Travel Forecasting for Corridor Alternatives Analysis

Purple Line Functional Master Plan
Advisory Group

January 22, 2008

Purpose of Travel Forecasting

- **Problem Definition**
  - Market Analysis
    - Current
    - Future
- **Alternatives Definition and Refinement**
- **Analysis of Alternatives**
  - Transportation Impacts
  - Emissions and Other Environmental Impacts
  - Equity Impacts
- **Financial Analysis**
- **FTA New Starts Criteria Development**

Travel Forecasting

- What it is
- What it isn’t

What is a Travel Forecasting Model?

- **Demographics**
  - Population
    - Location in Traffic Analysis Zones (TAZs)
    - Socio-economic characteristics
  - Employment in Traffic Analysis Zones (TAZs)
    - Location
    - Employment Type
- **Transportation Networks**
  - Roadway & Transit
    - Facility Type
    - Volumes
    - Performance
- **Model Algorithms**
  - Trip: how many; where; by what means and route; and when

How is the Model Created?

- **Information on Travel Behavior**
  - Home Interview Surveys
  - Place of Employment Surveys
- **Information on Travel Patterns**
  - On Board Surveys
  - Vehicle Intercept Surveys
- **Information on Transportation Systems Performance**
  - Travel/Vehicle Counts
  - Speed Measurement
  - Vehicle Occupancy

How is the Model Created?

- **Model Calibration**
  - Trip Generation – How many trips
  - Trip Distribution – Where are they going
  - Mode Split – By what means
  - Path Assignment – By what route
  - Temporal Distribution – At what time of day
- **Validation**

Forecasting the Future

- **Demographic Forecasts**
  - Source: Regional Land Use and Population/Employment Forecasts from Metropolitan Planning Organization
  - For Purple Line Corridor
    - Metropolitan Washington Council of Governments (MWCOG)
    - Maryland National Capital Park & Planning Commission (M-NCPPC)
    - Local Jurisdictions
- **Transportation Networks**
  - State Transportation Capital Program
  - County Transportation Capital Program
  - Committed and Funded Projects
- **For Alternatives Analysis and NEPA**
  - Currently using 2030 Planning Horizon Year

Forecasting Effects of Alternative

- **Define Transit Alternatives**
  - Travel Times/Speeds
  - Service Frequencies
  - Fares
- **Convert into Network Changes**
  - Nodes (Stations)
    - Where travelers enter/leave transit system
    - Means of access and egress
    - TAZ access links & times
    - Wait Times
  - Links (Alignments)
    - How people travel between stations
    - How long does it take – travel times
    - Operating Speeds
    - Dwell times
    - Delay times

Determining Link Speeds

- **Exclusive Operating Conditions**
  - Transit Mode Characteristics
  - Acceleration/Maximum Speed/Deceleration
- **Mixed/Shared Operating Conditions**
  - Transit is affected by prevailing traffic conditions & legal speed limits
  - Synchro -- simulations of current/future traffic conditions
    - Traffic Surveys
    - Traffic Growth
  - Vissum – simulations providing transit/traffic effects

Purple Line Alternatives

- **Transportation System Management (TSM)**
- **Bus Rapid Transit (BRT)**
  - Low/Medium/High Investment Alternatives
- **Light Rail Transit (LRT)**
  - Low/Medium/High Investment Alternatives
- **Degrees of Exclusive (High Capital Investment) versus Mixed (Lower Capital Investment) Operating Conditions**

What We Get Out of the Model -Times

		2007 Car	2007 Transit	2030 No Build (car)	2003 TSM	2030 Low BRT	2030 Med MRT	2030 High BRT	2030 Low LRT	2030 Med LRT	2030 High LRT
SSTC	UM campus	24	26	37	52	32	30	25	31	27	23
SSTC	Bethesda	14*	19	21**	32	22	17	16	11	9	9
SSTC	Takoma-Langley	13	14	21	28	16	14	12	14	12	12
Takoma-Langley	College Park Metro	16	22	24	24	16	16	13	17	15	12
Bethesda	New Carrollton	58***	80 (bus) 55 (metro)	88	108	73	64	57	59	52	46

Car travel times for 2007 were based on actual measured drive times. The times for east and westbound, and morning and evening peak hours were averaged together to come up with one number.

