6. Standard Reporting/QC

- FTA requirements for New Starts
- Implementation
- Thoughts on good practice

FTA Requirements

- Standard Summit reports
  - No-Build (2030) versus “today” *
  - TSM alternative versus No-build
  - Build alternative versus TSM alternative
  - Build opening year versus “today” *
- QC reports
  - Tests on (1) project and (2) IVT *
  - Template on “Travel Forecasts”
- Transit assignment results *

* = new in 2008

Purpose

- Enable routine quality control
- Support a coherent story for the project
  - How is 2030 different from today?
  - What would TSM accomplish?
  - How much more would the project do?
  - What would the project do in its opening year?

Changes over Time: Reports

- No-Build versus Today
- Build Opening Year versus Today

1.0 Demographics
2.0 Travel patterns
3.0 Travel times
4.0 Transit trips
5.0 Transit shares

1.0 Demographics

- General format
  - By district
  - Totals, absolute delta, relative delta
- Contents

  1.1 Population characteristics

  1.2 Employment characteristics

  1.3 Supporting statistics

Supporting Statistics

- Relationships between variables
  - Household size, workers per person, densities, parking costs, pop/emp ratio, etc.
- Checks on trip generation
  - Δ population versus Δ trip productions
  - Δ employment versus Δ trip attractions

2.0 Person Trips

- General format
  - District-to-district
  - Totals, absolute delta, relative delta
- Contents

  2.1 Total person trips

  2.2 Home-based work person trips

  2.3 Other person trips (as needed)

3.0 Travel Times

- General format
  - – District-to-district
  - – Peak and off-peak
  - – Averages, relative delta
- Contents
  - 3.1 Highway travel time
  - 3.2 Transit in-vehicle time
  - 3.3 Transit total weighted time

Travel Time Calculations

- Calculations
  - District-to-district aggregation of skims
  - Divided by district-to-district I-J cells
- Impedances
  - Highway: drive-alone time
  - Transit: “best” walk access path
  - Transit cells: <u>path available in both years</u>

4.0 Transit Trips

- General format
  - District-to-district
  - Totals, absolute delta, relative delta
- Contents

  4.1 Total transit trips (all modes)

  4.2 Home-based work transit trips

  4.3 Other transit trips *(as needed)*

  4.4 Guideway trips (by purpose, *as needed*)

5.0 Transit Shares

- General format
  - District-to-district
  - Totals, absolute delta, relative delta
- Contents

  5.1 Home-based work transit shares

  5.2 Other transit shares *(as needed)*

  5.3 Guideway shares (by purpose, *as needed*)

Changes between Alternatives: Reports

- TSM versus No-Build
- Build versus TSM
- Contents for <u>each</u> mode choice run

    1.0 Transit trips

    2.0 User benefits

1.0 Transit Trips

- General format
  - District-to-district
  - Totals, absolute delta, relative delta
- Contents for each mode choice run

  1.1 Transit trips

  1.2 Transit trips by "transit dependents"

  1.3 Guideway transit trips (as needed)

2.0 User Benefits

- General format
  – District-to-district
- Contents for each mode choice run

  2.1 Total user benefits

  2.2 User benefits accruing to "transit dependents"

2.0 User Benefits (cont.)

2.3 User benefits accruing to "base" riders

- "Base" = TSM for 2030 Build versus TSM
- "Base" = No-Build for 2030 TSM versus No-Build

2.4 "Base" riders' share of user benefits

2.5 Negative user benefits

2.6 Negative user benefits as a share of total

2.0 User Benefits (cont.)

2.7 Stratified tables

- Build alternative transit trips by change in transit price, separately for CW-CW and MD-MD

2.8 Frequency distributions

- Build transit trips by change in transit price
- User benefits by change in transit price
- All eight (8) access combinations

2.9 Thematic maps of user benefits by zone for (1) productions and (2) attractions

Quality Control

- Summit QC impacts in 2002
  - Errors in models
  - Errors in service plans
  - Errors in transit network coding
  - Base|Build coverage inconsistencies
- FTA analyses
  - User benefits unrelated to the project
  - User benefits other than transit IVT deltas

routine

case by case

Quality Control Report 1

- Share of UBs directly related to project
  1. Best paths by transit access (walk, drive)
  2. UBs based on local models & best paths
  3. I-J cells with path on the project (0/1)
  4. UBs in I-J cells with project paths
  5. Project UB share = step4 UBs / step2 UBs
- Summit district-to-district reports
- Project UB share < 80% → 'splaining

Quality Control Report 2

- Share of UBs caused by Δ transit IVT
  6. With best paths from Report 1: replace guideway-path IVT with IVT from baseline alternative
  7. Rerun mode choice and Summit
  8. IVT UB share = step2 UBs / best-path UBs
- Summit district-to-district reports
- ΔIVT share < 80% → 'splaining

Example: Honolulu Fixed Guideway

Honolulu Bench Test		User Benefits on I-J Paths Using the Project				User Benefits Lost by Setting IVT(Guideway) = IVT(TSM)		
		Headways of Local Bus Lines				Headways of Local Bus Lines		
		x 0.50	x 0.75	x 1.00		x 0.50	x 0.75	x 1.00
Rail Headway	1 minute	66%	75%	91%		32%	40%	55%
	3 minutes	64%	73%	90%		32%	42%	58%
	6 minutes	60%	70%	90%		33%	43%	64%

(highlighted) = as planned

Travel Forecast Template Inputs by Trip Purpose

- Daily transit trips, base and build
- Daily person trips (base = build)
- Daily hours of user benefits (UBs)
- Positive UB hours from coverage changes
  - MD-CW, NT-CW and NT-MD groups
- Daily hours of UBs changed by capping
- Daily hours of UBs for transit dependents

Travel Forecast Template Inputs for Special Markets

- Project trips per event day
- UB hours per event day
- Transit passenger miles per event day
- Number of event days per year

Travel Forecast Template
Other Inputs

- Daily project trips
  - Standard purposes, no special markets
  - Lowest socio-economic class (representation of transit dependents)
- Daily project passenger miles
  - Standard purposes, no special markets
  - Transit dependents
- Project length (miles)
- Annualization factor (days/year)

Travel Forecast Template Outputs-Standard Purposes

- Daily new transit trips
  - % distribution of total new transit trips
- % distribution of daily UBs
- % distribution of daily baseline transit trips
- % UBs lost to capping
- % UBs accruing to lowest socio-economic class

Travel Forecast Template Outputs-Special Markets

- % distribution of total new special-market annual transit trips
- % distribution of total special-market annual UBs
- Minutes of UBs per project trip

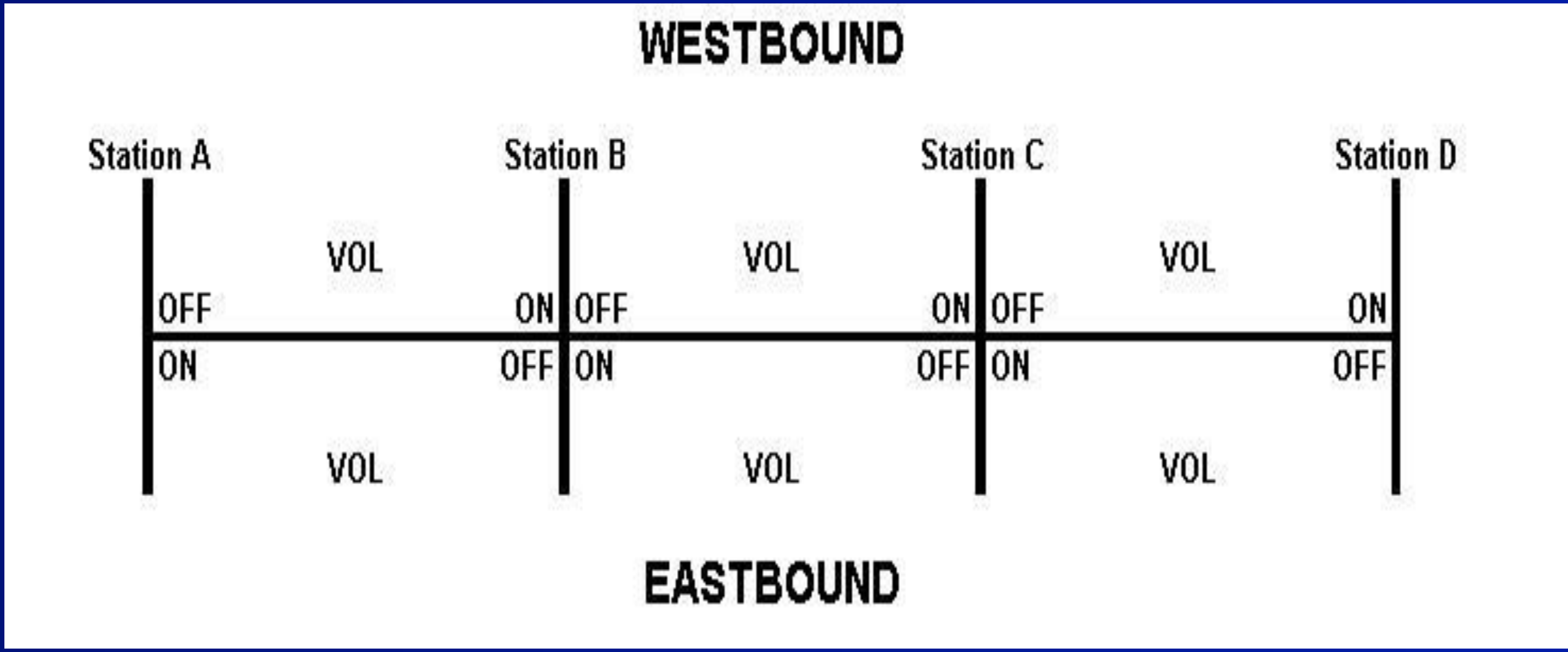
Travel Forecast Template Outputs-Quality Control Checks

- Minutes of UBs per daily project trip
  - Before capping
  - After capping
- % UBs coverage related
- % UBs from special markets
- % of project trips that are new transit trips
- Project's average trip distance / project length

Transit Assignment Results

- Production/attraction format
- Total riders (linked trips) and boardings (unlinked trips) by mode
- Guideway station ONs and OFFs by direction and mode of access
- Directional transit rider load volumes between stations
- Station to station transit riders

Ons, Offs, and Load Volumes



Mode of Access by Station

	Mode of Access					Mode of Egress		
	Walk	Bus	PnR	KnR	Total	Walk	Bus	Total
Station A								
Station B								
Station C								
Station D								
TOTAL								

Thoughts on Good Practice

- Boundaries for summary districts
- Changes over time
- Changes between alternatives
- Thematic maps
- Desire-line plots

Summit Districts

- Generally, between 15 and 20 for reporting
- Smaller near project; larger elsewhere
- Thematic maps of UBs → district boundaries
- Corridor (for making-the-case discussion)
  - Aggregations of districts
  - Perhaps immediate and broader corridors
- Different structures for special analysis

Changes over Time

- Identify/justify very high or very low % changes
- Comparisons to observed growth trends
- Roadway and transit supply checks
- Roadway and transit speed checks
- Transit passenger PMT and PHT checks

Changes between Alternatives

- Identify/justify large changes in zone to zone mode shares
- Examine zone-to-zone pairs with major negative user benefits or high “per rider” positive user benefits

Thematic Maps

- Zonal population, employment, trip end and transit mode share changes
- User benefits per impacted transit trip production or attraction
- Percent of zone's transit riders with a change in user benefits
- Positives separate from negatives

Desire Line Plots

- District-to-district “bandwidth” lines for those pairs representing 25, 50, and 75% of all user benefits
- District-to-district lines for those pairs with some zone-to-zone negative benefits

7. Lifting the Cap

- FTA requirements for New Starts
- Background
- Analytical approach to adjusting the cap

FTA Requirements

- Cap on per-trip transit user benefits
  - Applied to CW-CW and MD-MD trips I-J
  - ("Off-diagonal" UBs handled separately)
  - Standard cap = ±45 weighted minutes
- FTA adjustment of cap
  - Case-by-case consideration
  - Based on demonstration of actual project benefits > 45 weighted minutes/trip

Background

- The creature from the swamp – 2002
  - Early Summit testing of 12-15 projects
  - Large problems with <u>most</u> forecasts
    - Model properties (bizarre guideway constants)
    - Alternatives (inconsistent baselines)
  - Prospect of few rated projects in 2002
  - "Cap" to salvage <u>some</u> project ratings
    - Model-related problems → large UB/trip
    - No pending New Starts decision

Background

- Near-term application
  - Adjust/remove cap where appropriate
  - Criteria
    - Large project-caused user benefits per trip
    - Absence of large spurious benefits
- Longer-term FTA aspiration
  - The swamp dries up
  - The creature moves away

} Soon?

