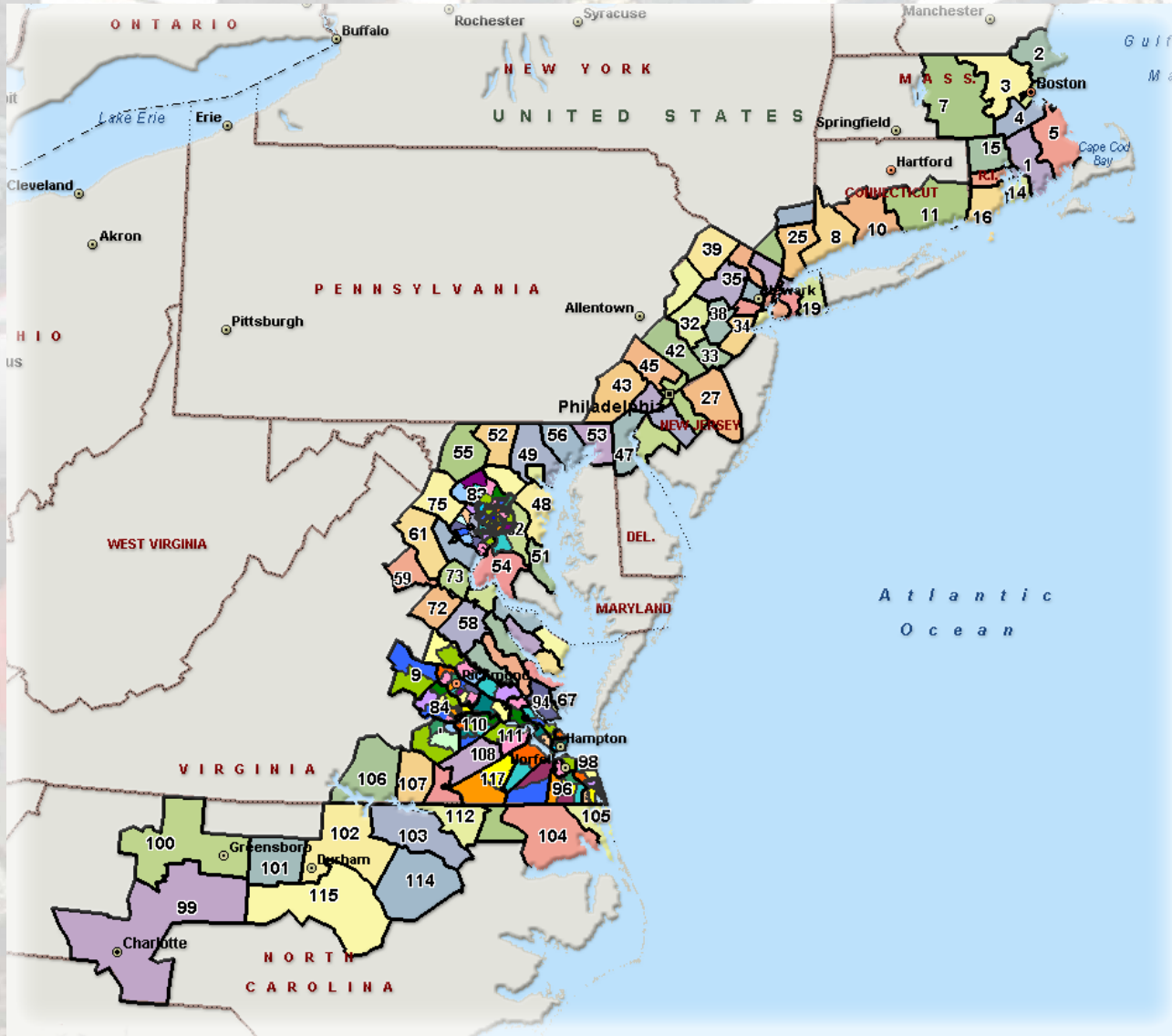
$P_{ijmp}$  = Percentage of trips between zones  $i$  and  $j$  by mode  $m$  for trip purpose  $p$

$U_{ijmp}, U_{ijnp}$  = Utility functions of modes  $m$  and  $n$  between zones  $i$  and  $j$  for trip purpose  $p$  is called the nesting coefficient

In Equation 1, the utility of travel between zones  $i$  and  $j$  by mode  $m$  for trip purpose  $p$  is a function of the generalized cost of travel. Where mode  $m$  is a composite mode (e.g., the surface modes in the third level of the Modal Split Model hierarchy, which consist of the rail and bus modes), the utility of travel, as described below, is derived from the utility of the two or more modes it represents.