The 2007 transit times are from published schedules. However many of these routes often run far longer than the published times because of the congestion on the roads.

* Via East-West Highway

** Increase in 2030 estimated based on percent increase along other corridors

*** Route represents East-West Highway from Bethesda to SS, Wayne Avenue, Piney Branch, MD 193, Campus Drive, Paint Branch Pkwy, River Rd, Kenilworth, East-West Highway, Veterans Pkwy and Ellin Rd. (Total distance of ~16 miles).

Ridership Forecasts and Cost Estimates

Ridership

- Based on Future Year 2030 Population & Employment Forecasts
- “Travel times” are between New Carrollton and Bethesda
- “Boardings” are the number of riders who would use the Purple Line on a typical weekday
- Ridership (boardings) estimates do not yet include expected trips by University of Maryland students and special event visitors. These forecasts are under development.

Capital Costs

- Estimates in 2007 Dollars; subject to inflation to the time when a project is implemented
- Includes costs to design, manage and construct facilities, acquire right-of-way, and purchase equipment including transit vehicles

Operating and Maintenance (O&M) Costs

- Estimates in 2007 Dollars; subject to inflation to the time when a project starts operating
- Includes costs to operate transit services and maintain the vehicles, facilities, and equipment
- Accounts for adjustments to local bus services

What We Get Out of the Model – Trips

Purple Line Alternatives Preliminary Travel Demand Forecasts & Cost Estimates				
Alternative	**End to End Peak Period Travel Time** (minutes)	**Ridership** (Daily Boardings)	**Capital Costs** (Millions -2007$)	**Operating & Maintenance Costs** (Millions -2007$)
Alternative 2: TSM	108	N/A	$105	$8
BRT				
Alternative 3: Low Investment BRT	73	29,000 - 35000	$450 - 520	$9
Alternative 4: Medium Investment BRT	64	38,000 - 41000	$650 - 750	$9
Alternative 5: High Investment BRT	57	42,000 - 45000	$1,170 - 1,340	$8
LRT				
Alternative 6: Low Investment LRT	59	38,000 - 41,000	$1,160 - 1,330	$20
Alternative 7: Medium Investment LRT	52	42,000 - 45,000	$1,170 - 1,350	$18
Alternative 8: High Investment LRT	46	44,000 - 47,000	$1,580 - 1,790	$17