Analytical Approach

- Sources of benefits
  - Based on best paths, Base and Build
  - Computation of time savings
    - TS_{tot} = build transit trips x ($imped_{bas}$ – $imped_{bld}$)
    - TS_{ivt} = build transit trips x (IVT_{bas} – IVT_{bld})

      where: imped = total weighted impedance

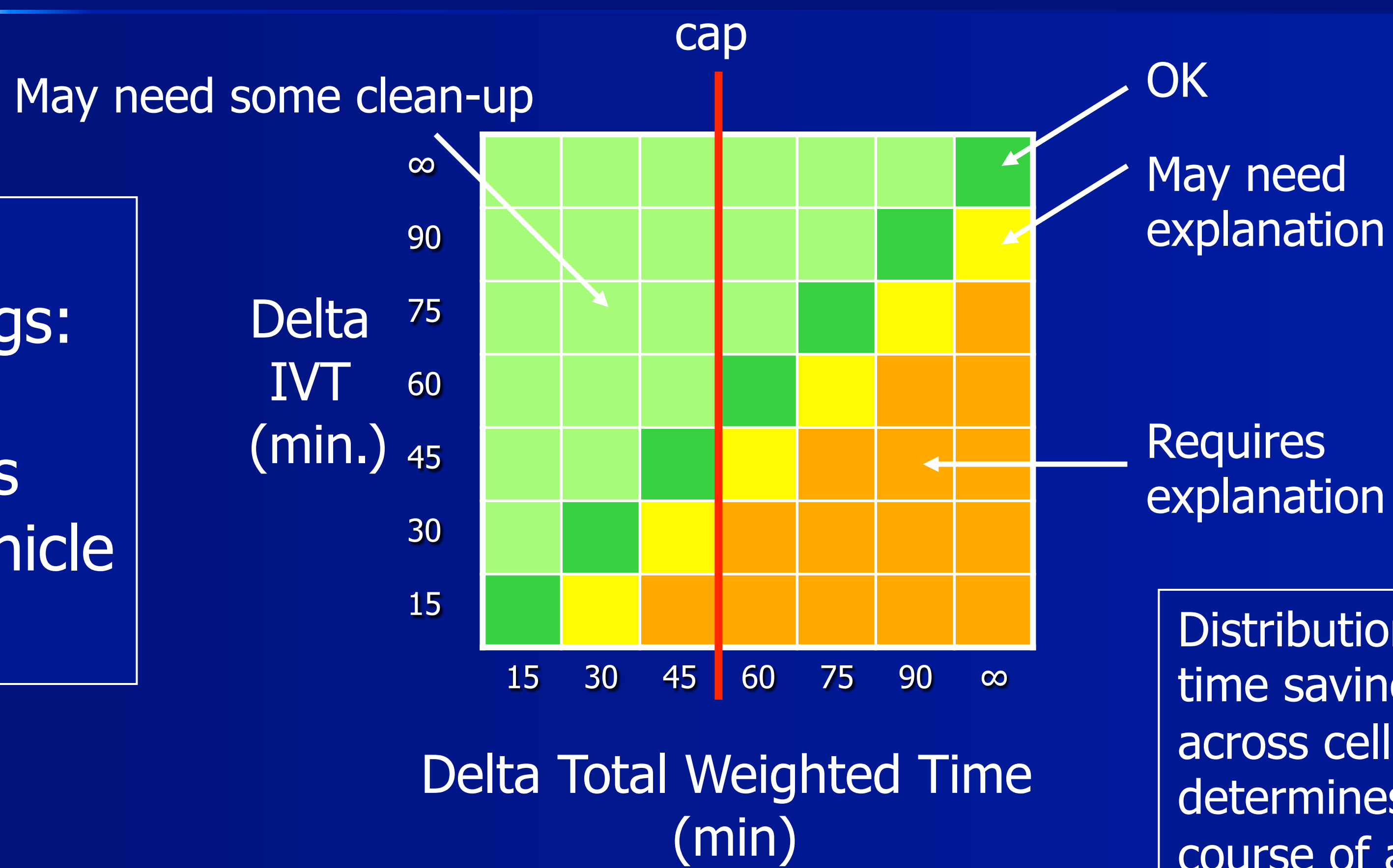
      IVT = in-vehicle time

Analytical Approach

- Inspection of time savings
  - Total versus IVT-caused
  - Fraction on I-J paths on project
  - D-to-D trips with large per-trip time savings
  - Detailed analysis of illustrative paths
- Anticipated outcome
  - ΔIVT *usually* the cause of most benefits
  - Project in path for most benefits

Analytical Approach

Time Savings: Total versus In-Vehicle Time



Distribution of time savings across cells determines course of action

Analytical Approach

- Implementation
  - Custom-written programs
  - Reporting features of forecasting software?
  - Summit
- Track record on cap increases
  - Largely IVT-caused: yes increased for all
  - Largely service-policy caused: no
  - Largely walk/xfer caused: yes

- Example: NY East-Side Access
  - – Long Island Railroad
  - – Now: to Penn Station only
  - – Project: also to Grand Central Station
  - – Analysis → No cap
    - ~All 45+minute changes to east side
    - ~All had much shorter walks, many fewer xfers
    - IVT changes contributed a modest share of UBs

Summary

- Cap exists to ward off swamp creatures
- Projects with large per-trip UBs
  - Demonstration of real project causes
  - Usually ΔIVT, but not always
- Soon(?): routine QC of forecasts will eliminate need to cap

8. CTPP-based QC Forecasts

- FTA requirements for New Starts
- Background
- Application
- Examples

FTA Requirements

- No requirement for sketch QC forecast
- Other relevant requirements
  - Plausible forecasts
  - Analysis of uncertainties
- Potentially desirable applications
  - Starter lines
  - Unfortunate track records

Background

- Motivation – to learn from experience
  - New Starts projects over the past 20 years
  - Presumption of available insights
  - Simple model: markets → ridership experience
- Purpose – to provide a:
  - Synthesis of accumulated general experience
  - Readily available & consistent method and data
  - *Low-cost source of a <u>second</u> number*
  - *Way to address entirely new park/ride options*

Background

- Aggregate Rail Ridership Forecasting (ARRF) Model
  - Sponsored by FTA; developed by AECOM
  - Based on recently built projects
    - Light rail (11 projects)
    - Commuter rail (9 projects)

ARRF – Key Elements

1. CTPP → $workers_{ij}$
2. GIS → $workers_{ij}$ served by rail line
   - Home buffers:
     - 6 mi. PNR station
     - 2 mi. other station
   - Work buffers: walk 1 mi.
3. Model → total $riders_{ij}$ on rail

ARRF – Key Elements (cont'd)

- LRT model
  - Total $riders_{ij}$ on rail = function of
    - $Workers_{ij}$
    - Workplace density
    - Direction length of LRT line

ARRF – Key Elements (cont'd)

- CR model
  - Total $riders_{ij}$ on rail = function of
    - $Workers_{ij}$ by income class
    - Average system speed
    - Train-miles per mile
    - Connection to fixed-guideway distributor

Application

1. Obtain basic input files
2. Determine the socio-economic characteristics of the geography
3. Prepare the CTPP Part 3 flow data
4. Determine the relationships between rail stations & geography
5. Run *RailMarket* program to determine the number of work for both live & work nearby rail stations
6. Enter the information from *RailMarket* into the model spreadsheet

Application

- Aggregate test of reasonableness
  - Guideway ridership only
  - Worker-flows as proxy for overall markets
- Not a replacement for local models
  - Unique markets and transit contexts
  - Locally defined purpose and need
  - *Ridership potential ≠ project merit*

Materials Available from FTA

- Detailed documentation
  - Part-1: Model Application Guide
  - Part-2: Input Data Development Guide
  - Part-3: Model Calibration Report
- *RailMarket* program
- Spreadsheets: LRT and CR
- Nazrul.Islam@dot.gov

Example ARRF Applications

- Five Examples
  - David Schmitt, AECOM Consult
- Three Examples
  - Yasasvi Popuri, Cambridge Systematics

ARRF Applications

Dave Schmitt
AECOM Consult

Applications – City A

- New rail line between CBD and suburban activity centers; strong corridor bus ridership & service
- Compared ARRF LRT model with travel demand model results
- Results
  - ARRF LRT model results were 100% higher than travel demand model estimates
  - Stronger motivation to investigate transit model parameters; subsequently identified issues with walk- and auto-access connector methodology

Applications – City A (cont'd)

- Conclusions
  - ARRF model may partially explain attractiveness of rail over existing bus service
  - TDM path-builder probably better at evaluating bus/rail competition:
    - Equal service levels for bus & rail
    - Buses are just as close or closer to corridor activity centers

Applications – City B

- New rail line between CBD and suburban residential areas
- Used ARRF to develop rationale for alternative-specific constant
- Results on next slide…

Ridership Forecasts – City B

	Walk	Drive/ Drop-Off	Total
ARRF	14,794	6,548	21,342
TDM Model (no bias)	11,520	4,556	16,076
TDM Model (7.5 minute walk, 15 minute drive)	13,145	6,341	19,487
TDM Model (10 minute walk, 15 minute drive)	14,770	6,277	21,047

Applications – City C

- Streetcar in low density urban activity center; existing service is local & primarily captive market
- ARRF LRT model compared with travel demand model (2000 trip tables, 2030 networks)

Applications – City C (cont'd)

- Result
  - Aggregate model forecast 120% higher than travel demand model

- Conclusion
  - ARRF model may partially explain attractiveness of rail over existing service, but does not well-represent benefits of project since:
    - The project mode is different than calibrated mode
    - Lack of choice market not consistent with LRT sample cities

Applications – City D

- Commuter rail between two adjacent metropolitan areas; some express bus service to each CBD, but no service between CBD's
- Commuter rail ARRF model compared with travel demand model (2000 trip tables, 2030 networks) applied to *each* CBD

Applications – City D (cont’d)

- Result
  - Aggregate model forecast 130% higher than travel demand model

- Conclusion
  - ARRF model may partially explain attractiveness of rail over existing commuter bus service, but does not well-represent benefits of project since lack of service between CBDs unlike CR sample cities

Applications – City E

- New commuter rail line to high mode share CBD with established "choice market" commuter bus service from large park and ride facilities
- Commuter rail ARRF model compared with travel demand model (2000 trip tables, 2030 networks) applied

Applications – City E (cont'd)