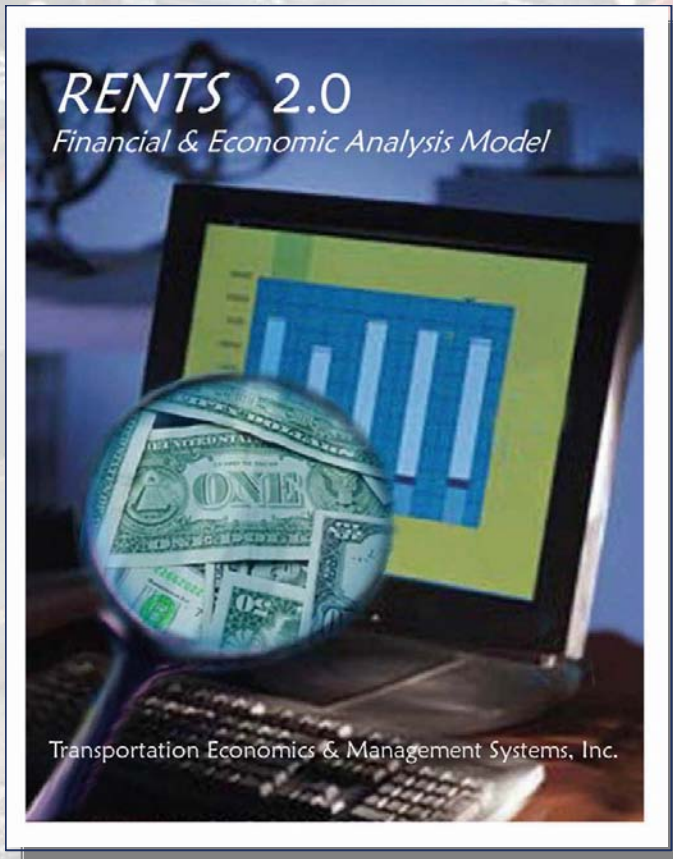
# Preliminary Zone System



# Main Sources for Socioeconomic Database

- 1. Hampton Roads MPO**
- 2. Richmond Area MPO**
- 3. Crater MPO**
- 4. Metropolitan Washington Council of Governments**
- 5. Baltimore Metropolitan Council**
- 6. State Planning Organizations (multiple)**
- 7. Bureau of Economic Analysis**
- 8. U.S. Census Bureau**
- 9. Applied Demographic Solution**

# RENTS™ will determine what technology and routes are financial and economically feasible and meet FRA requirements



**RENTS™** uses output from the **COMPASS™** Demand Forecasting System to estimate the financial and economic benefits of a project. This includes the financial return (Operating Ratio, NPV and IRR), economic return (Gross and Net Consumer Surplus, NPV, and Cost-Benefit Ratio), and Economic Rent, i.e., community benefits (changes in household income, employment by sector, property values, and population) that result from infrastructure and technology improvements or timetable and fare modifications.

# We will provide **Pro forma Financial Analysis**

## 7.5 Pro forma Cash Flows

The pro forma cash flows are shown in Exhibit 7.7 and Exhibit 7.8. These present the forecasted total revenues and operating expense projections for 2012 through 2040. Since these projections are based on the *Back Loaded* capital plan, operations can't start before 2012. This plan includes two years of revenue ramp up at 50% and 90% factors for the first and second years, respectively, so the first year of full operations occurs in 2014\*.