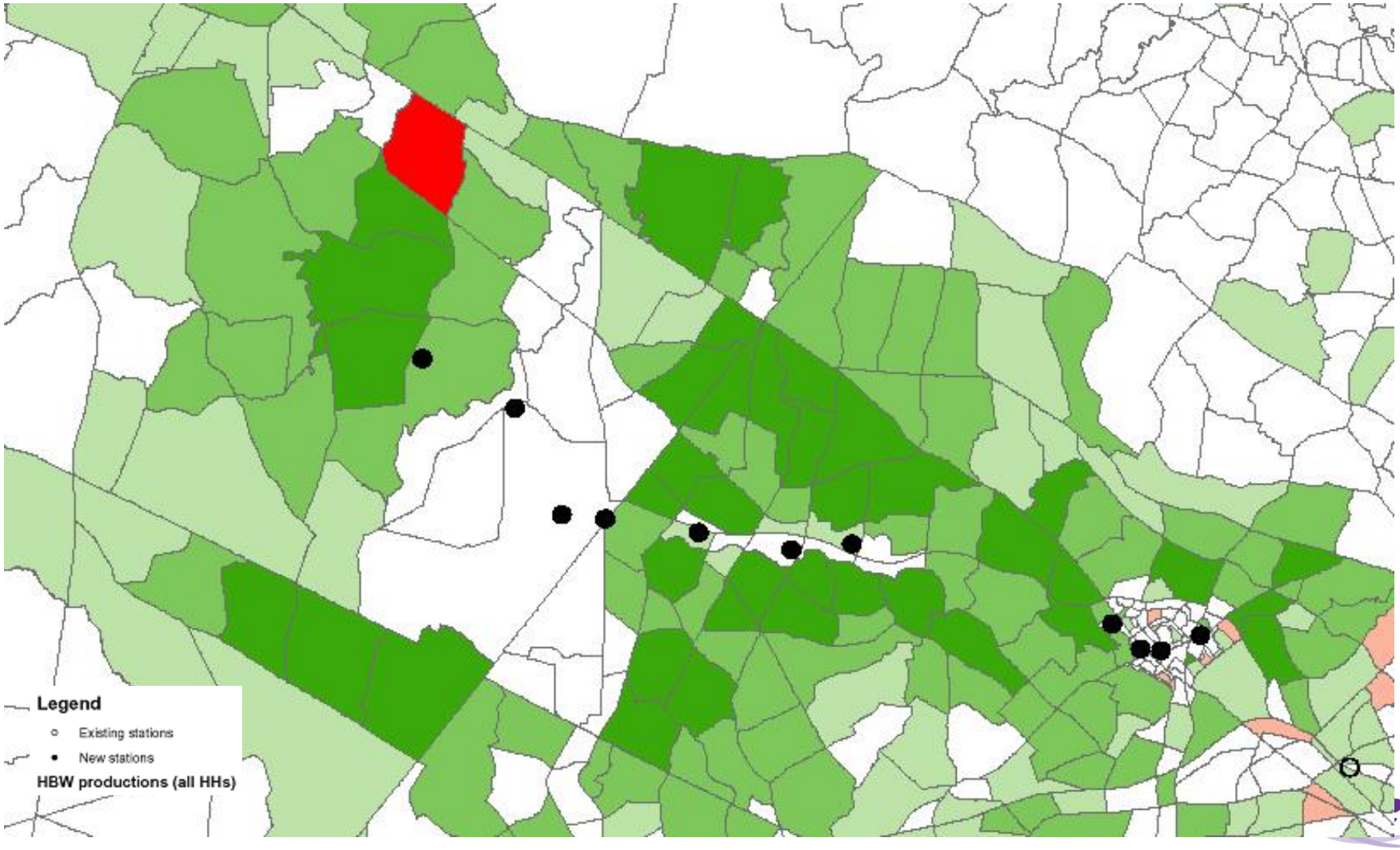
Preliminary estimates; subject to change based on possible refinements to the alternatives.

The Ridership (Daily Boardings) estimates do not yet include expected trips by University of Maryland students and special event visitors. These forecast are under development.

What We Get Out of the Model

- For Various Purposes and Peak/Non - Peak
  - Home Based Work
  - Home Based Other
  - Non-Home Based
- Total Transit Trips
- New Transit Trips (Diverted from Autos)
- Station Boardings / Alightings
- Stations Mode of Access and Egress
- Farebox Revenue
- Transportation System User Benefits (TSUB)
- Transit Route and Highway Volumes

Transportation System User Benefits for Travel Produced in Each Zone



What is Not In Model Yet?

- All University of Maryland Student Trips
- Special Generators Trips

What FTA Is Looking For?

- **A "Good" Model**
  - Developed from Survey Data
  - Industry Standard Structure & Calibration/Validation
  - Based Metropolitan Planning Organization Regional Model
    - Refined for Corridor Level Transit Analysis
- **Market Analysis**
  - Mobility Needs Definition
  - Various Travel Markets
- **Alternatives that Respond**
  - Mobility Needs
  - Corridor Conditions & Features
- **Explainable Forecasts**
  - Change in Travel Patterns
  - Change in Transit Riders
- **Explainable Measures of Effects**
  - Transportation System User Benefits
  - Distribution of Benefits/Effects

Why It Is Important

- Support Development and Evaluation of Alternatives
- Support Explanation of Effects of Alternatives
- Support to Decision Making
- Input to Funding Request
  - FTA New Start Program