- Result
  - Aggregate model forecast 30% lower than travel demand model
- Conclusion
  - Existing commuter ("choice") market in corridor stronger than CR sample cities

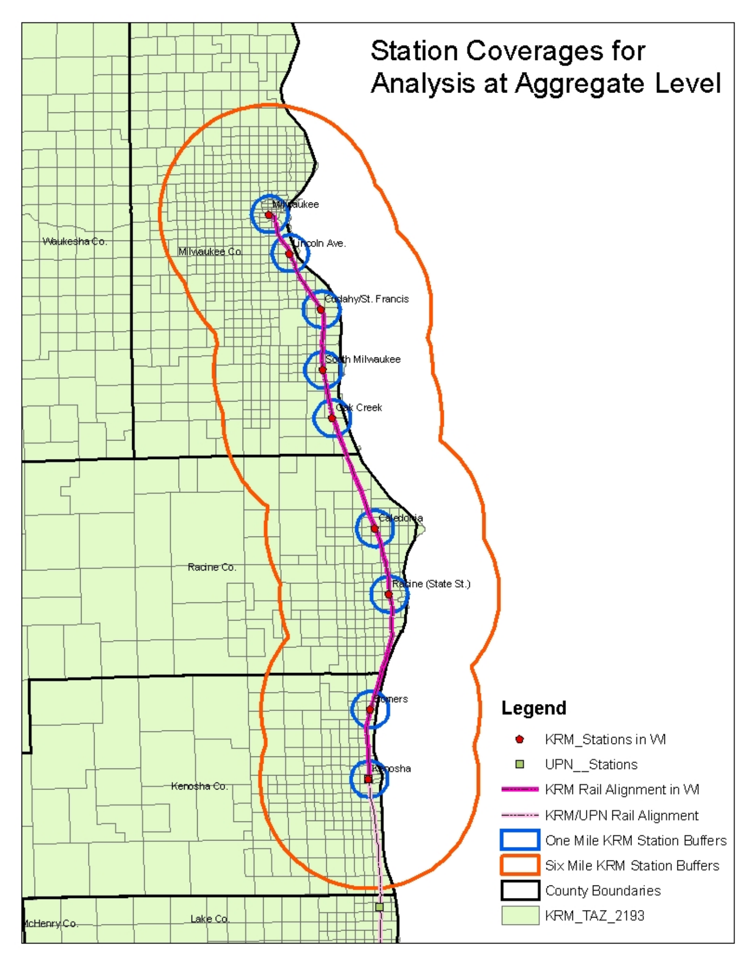
Applications in Milwaukee, Kansas City, and St. Louis

Yasasvi Popuri
Cambridge Systematics

Overview

- Recent ARRF applications
  - Kenosha-Racine-Milwaukee (WI)
  - Kansas City, St. Louis, MO
  - Madison, WI
  - Indianapolis, IN
- General insights from ARRF application
  - Second data point
  - Support for model re-evaluation

Kenosha-Racine-Milwaukee



KRM Service

- ARRF vs. current UPN ridership.
  - UPN: 26,000 daily trips
  - ARRF estimate: 21,000 daily trips
- Wisconsin Only
  - Service is close to ARRF defaults
  - ARRF estimate: 2,800 daily riders
- Entire Corridor in WI and IL
  - Existing UPN <u>and</u> proposed KRM service
  - ARRF forecasts: Entire corridor <u>minus</u> Existing UPN
  - ARRF estimate: 4,500 daily riders

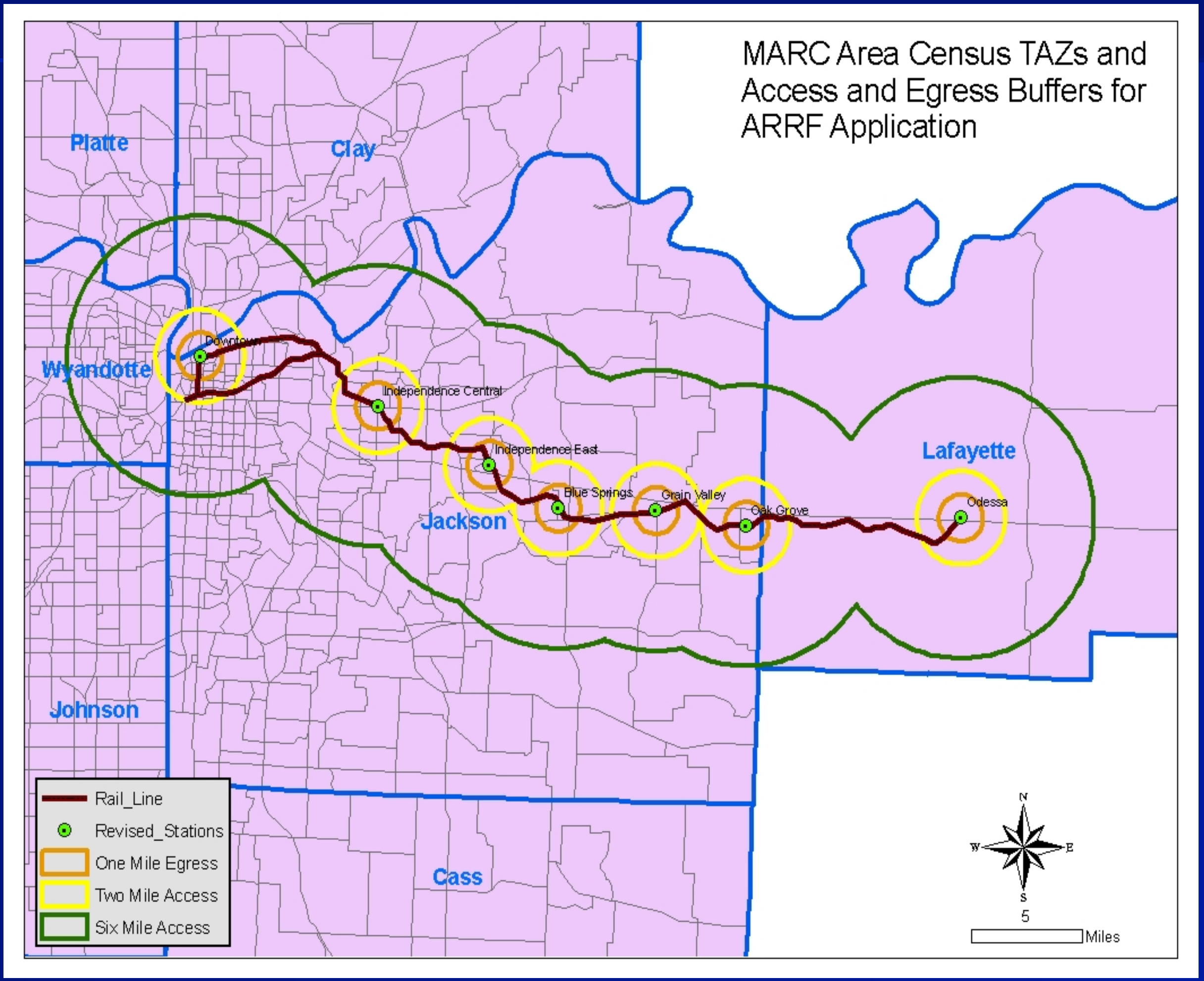
KRM Service
ARRF vs. Model Results

	KRM WI Only (RCI = 0.5)	KRM – WI & IL (RCI = 1)	UPN (Obs = 26,000)
ARRF	2,800	4,500	21,000
KRM Model-2002	4,400	5,900	25,075

KRM Service Conclusions

- ARRF for existing UPN lower than observed
  – Existing UPN service (not a "new" New Start)
- ARRF for KRM lower than model
  – KRM as a natural "extension" of UPN
- Take a second look at the model:
  – Trip interchanges
  – Transit trip interchanges
  – PnR and walk access patterns

Kansas City – I-70 Corridor



Kansas City – I-70 Corridor

- Traditional suburb-to-CBD commuter rail
  - Low proposed level of rail service
  - Location of downtown terminal
  - "What if" scenarios for frequency
- ARRF offered a set of "second data points"
  - Introduced after model forecasts were completed
  - Independent estimate of model results and sensitivity

Kansas City – I-70 Corridor

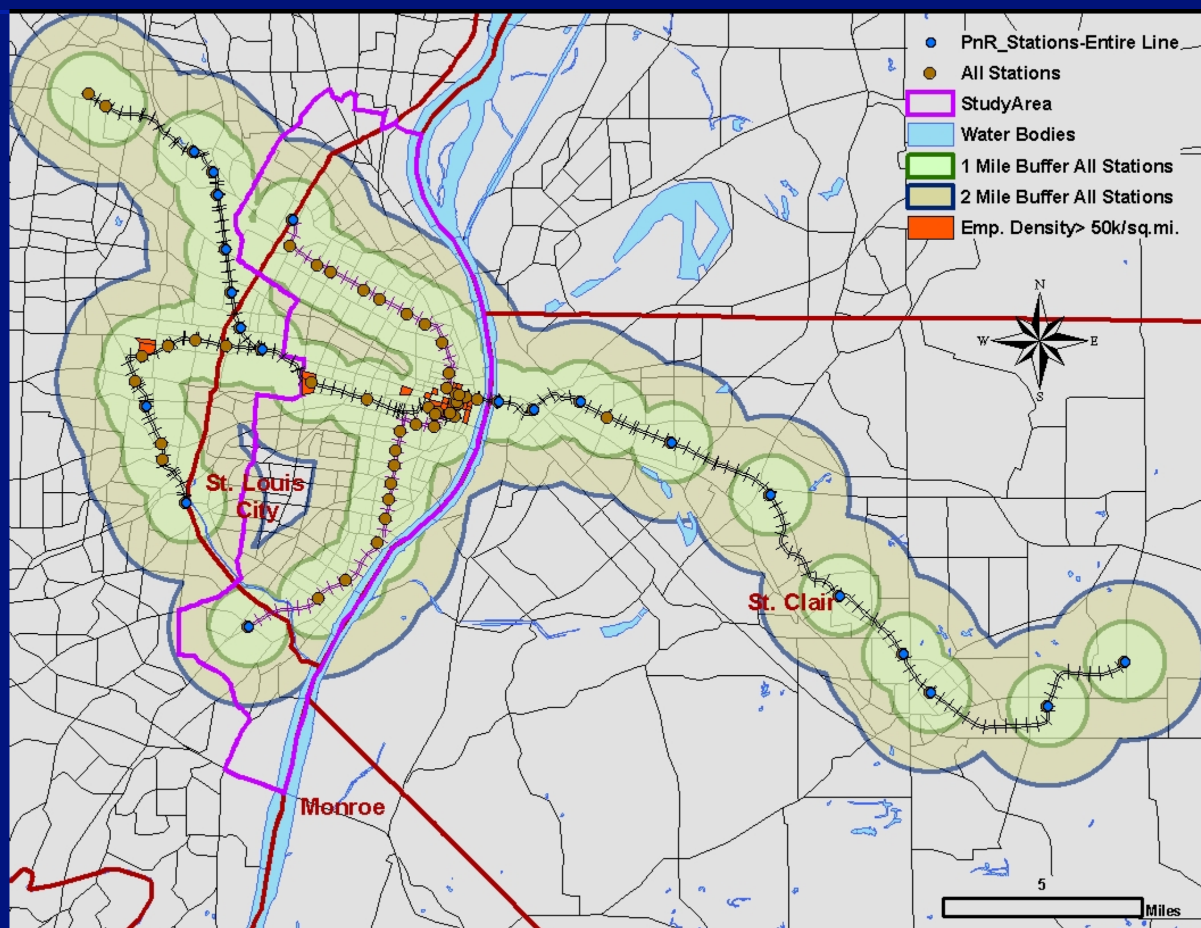
- Model results with Riverfront Terminal
  - 4 peak trains, two-way, and $2.50 fare: 1,244 riders