**Exhibit 7.7 Minneapolis to Duluth 110-mph Rail Service: 8-Train Base Plan - Preliminary Operating Statement**

Thousands of 2006 \$	Total to 2040	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
<b>Revenues</b>											
Ticket Revenue	\$1,080,230	\$13,567	\$25,107	\$28,659	\$29,422	\$30,185	\$30,948	\$31,711	\$32,474	\$33,236	\$33,999
On Board Services	\$86,418	\$1,085	\$2,009	\$2,293	\$2,354	\$2,415	\$2,476	\$2,537	\$2,598	\$2,659	\$2,720
Express Parcel Service (Net Rev)	\$54,011	\$678	\$1,255	\$1,433	\$1,471	\$1,509	\$1,547	\$1,586	\$1,624	\$1,662	\$1,700
<b>Total Revenues</b>	<b>\$1,220,660</b>	<b>\$15,331</b>	<b>\$28,371</b>	<b>\$32,385</b>	<b>\$33,247</b>	<b>\$34,109</b>	<b>\$34,971</b>	<b>\$35,833</b>	<b>\$36,695</b>	<b>\$37,557</b>	<b>\$38,419</b>
<b>Train Operating Expenses</b>											
Energy and Fuel	\$75,081	\$2,013	\$2,013	\$2,013	\$2,013	\$2,013	\$2,013	\$2,013	\$2,013	\$2,542	\$2,542
Train Equipment Maintenance	\$204,890	\$5,494	\$5,494	\$5,494	\$5,494	\$5,494	\$5,494	\$5,494	\$5,494	\$6,937	\$6,937
Train Crew	\$96,367	\$3,323	\$3,323	\$3,323	\$3,323	\$3,323	\$3,323	\$3,323	\$3,323	\$3,323	\$3,323
On Board Services	\$80,631	\$1,833	\$2,295	\$2,437	\$2,467	\$2,498	\$2,528	\$2,559	\$2,589	\$2,620	\$2,650
Service Administration	\$147,171	\$5,075	\$5,075	\$5,075	\$5,075	\$5,075	\$5,075	\$5,075	\$5,075	\$5,075	\$5,075
<b>Total Train Operating Expenses</b>	<b>\$604,139</b>	<b>\$17,738</b>	<b>\$18,200</b>	<b>\$18,342</b>	<b>\$18,372</b>	<b>\$18,403</b>	<b>\$18,434</b>	<b>\$18,464</b>	<b>\$18,495</b>	<b>\$20,497</b>	<b>\$20,527</b>
<b>Other Operating Expenses</b>											
Track & ROW Maintenance	\$114,663	\$3,954	\$3,954	\$3,954	\$3,954	\$3,954	\$3,954	\$3,954	\$3,954	\$3,954	\$3,954
Station Costs	\$40,547	\$1,398	\$1,398	\$1,398	\$1,398	\$1,398	\$1,398	\$1,398	\$1,398	\$1,398	\$1,398
Sales & Marketing	\$51,009	\$643	\$1,190	\$1,358	\$1,394	\$1,429	\$1,465	\$1,501	\$1,536	\$1,572	\$1,607
Insurance Liability	\$43,345	\$549	\$1,015	\$1,158	\$1,188	\$1,218	\$1,248	\$1,278	\$1,308	\$1,338	\$1,368
<b>Total Other Operating Expenses</b>	<b>\$249,564</b>	<b>\$6,544</b>	<b>\$7,557</b>	<b>\$7,868</b>	<b>\$7,934</b>	<b>\$7,999</b>	<b>\$8,065</b>	<b>\$8,130</b>	<b>\$8,196</b>	<b>\$8,262</b>	<b>\$8,327</b>
<b>Total Operating Expenses</b>	<b>\$853,703</b>	<b>\$24,283</b>	<b>\$25,757</b>	<b>\$26,210</b>	<b>\$26,306</b>	<b>\$26,402</b>	<b>\$26,498</b>	<b>\$26,594</b>	<b>\$26,690</b>	<b>\$28,758</b>	<b>\$28,854</b>
<b>Cash Flow From Operations</b>	<b>\$366,957</b>	<b>(\$8,952)</b>	<b>\$2,614</b>	<b>\$6,175</b>	<b>\$6,941</b>	<b>\$7,707</b>	<b>\$8,473</b>	<b>\$9,239</b>	<b>\$10,005</b>	<b>\$8,799</b>	<b>\$9,565</b>
<b>Operating Ratio</b>	<b>1.43</b>	<b>0.63</b>	<b>1.10</b>	<b>1.24</b>	<b>1.26</b>	<b>1.29</b>	<b>1.32</b>	<b>1.35</b>	<b>1.37</b>	<b>1.31</b>	<b>1.33</b>