FTA New Starts Program

Key Historical Principles of the New Starts Program

- Discretionary transit capital program
  - Federal highway funding is a programmatic allocation
- Legal requirement of alternatives analysis
- Multiple measures for project justification
- Local financial commitment

Program Goals

Fund meritorious projects

- Develop reliable information on project benefits and costs
- Ensure projects treated equitably nationally
- Facilitate communication between FTA, transit industry and Congress

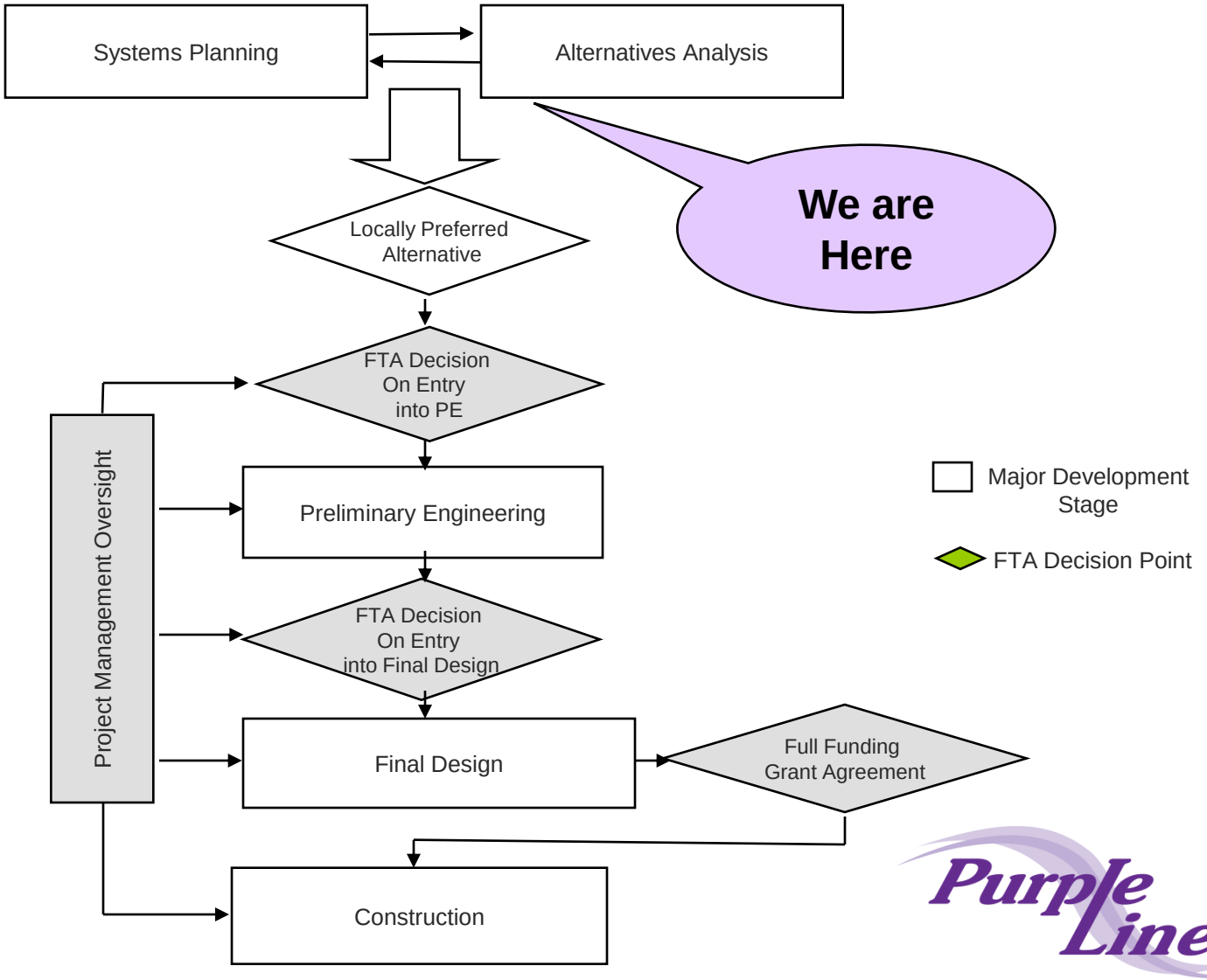
New Starts Evaluation and Oversight

- Among most rigorous in government
- Starts with Request to Initiate PE
- Increasingly credible and important to Congress and local communities
- Program Management Oversight recommended by GAO and OIG