	3 Peak Direction Trains	3 Peak + 3 Reverse Trains	4 Peak + 4 Reverse Trains
ARRF Riverfront Terminal	815	1,020	1,125
ARRF Downtown Terminal	1,060	1,330	1,460

Kansas City – I-70 Corridor Conclusions

- ARRF used as a second data point
- ARRF used for testing ridership sensitivity to:
  - Terminal location
  - Frequency of service
- Reasonable agreement b/w ARRF and model

St. Louis Alternatives Analysis



St. Louis Alternatives Analysis

- Data point in ARRF calibration
- On-going study
- LRT version of ARRF: markets only, no LOS
- ARRF applied for 2000 and 2006 MetroLink
  - Lower ARRF forecasts for 2000 and 2006
  - Strong impact of special generator trips (ball games, airport trips)

	2002 MetroLink	2006 MetroLink
ARRF	30,600	60,400
Observed	42,000	~80,000

St. Louis Alternatives Analysis

- The "build" alignment treated as an incremental version to the 2006 MetroLink.
  - Growth of 43% from 2006 no-build ridership
  - Ridership of 26,000 without any adjustments
- Model currently being refined
  - Lower forecast than ARRF
  - Examine speeds on competing bus routes
  - Examine highway speeds

	2006 MetroLink	2006 MetroLink + Proposed Alignment
ARRF	60,400	86,200
Observed	~80,000	

ARRF Insights

- Market assessment tool
- Second data point
- Sets the stage to re-evaluate model
  - Total trips produced
  - Trip interchange patterns
  - Transit trip patterns
  - Sensitivity to frequency
  - Speeds on competing transit and highway facilities

9. Alternative-Specific Effects

- FTA requirements for New Starts
- Implementation
- Three examples

FTA Requirements

- Motivations
  - Correct the "new New Starts" disadvantage
  - Respond to recent evidence
    - Positive guideway constants in "well-scrubbed" models
    - Higher-than-explainable BRT ridership impacts (LA, KC)
- Approach
  - Attributes rather than modes
  - Differential constant and C_{ivt} discount
  - Post-mode-choice application

FTA Requirements

- Applicability
  - 2007: “new New Starts” guideways
  - 2008: guideway elements of baselines
    - Stations: amenities and branding
    - Vehicles: amenities and branding
    - Dynamic arrival information
    - Exclusive running
    - Other attributes

Attributes, Not Modes

- Attributes not found in models
- Alternative-specific conditions
  - Important: missing attributes
  - Not important: labels like "BRT" or "CR"
  - Effects on ridership and mobility benefits
- Guideway-only vs. guideway+local bus

Someone, please, define these "modes."

Constant and C_{ivt} Discount – FTA

Guideway Attributes that Are Different from Local Bus	Maximum Alternative-Specific Effect versus Local Bus (mins.): Guideway(s) only	Maximum Alternative-Specific Effect versus Local Bus (mins.): Guideway(s) + local bus	Maximum Guideway Civt Discount: Any Guideway
Guideway-like characteristics	**8**	**3**	**Civt x 0.85**
-- Reliability of vehicle arrival, travel time	4	2	Civt x 0.90
-- Branding/visibility/learnability	2	1	--
-- Schedule-free service	2	0	--
-- Ride quality	--	--	Civt x 0.95
Span of good service	**3**	**0**	**--**
Passenger facilities	**4**	**3**	**--**
-- Amenities at stations/stops	3	2	--
-- Dynamic schedule information	1	1	--
Vehicle amenities	**--**	**--**	**Civt x 0.95**
Availability of seat	**--**	**--**	**Civt x 0.95**
Maximum effect	**15**	**6**	**Civt x 0.75**

Post Mode Choice

- Track record
  - FTA reviews of 19 New Starts forecasts
  - Starter lines → highest risk of overestimate
- Consequently
  - ASE adjustments for user benefits only
  - No change in total or guideway ridership
  - No change in walk/bus/auto access modes
  - <u>Judgment</u> on sizing of park-ride lots

Implementation

- Identification of appropriate ASEs
  - Sponsor: description of service attributes
  - FTA: determination of ASE values
- Detection of paths using the project
- Detection of guideway-only paths

Paths using the Project

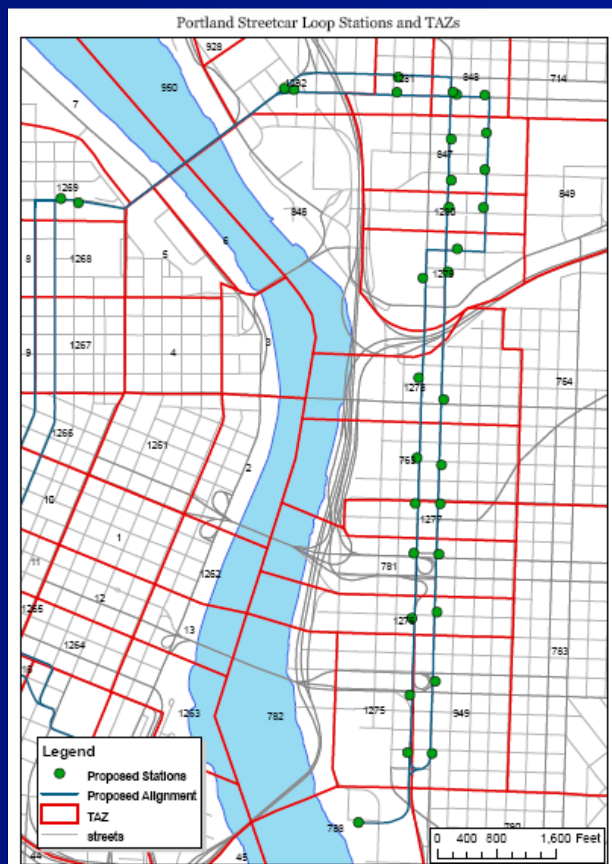
- With all-or-nothing impedances
  - For each I-J:
    - B = If ${}^{bld}IVT_{gdwy} > {}^{bas}IVT_{gdwy} \rightarrow 1$, else 0
    - ASE = B x ${}^{bld}trips_{trn}$ x ASC

      + ASD_{ivt} x $({}^{bld}IVT_{gdwy} - {}^{bas}IVT_{gdwy})$
- With probability-weighted impedances
  - Assignment based
  - Example

Guideway-only Paths

- Imprecise conventions in most models
  - Zone walk-access percents for <u>any</u> transit
  - I-J paths for <u>any</u> transit
  - Unable to isolate guideway-only paths
- FTA convention
  - Guideway-only ASC for PnR/KnR only
  - Case-by-case exceptions for (1) model structure or (2) small zones near project

Guideway-only Paths



- Portland streetcar
- Subdivision of zones
- Low chance of bus component if $IVT_{bus} = 0$
- FTA agreement on ASC_{gdwy} for walk-access

Examples

- ASEs for BRT with an Older Pathbuilder
  - Jeff Bruggeman, AECOM Consult
- ASEs for Streetcar with Multi-paths
  - Jennifer John, Portland Tri-Met
- ASEs for BRT with Some Refinements
  - Tom Maziarz, Hartford CRCOG

BRT and Path Choice with an Older Pathbuilder

Jeffrey M. Bruggeman
AECOM Consult

Nature of Alternatives

- System with BRT projects to be built parallel to or within right-of-way of major highways
- Baseline alternative to be created with same operating plan
- Benefits to flow exclusively from improved speeds on BRT rights-of-way

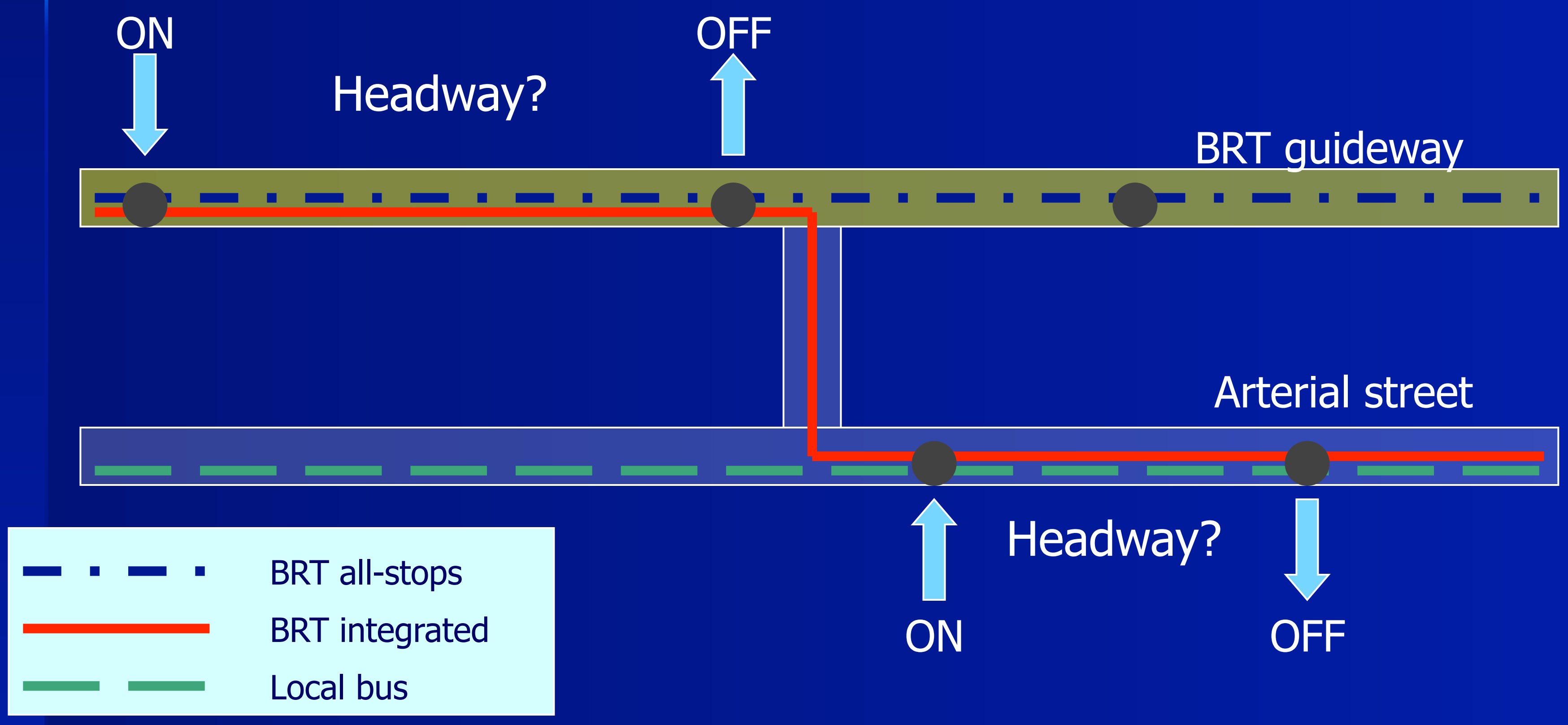
Anticipated Results

- Buses on BRT guideway equivalent to a premium transit mode (so, coded as a different "mode" in the network)
- Paths with identical out-of-vehicle times between baseline and build
- Travel time benefits only on the BRT guideway only

Nature of Problem

- Some BRT routes circulate before and/or after travel on BRT guideway
- Some arterial routes diverge at BRT entry points with some bus-trips using the BRT facilities and others continuing on an arterial
- Path builder finds off-guideway differences between baseline and build, causing negative user benefits
- Cause: breaking of combined headways