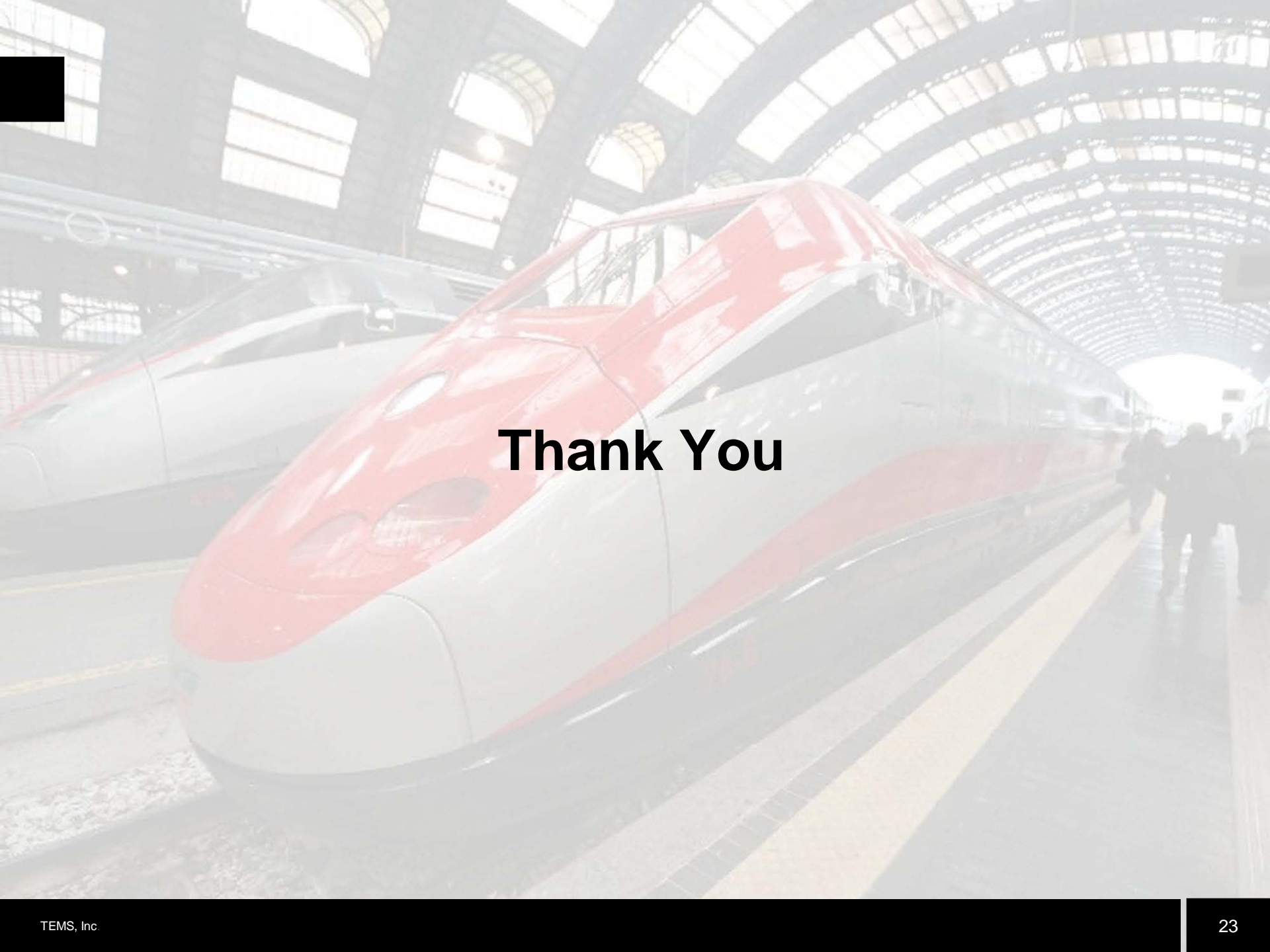
# We will measure USDOT FRA approved economic benefits

Benefits	Billions in 1998 dollars
<b>MWRRS User Benefits</b>	
Consumer Surplus (e.g., time savings expressed as dollars)	\$6.4
System Revenues	\$6.8
<b>Other Mode User Benefits</b>	
Airport Congestion Relief	0.7
Highway Congestion Relief	1.3
<b>Resource Benefits</b>	
Air Carrier Operating Cost Reductions	0.4
Emission Reductions	0.3
<b>Total Benefits</b>	<b>\$15.9</b>
<b>Costs</b>	
Capital	\$4.1
Financing	0.2
Operating and Maintenance	5.0
<b>Total Costs</b>	<b>\$9.3</b>
<b>Ratio of Benefits to Costs</b>	<b>1.7</b>

# Will estimate supplyside community benefits

Economic Rent Factor	110/4	125/4	110/8	125/8
<b>State of Minnesota:</b>				
Employment (# productivity jobs)	5,647	6,409	13,114	13,876
Income (2006\$)	\$252 mill	\$285 mill	\$583 mill	\$616 mill
State Income Tax (2006\$)	\$10.6 mill	\$12.0 mill	\$24.5 mill	\$25.9 mill
Federal Income Tax (2006\$)	\$28.5 mill	\$32.3 mill	\$66.0 mill	\$69.7 mill
Property Value (2006\$)	\$722 mill	\$817 mill	\$1,672 mill	\$1,767 mill
Property Tax (2006\$)	\$ 8.4 mill	\$ 9.5 mill	\$ 19.5 mill	\$ 20.6 mill
Average Household Income (2006\$)	\$167	\$189	\$384	\$406
<b>State of Wisconsin:</b>				
Employment (# productivity jobs)	305	351	719	765
Income (2006\$)	\$15 mill	\$17 mill	\$34 mill	\$37 mill
State Income Tax (2006\$)	\$0.5 mill	\$0.6 mill	\$1.2 mill	\$1.3 mill.
Federal Income Tax (2006\$)	\$1.5 mill	\$1.7 mill	\$3.5 mill	\$3.8 mill
Property Value (2006\$)	\$45 mill	\$52 mill	\$106 mill	\$113 mill
Property Tax (2006\$)	\$ 0.8 mill	\$ 0.9 mill	\$ 1.8 mill	\$ 2.0 mill
Average Household Income (2006\$)	\$102	\$117	\$240	\$255





**Thank You**