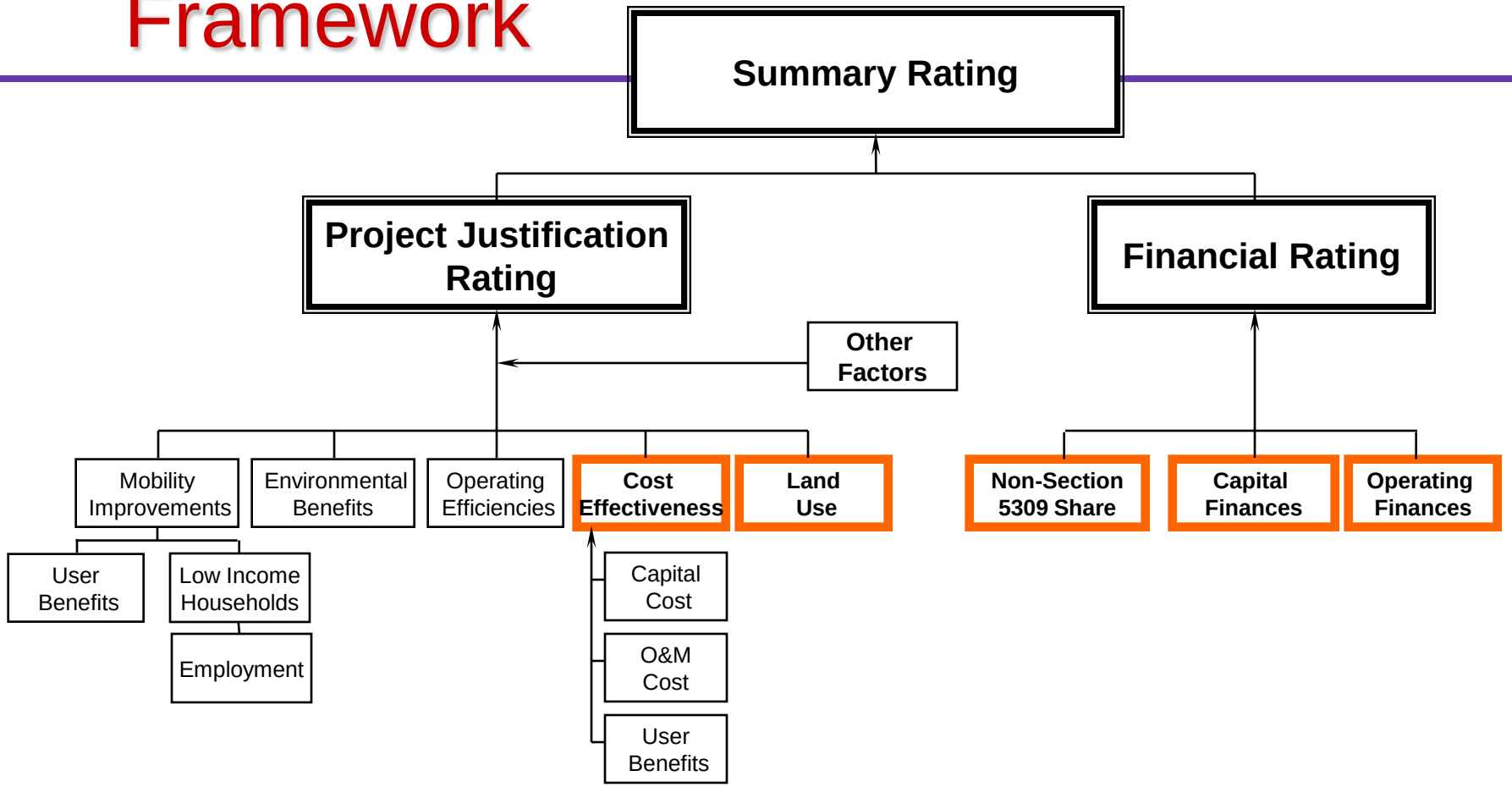
Overall Project Ratings

- “Highly Recommended”, “Recommended”, or “Not Recommended” Rating
- Applied for FTA approvals of Preliminary Engineering, Final Design, and FFGA’s
- Updated for the Annual Report on New Starts