Nature of the Problem



Flagging Guideway Paths

- Same mode-code for all bus routes in network and path-building
- Transit line file parsed to determine usage of guideway
- Pseudo-fare links coded for each guideway link traversed by each line
- Result: detection of both “guideway all-stops” and “guideway express” routes

Path Conditioning

- Single path built with all routes treated as local bus
- Fare links skimmed as they are encountered on path
- Fare conditioning program
  - – Paths using at least one fare links – BRT
  - – Paths using no fare links – local or express

Mode Choice

- Mode choice model considers express, local, and BRT choices
- Express-bus choice is from a separate path-building step for expresses that do not use the BRT guideway
- "Silver bullet" added to utility expression for BRT paths

Current FTA Needs

- Latest FTA guidance does not allow for "silver bullet" within model to create higher ridership
- Technique would have to be changed to skim amount of path time on guideway
- Could be accommodated by updating fare flags to reflect link impedance

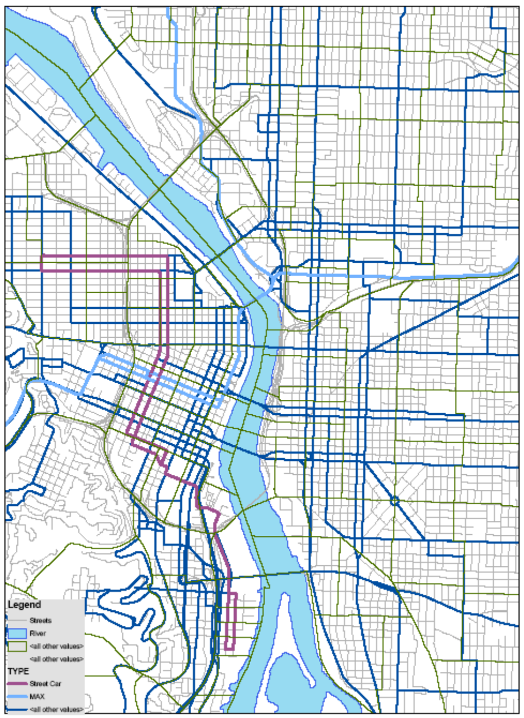
Isolation of Trips and Travel Time on a Project In a Multipath Environment

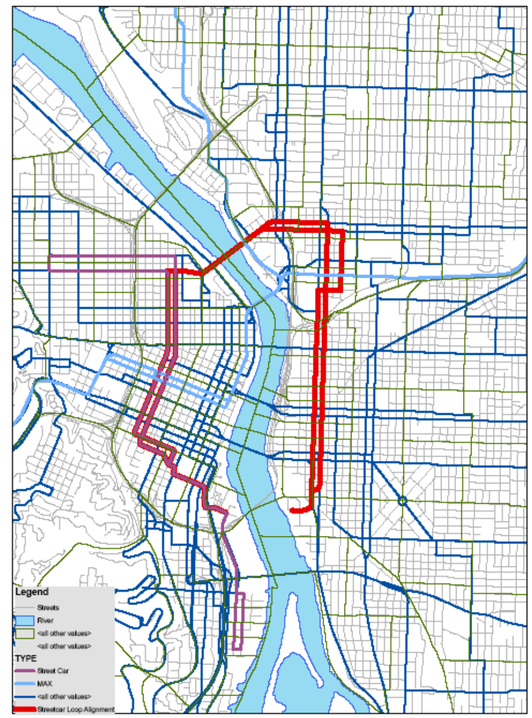
Jennifer John
TriMet
Portland, Oregon

Multi-path Assignment in EMME/2

- Several paths between an origin and a destination are identified
- Trips are assigned to the paths using probabilities based on weights in the assignment parameters (in-vehicle, out-of-vehicle, walk) and headways of the routes
- Assignment creates weighted travel time based on proportion of trips on each path

Portland Streetcar Example





Isolating Streetcar Trips

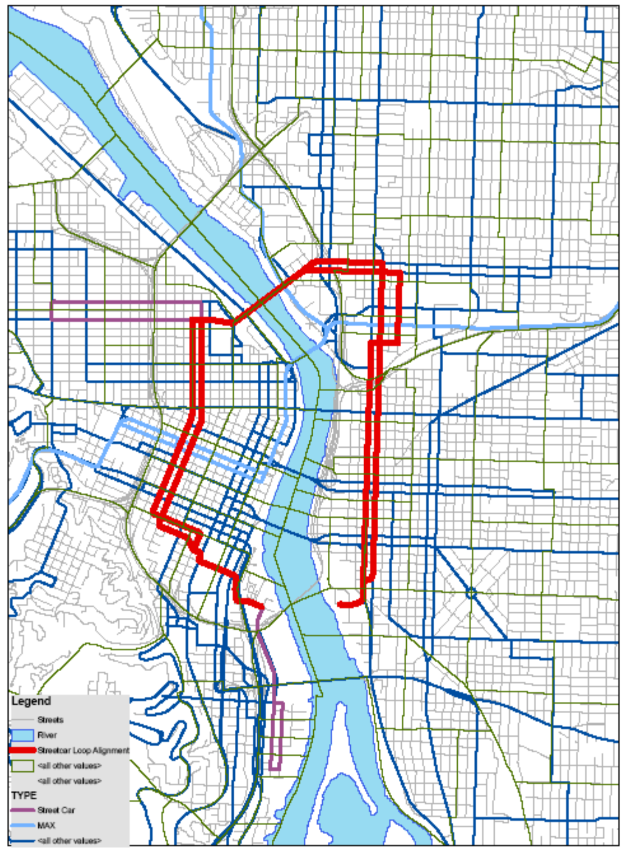
- Multipath assignment results in trips on LRT, bus, and streetcar.
- The project is a streetcar extension.
- How do we isolate information about the trips that use the project?
  - How do we isolate this information from travel on the existing part of the Streetcar route?

Isolating Streetcar Trips

- In EMME/2
  - Code Streetcar as unique mode in network and transit line coding
  - Flag Streetcar route

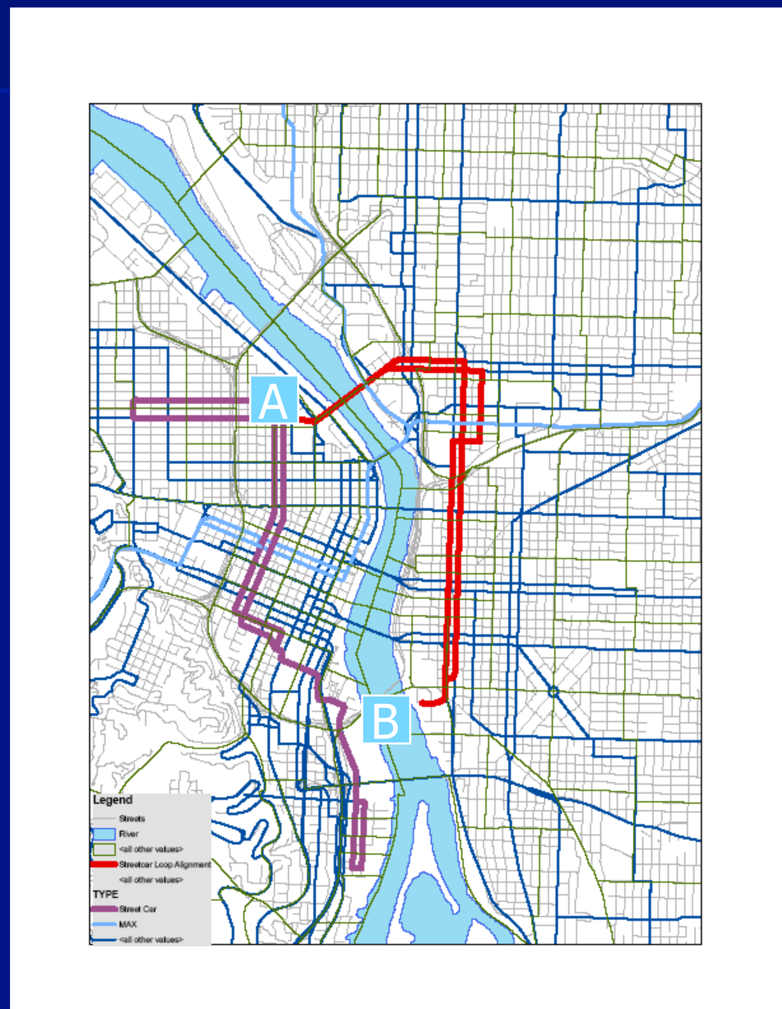
Flagging the Streetcar "Project"

Total Streetcar Trips for the Full route = 10,500



Flagging the Streetcar "Project"

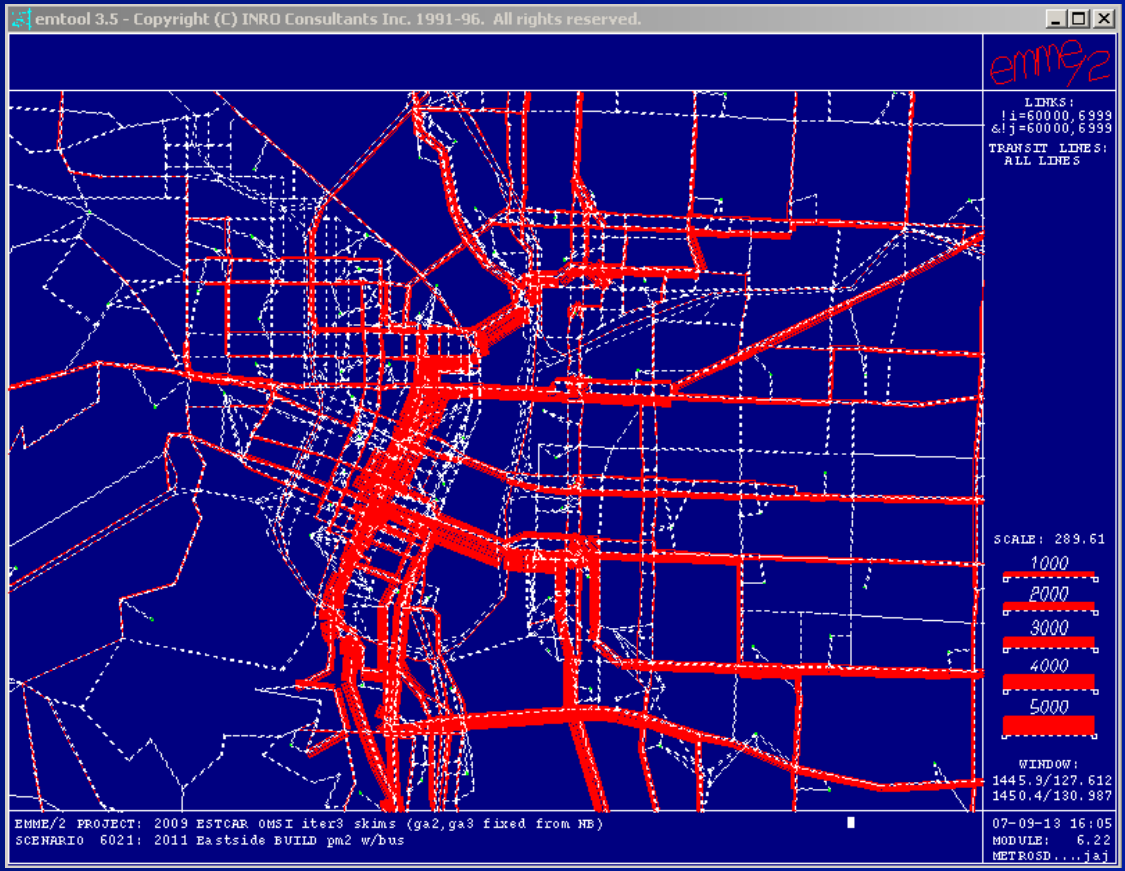
How many Streetcar trips Are on ONLY The new Portion (A-B) Of the route?



Additional Options Assignment

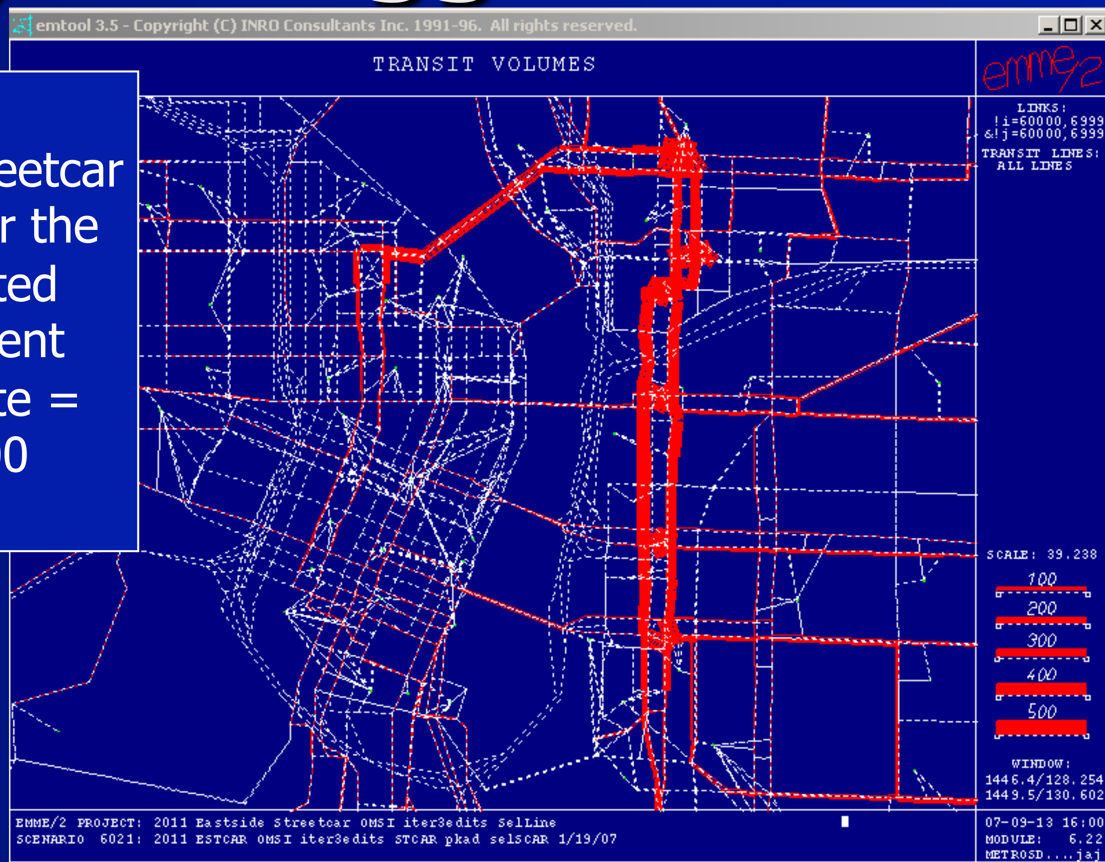
- Select Line/Segment
  - Results
    - O/D Matrix of trips for flagged route (or portion of route as in the case of an extension of an existing line)

Multipath Assignment Results: No Flags



Additional Option Assignment Results: Project Flagged

Total Streetcar Trips for the Selected Segment Of route = 8,100



Using the Assignment Results

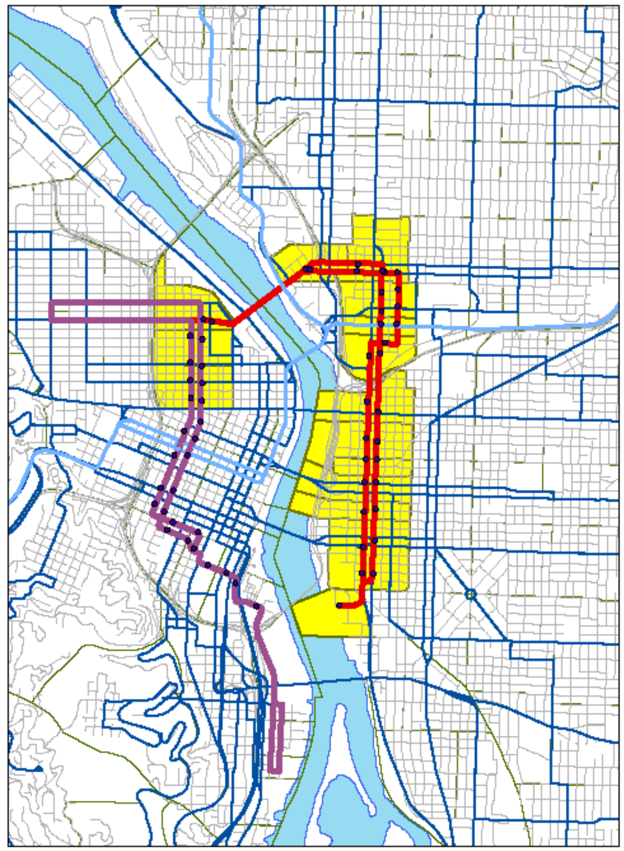
- Total boardings for the project as isolated in the assignments are used to apply ASE calculations
  - Maximum value of 15 for Guideway ONLY
  - Maximum value of 6 for Guideway + local bus

Guideway ONLY Trips

- Portion of the O/D results matrix
  - Isolated by a submatrix of the additional options assignment results
  - Includes only zone-pairs where direct walk to/from a streetcar stop is <u>certain</u> at <u>both</u> ends of the trip
  - Would be eligible for up to 15 minutes (as determined by FTA) of ASE

Guideway ONLY Trips

TAZs in Yellow Have direct Walk access to Project (no transfers)



Guideway + Local Bus

- Portion of the O/D results matrix
  - Remainder of trips in the matrix that do not have direct walk on/off access to the project
  - Would be eligible for up to 6 minutes (as determined by FTA) of ASE

Isolating Project In-Vehicle Travel Times

- Used in C_{ivt} Calculations
- Project coded as unique mode
  - In EMME/2 transit times can be saved out specific to a mode
  - Use these transit times along with the o/d matrix from the additional option assignment to identify travel time on project

Conclusions

- Multi-path environment and ASEs
  - Feasible application
  - In EMME/2, the key is the additional option assignment
  - Full credit for walk-only ASEs also depends on small zones

ASEs for the New Britain – Hartford Busway

Tom Maziarz & Ming Zhao
Capitol Region Council of Governments

Keys to Hartford's Approach

Start with advantage: 6 transit skims produced for MC

- Walk to guideway – Walk from guideway (WG-WG)
- Walk to guideway – Walk from bus (WG-WB)
- Walk to bus – Walk from guideway (WB-WG)
- Walk to bus – Walk from bus (WB-WB)
- Drive to transit (PNR) – Walk from guideway (DT-WG)
- Drive to transit (PNR) – Walk from guideway (DT-WB)

Goal: Consider individual trip attributes of each O-D path

Assign weight for <u>each factor</u> & for <u>each path type</u>

- Reliability
- Branding & Learnability
- Station amenities
- Schedule-free service
- Long span of service
- Dynamic schedule information

Keys to Hartford Approach:

Breakdown & isolate path types using combination of:

- 6 skims
- Key data from skims *(some newly created)*
- Creative analysis of skim data
  - Total IVT
  - IVT on BRT routes *(requires separate coding)*
  - # Transfers ….

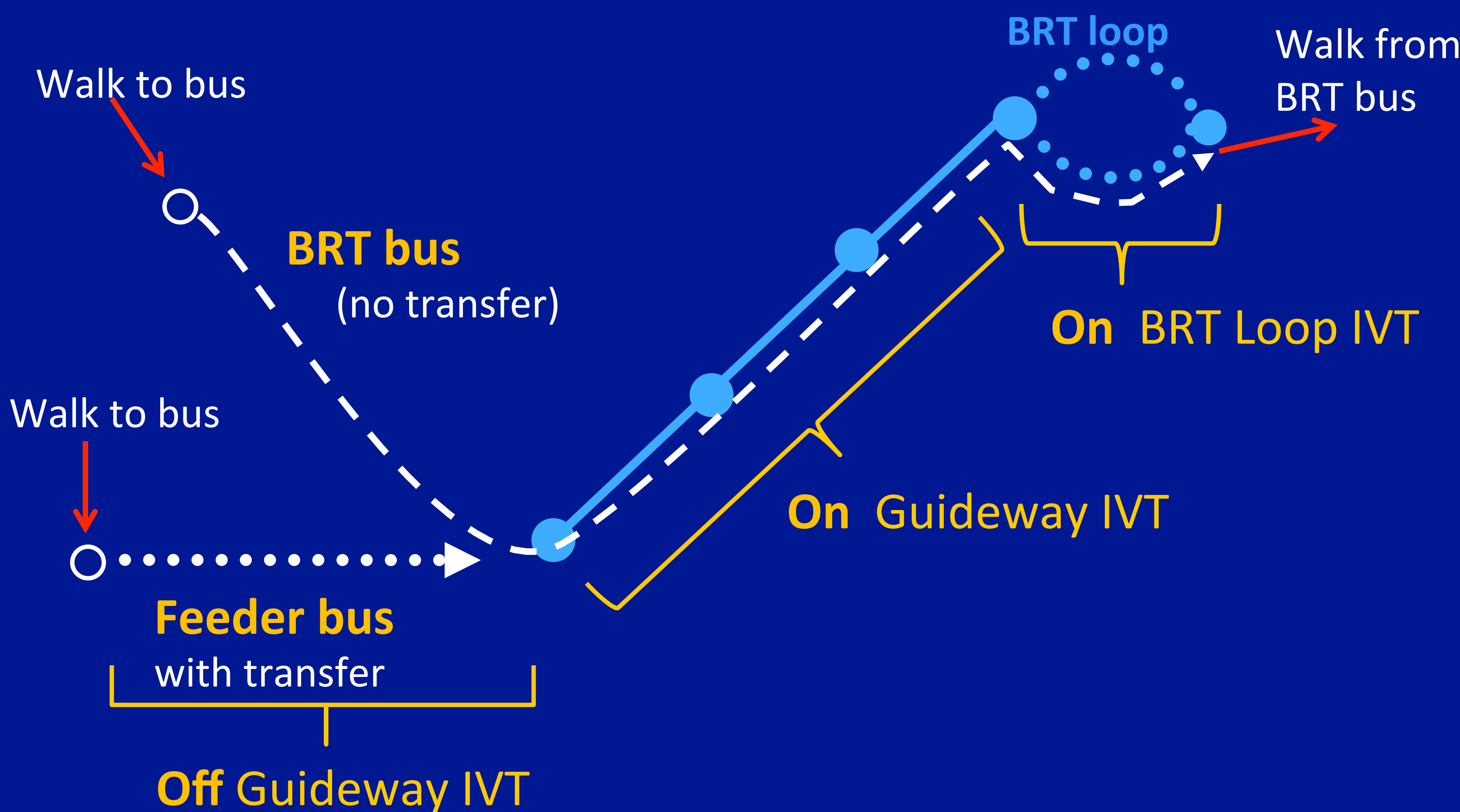
Basic Concept: break down a path into 3 components