  - Administration’s budget recommendations for congressional appropriations

New Starts Project Development Process



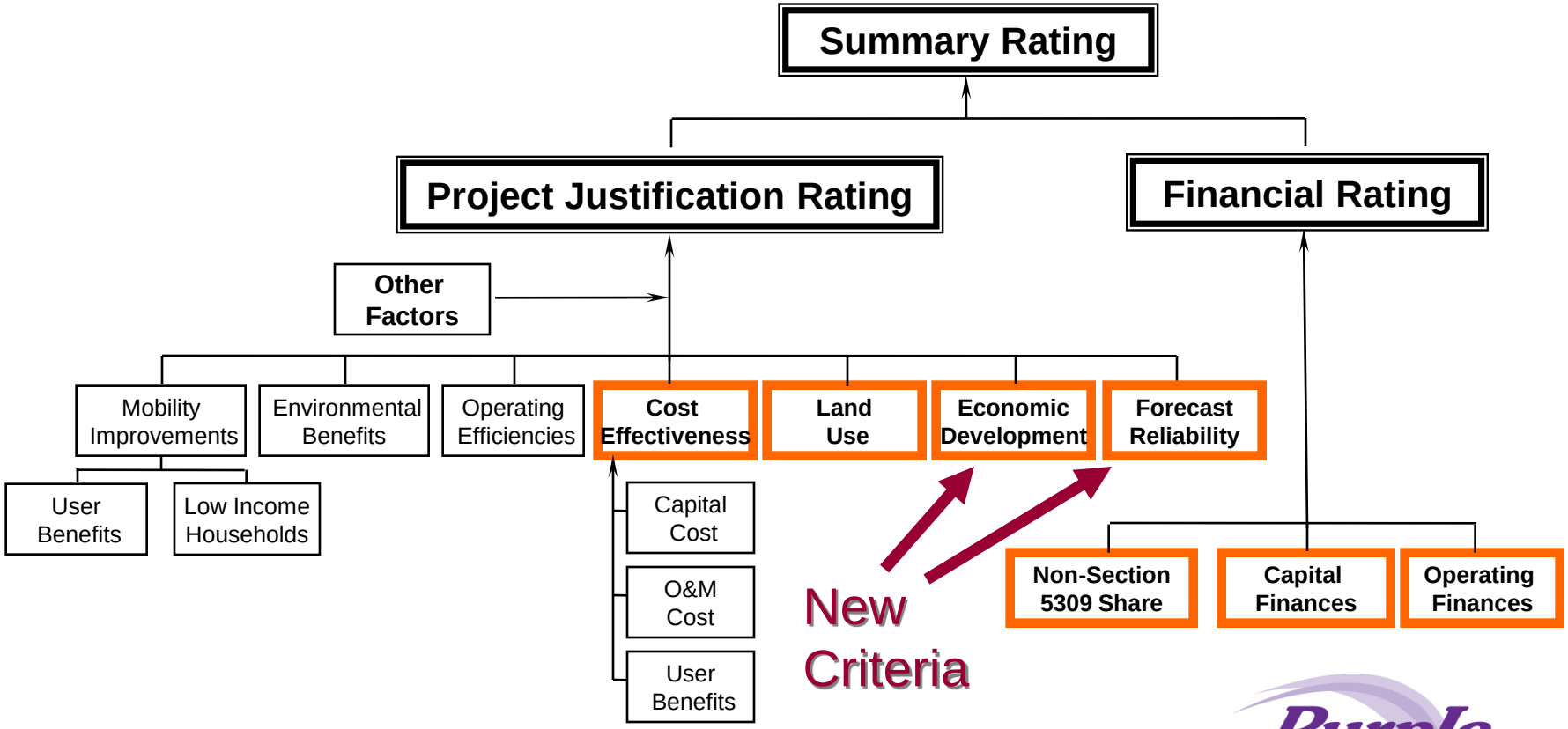
Previous New Starts Evaluation and Rating Framework