- IVT **ON the guideway** *(requires separate coding)*
- IVT **ON BRT loop** *(requires separate coding)*
- IVT **OFF guideway**

Process yields: 12 path types that <u>use the guideway</u>

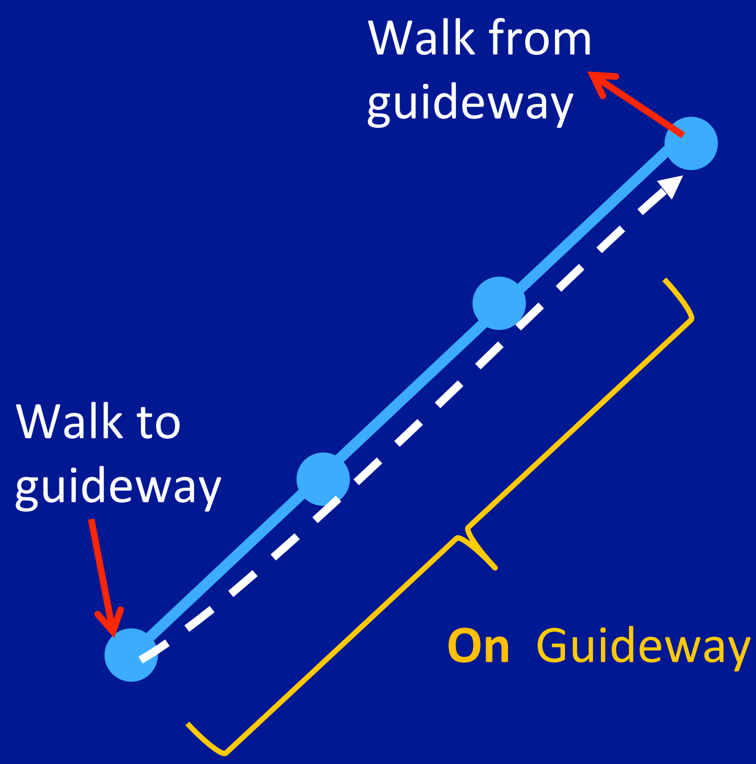
Components used to classify path types

dashed line also illustrates "BRT bus route" (mode 5)



Examples of Path Types

Most basic path type: 100% On-Guideway



WG–WG trip

Identifiers:

- From WG-WG skim

Alternate ID:

- Total IVT = Guideway IVT

Key ID for all 12 path types:

- Guideway IVT > 0

More complex path type: On-Guideway + On-BRT Loop

Identifiers:

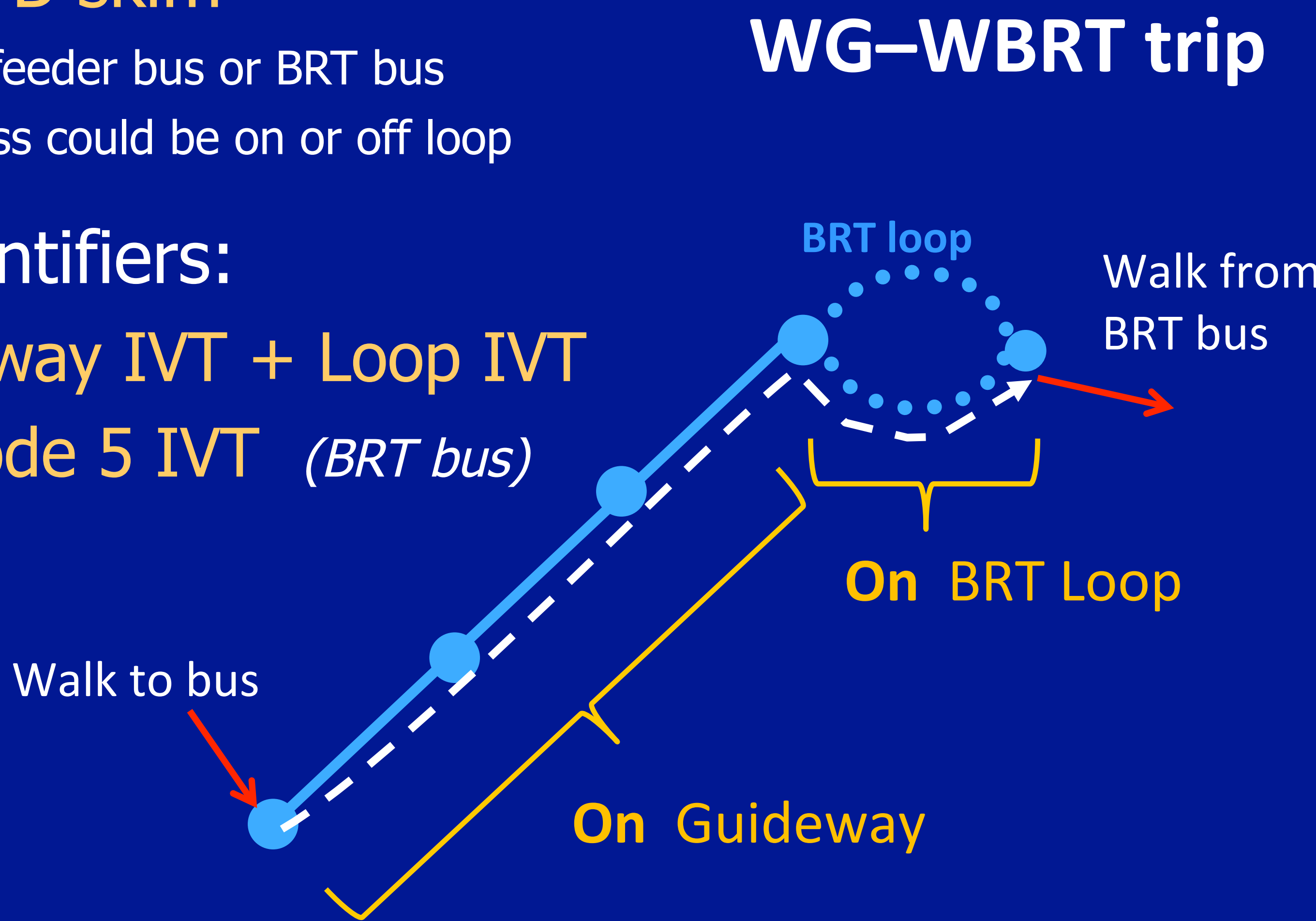
- From WG-WB skim
  - WB could be feeder bus or BRT bus
  - BRT bus egress could be on or off loop

Additional Identifiers:

Total IVT = G-way IVT + Loop IVT

Total IVT = Mode 5 IVT *(BRT bus)*

Transfers = 0



Another complex path type:

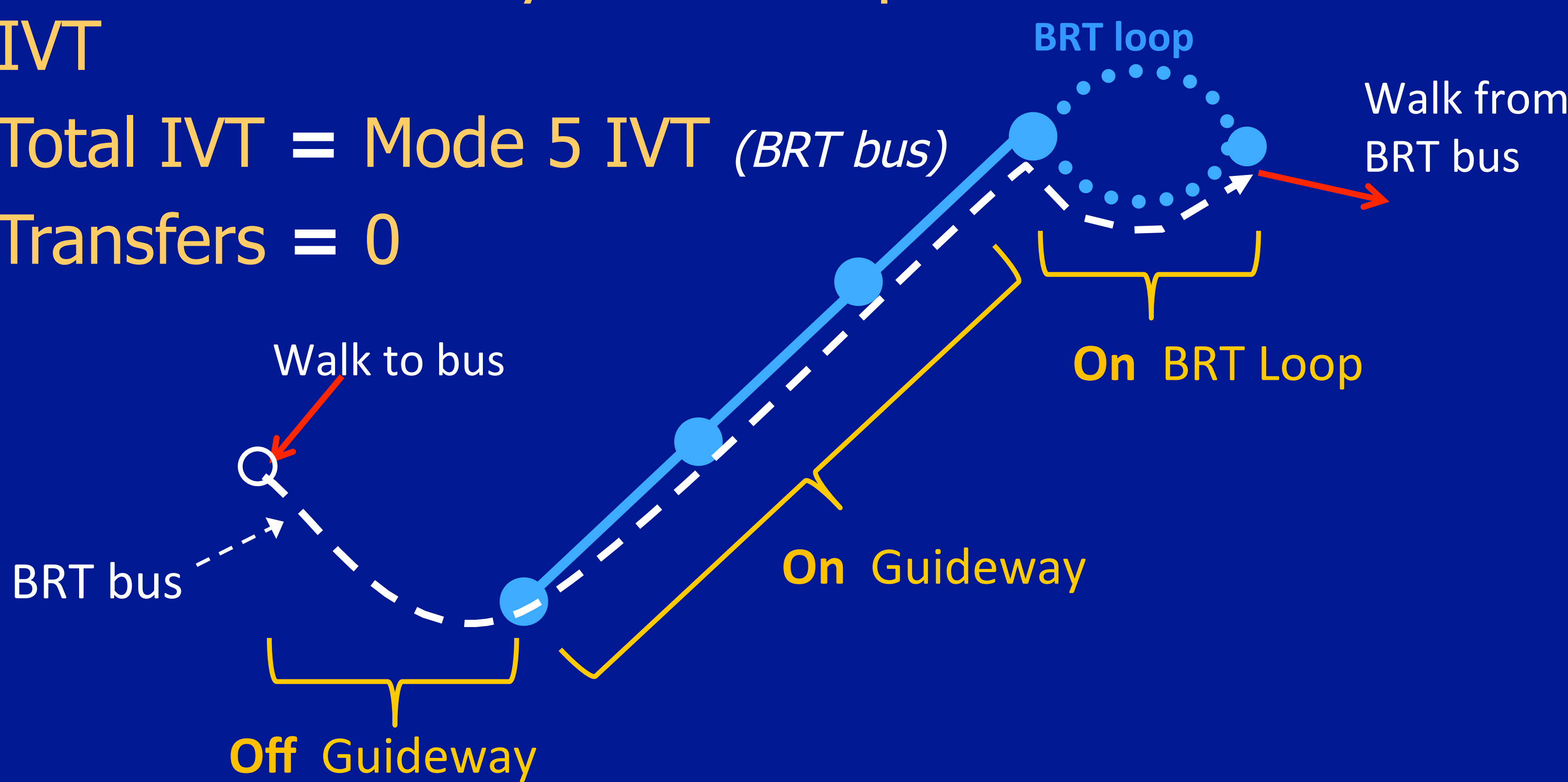
Off Guideway + On-Guideway + On-BRT Loop

Identifiers:

- From WB-WB skim
- Total IVT > G-way IVT + Loop IVT
- Total IVT = Mode 5 IVT *(BRT bus)*
- Transfers = 0

WB–WBRT trip

(Single seat trip)



Final example of path type:

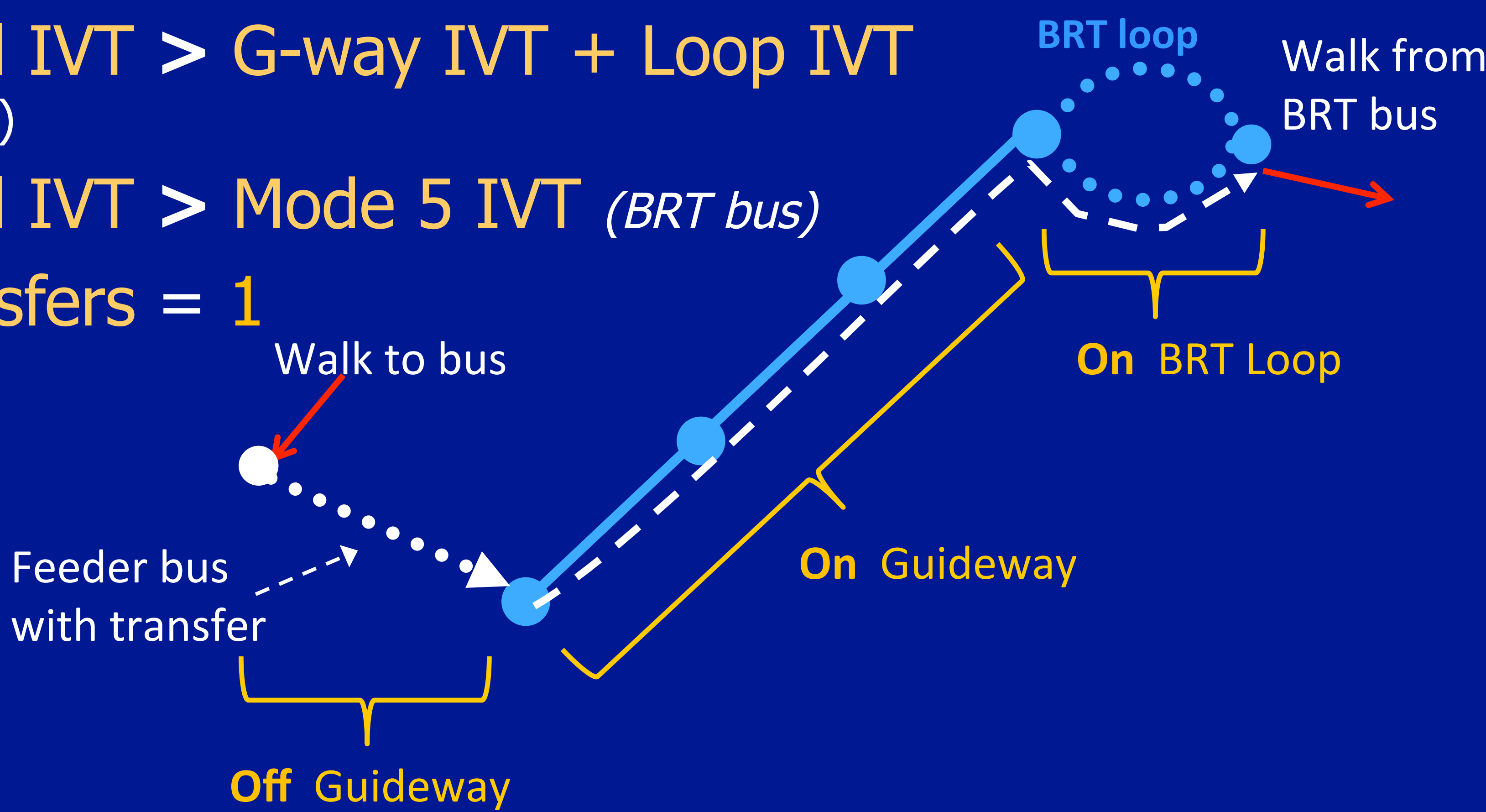
Off Guideway + On-Guideway + On-BRT Loop

Identifiers:

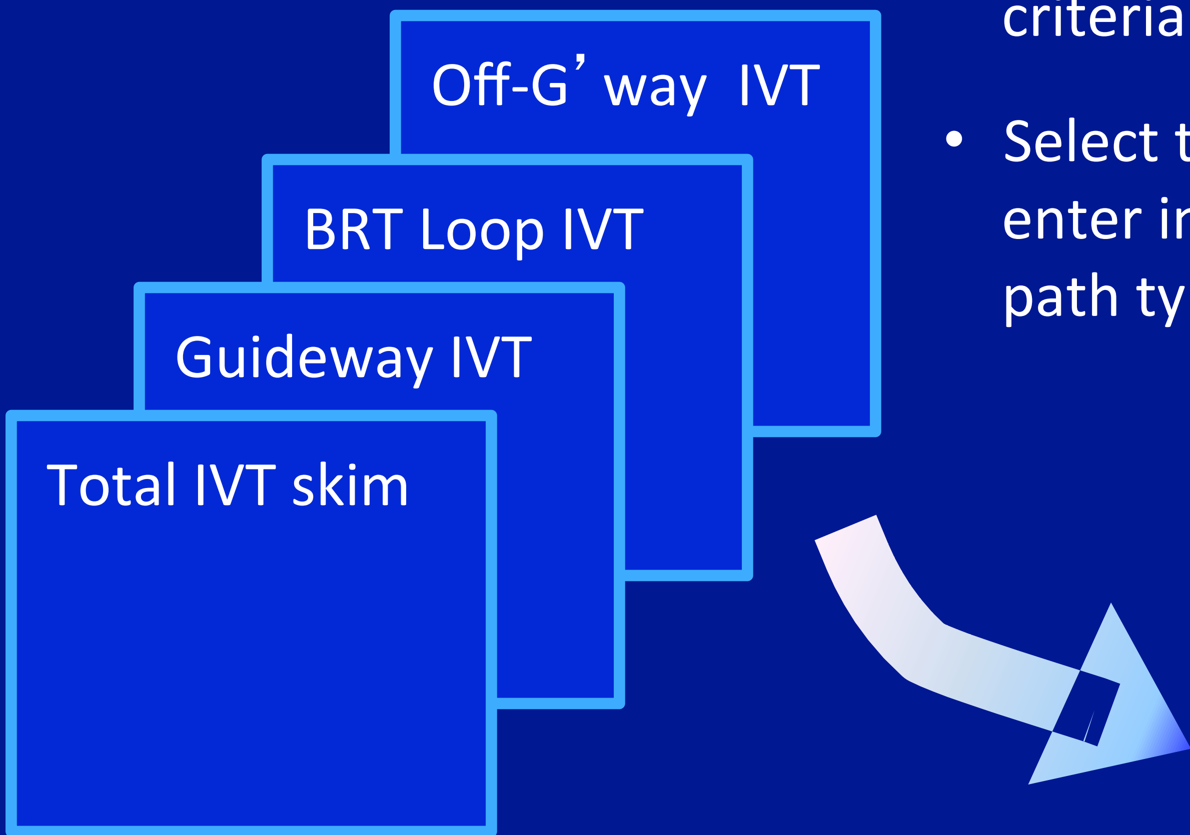
- From WB-WB skim (same as previous slide)
- Total IVT > G-way IVT + Loop IVT (same)
- ✓ Total IVT > Mode 5 IVT *(BRT bus)*
- ✓ Transfers = 1

WB–WBRT trip

(with transfer)



Process skim tables to develop trip tables for each path type



- Identify O-D pairs that meet criteria for path type
- Select trips for that O-D pair & enter into trip table for that path type

- WG-WG trips
- WG–WBRT trips
- WG-WB trips
- .....
- ......
- ...... (12 classes)

Results: # HBW Trips by **Path Type**

(only trips that use all or part of guideway)

	Walk Access						
	1 *1-seat ride* **WG-WG**	2 *1-seat ride* **WG-WBRT**	3 *1-seat ride* **WB-WG**	4 *1-seat ride* **WB-WBRT**	5 *transfer* **WG-WB**	6 *transfer* **WB-WG**	7 *transfer* **WB-WBRT**
Trips	**87**	**209**	**221**	**620**	**276**	**1,439**	**1,749**
Access	guideway station	guideway station	BRT bus	BRT bus	guideway station	feeder bus	feeder bus
Egress	guideway station	loop station	guideway station	loop station	feeder bus	guideway station	loop station

	Drive Access				
	8 *1-seat ride* **DG-WG**	9 *1-seat ride* **DG-WBRT**	10 *1-seat ride* **DB-WG**	11 *1-seat ride* **DB-WBRT**	12 *transfer* **DG-WB**
Trips	**316**	**720**	**140**	**483**	**462**
Access	guideway station	guideway station	BRT bus	BRT bus	guideway station
Egress	guideway station	loop station	guideway station	loop station	feeder bus

Assigning attribute weights (constants)

	Attribute Weights in Minutes *Walk Access Trips* 1 *100% BRT* *1-seat ride* WG-WG	2 *100% BRT* *1-seat ride* WG-WBRT	3 *1-seat ride* WB-WG	4 *1-seat ride* WB-WBRT	5 *transfer* WG-WB	6 *transfer* WB-WG	7 *transfer* WB-WBRT
Reliability	2.0	2.0	1.0	1.0	0.0	0.0	0.0
Branding-Learn.	2.0	2.0	0.5	0.5	0.0	0.0	0.0
Schedule-free serv	2.0	2.0	----	----	----	----	----
Span of service	2.0	2.0	----	----	----	----	----
Station amenities	1.0	1.0	0.5	0.5	0.5	0.5	0.5
Dynamic sched info	1.0	1.0	0.0	0.0	0.0	0.0	0.0
Total Constant	**10.0**	**10.0**	**2.0**	**2.0**	**0.5**	**0.5**	**0.5**

	1 *100% BRT* *1-seat ride* WG-WG	2 *100% BRT* *1-seat ride* WG-WBrt	Max
Reliability	2.0	2.0	4
Branding	2.0	2.0	2
Sched-free serv	2.0	2.0	2
Span of serv	2.0	2.0	3
Sta. amenities	1.0	1.0	3
Dyn. sched info	1.0	1.0	1
Total	**10.0**	**10.0**	**15**
Trips	**87**	**209**	
Benefits	**14.5**	**34.8**	

Benefits (hours) = Constant x trips/60 min

Entirely on Guideway or Loop

Receive full benefit of guideway (To degree that busway achieves full functionality)

- Reliability: exclusive ROW
- Branding : distinct stations, etc.
- Freq serv: 2-4 min h'dways any station-station trip
- Span of serv: 18 hours
- Sta. amenities: covered platforms, visible, secure
- Dynamic schedule info: at guideway & loop stations

	3	4
	1-seat ride WB-WG	*1-seat ride* WB-WBRT
Reliability	1.0	1.0
Branding-Learn.	0.5	0.5
Sched-free serv	----	----
Span of service	----	----
Sta. amenities	0.5	0.5
Dyn. sched info	0.0	0.0
Total	2.0	2.0
Trips	221	620
Benefits	7.4	20.7

Start off-busway on a 'BRT' bus

Receive some benefit of G'way

- Reliability: lose some reliability with off-busway segment, but start at less congested end
- Branding : some benefit from BRT marketing, bus branding , etc.
- Freq serv: NO – single route
- Span of serv: NO – single route
- Sta. Amenities: one end of trip
- Dynamic schedule info: NO

	5	6	7
	transfer WG-WB	*transfer* WB-WG	*transfer* WB-WBrt
Reliability	0.0	0.0	0.0
Branding-Learn.	0.0	0.0	0.0
Sched-free serv	----	----	----
Span of service	----	----	----
Sta. amenities	0.5	0.5	0.5
Dyn. sched info	0.0	0.0	0.0
Total	0.5	0.5	0.5
Trips	276	1,439	1,749
Benefits	2.3	12.0	14.6

- All use guideway
- But all involve transfer & feeder bus
- Most guideway benefits compromised by dependence on feeder bus & transfer
- Only 0.5 min credit

Final Thoughts: Will it work with other models?

Experience in Hartford

- Suggests potential to adapt to other areas
- Creative use of coding and & analysis of skims allowed
  - Better definition of path types
  - Better assessment of guideway related benefits

Identifiers:

- From WB-WB skim
- Total IVT > G-way IVT + Loop IVT
- Total IVT > Mode 5 IVT
- Transfers = 1