Minimum Project Development Requirements:

Metropolitan Planning and Programming Requirements	**Project Management Technical Capability**	**NEPA Approvals**	Other Considerations

Proposed New Starts Evaluation and Rating Framework



New Starts Ratings

- **HIGHLY RECOMMENDED**
  - Project rated at least "medium-high" for both finance and project justification
- **RECOMMENDED**
  - Project rated at least "medium" for both finance and project justification
- **NOT RECOMMENDED**
  - Project not rated at least "medium" for both finance and project justification

Key Issues

- Ridership Forecasts
  - Quality of regional model and input data
  - Alternatives definition including baseline
  - Transportation System Users Benefit (TSUB)
    - SUMMIT Program
- Capital Costs
  - Risk analysis
  - Reporting format
- Funding levels and commitment

Cost Effectiveness Measure

Cost per unit of benefit:

- Annualized incremental capital (federal and local) plus annual operating cost
- Old benefit measure: new transit trips
- New benefit measure: hours of user benefits

Transportation System User Benefits

- Mobility benefits for all travelers
  - Existing transit users
  - New transit users
- Expressed in terms of travel time savings – hours
- Composed principally of travel time savings

Purpose of the Baseline Alternative

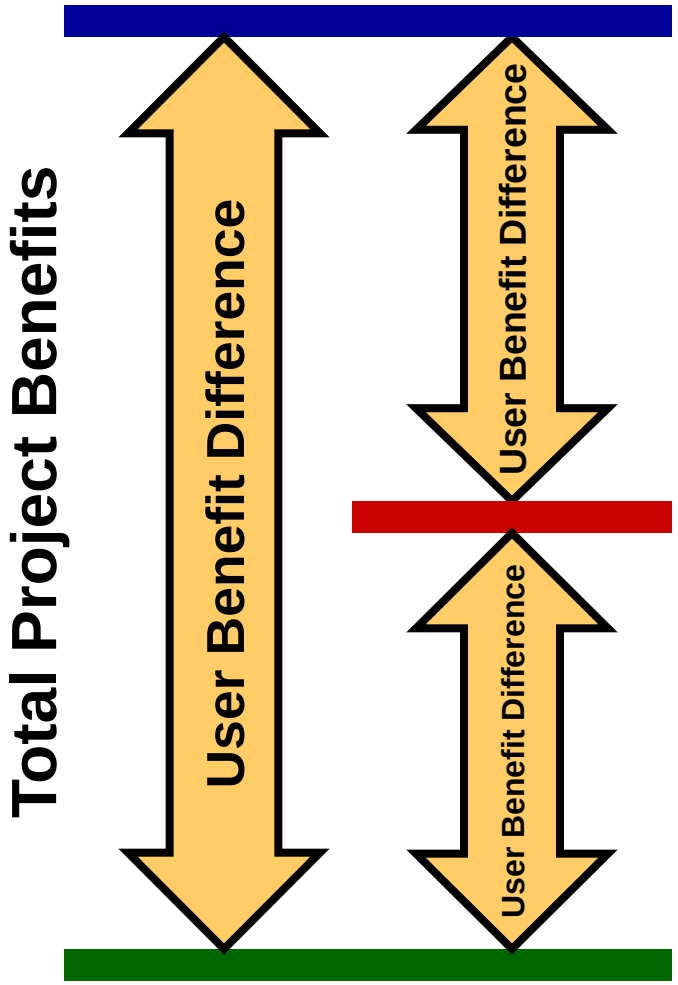
- Basis for comparing New Starts criteria
- Allows for isolation of New Starts project's benefits and costs
- Insures consistency nationally

FTA'S Purpose for Baseline

Project

Future Baseline

Future No Build



Benefits of Guideway Investment

Benefits of Service Improvements

Purple Line

FTA Cost Effectiveness Formula

$$C/E = \frac{\triangle \text{Annualized Costs}}{\triangle \text{User Benefits}}$$

Annualized Costs = Equivalent Annualized Capital Cost + Annual Operating Cost

$\triangle$ = Difference between Build Project and Baseline Alternative

FTA Cost Effectiveness Formula

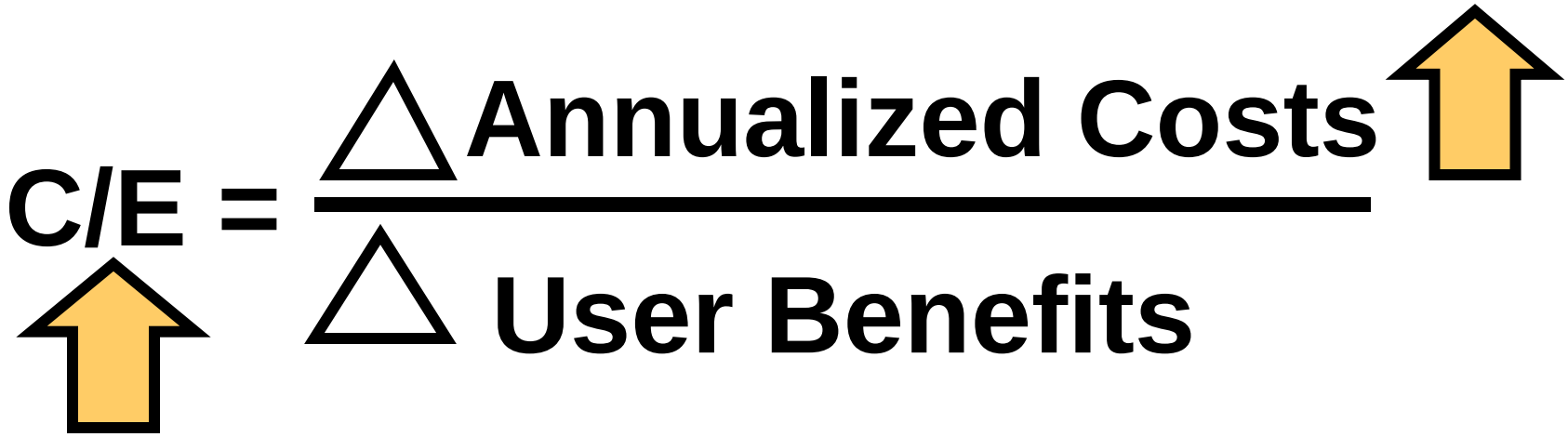
$$C/E = \frac{\triangle \text{Annualized Costs}}{\triangle \text{User Benefits}}$$

As User Benefits Goes Down, C/E Goes Up

Annualized Costs = Equivalent Annualized Capital Cost + Annual Operating Cost

△ = Difference between Build Project and Baseline Alternative

FTA Cost Effectiveness Formula



As Cost Goes Up,
C/E Goes Up

Annualized Costs = Equivalent Annualized Capital Cost + Annual Operating Cost

△ = Difference between Build Project and Baseline Alternative

Cost-Effectiveness

- Rating Values:
  - Low >$30.00 per hour
  - Medium-low $24.00 - $30.00 per hour
  - Medium $15.50 - **$24.00 per hour**
  - Medium-high $12.00 - $15.50 per hour
  - High < $12.00 per hour

Local Financial Commitment

Performance Measures:

- Proposed Local Share of Project Costs
- Stability and Reliability of Capital Financing
- Stability and Reliability of Operating Funds