TMIP FMIP

Better Methods. Better Outcomes.

Transportation Modeling and the Traffic Impact Analysis Process

AMPO National Conference
Clark County, NV October 2015

FMPO

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Why A Peer Review?

To improve the role of the FMPO Regional Travel Model in the Transportation Impact Analysis Process

TO ELIMINATE THE STRIFE

To give bikes, peds, & transit equal treatment

Why this is important

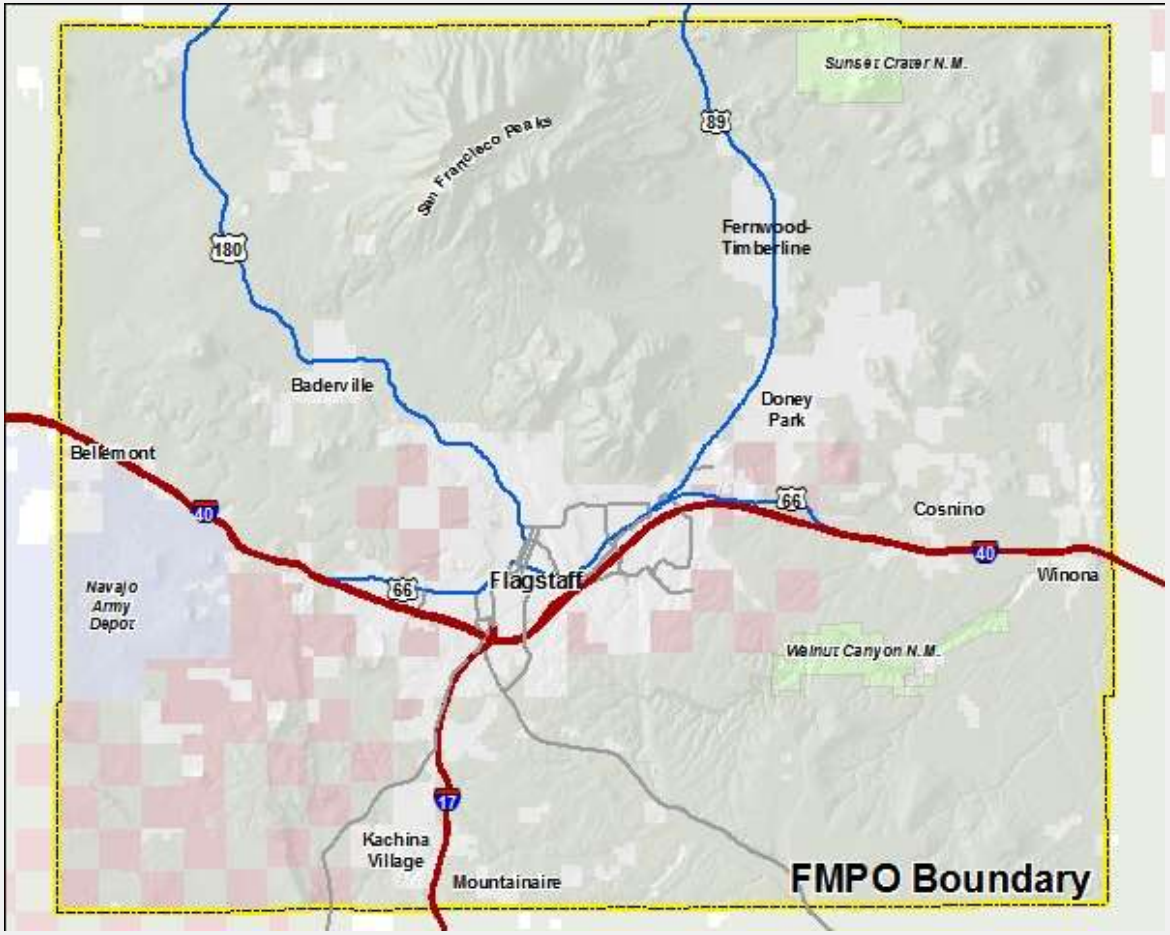
- Add value for member agencies
- Magnitude of private investment in transportation system
- Legal and financial implications for proportional share

- Getting the details right for non-motorized modes

Major Take-Aways

- Regional Model > Site Plan
  - Two sets of often independent lessons
- Good models can help:
  - Trip distribution
  - Trip assignment / Proportional share
  - Multimodal evaluations
- Tracking TIA processes can inform updates to regional model inputs
- One size doesn’t fit all

The FMPO Region



- 2 hours north of Phoenix
- Study area size:
  525 sq. miles
- Total population:
  90,301
- Transit awards
- Walk-Friendly
- Bike-Friendly

TRANSPORTATION IMPACT ANALYSIS

PURPOSE

- **Ensure Safe and Efficient Transportation**
- **Primary Beneficiary – Business and Customers**
- **Secondary Beneficiary – Travelers and Public Agency**

FOCUS NOW: APPROVAL

TYPICAL PRELIMINARY MEETING

- Existing and Proposed Land Uses
- Preliminary Site Plan
- Analysis Scope
  - Small – Trip Generation Comparison Only
  - Medium – Close Intersection(s) and Opening Year
  - Large – Numerous Intersections and Years
- Trip Generation and Trip Distribution
  - Some Agencies Second Meeting

Primary Decision Points

Analysis Periods

- Weekday / Morning / Evening Peak Hour
- Saturday Peak Hour

Trip Generation (& Reduction)

- Land Use and Independent Variable
- Rate versus Equation versus Plotted Points

Trip Distribution & Assignment

- Population or Employment or Traffic Volumes or Model

SITE PLAN

Need & Model Practice

- Access, circulation
- Traffic Analysis Zone (zones) structure
- Centroid connectors / Network

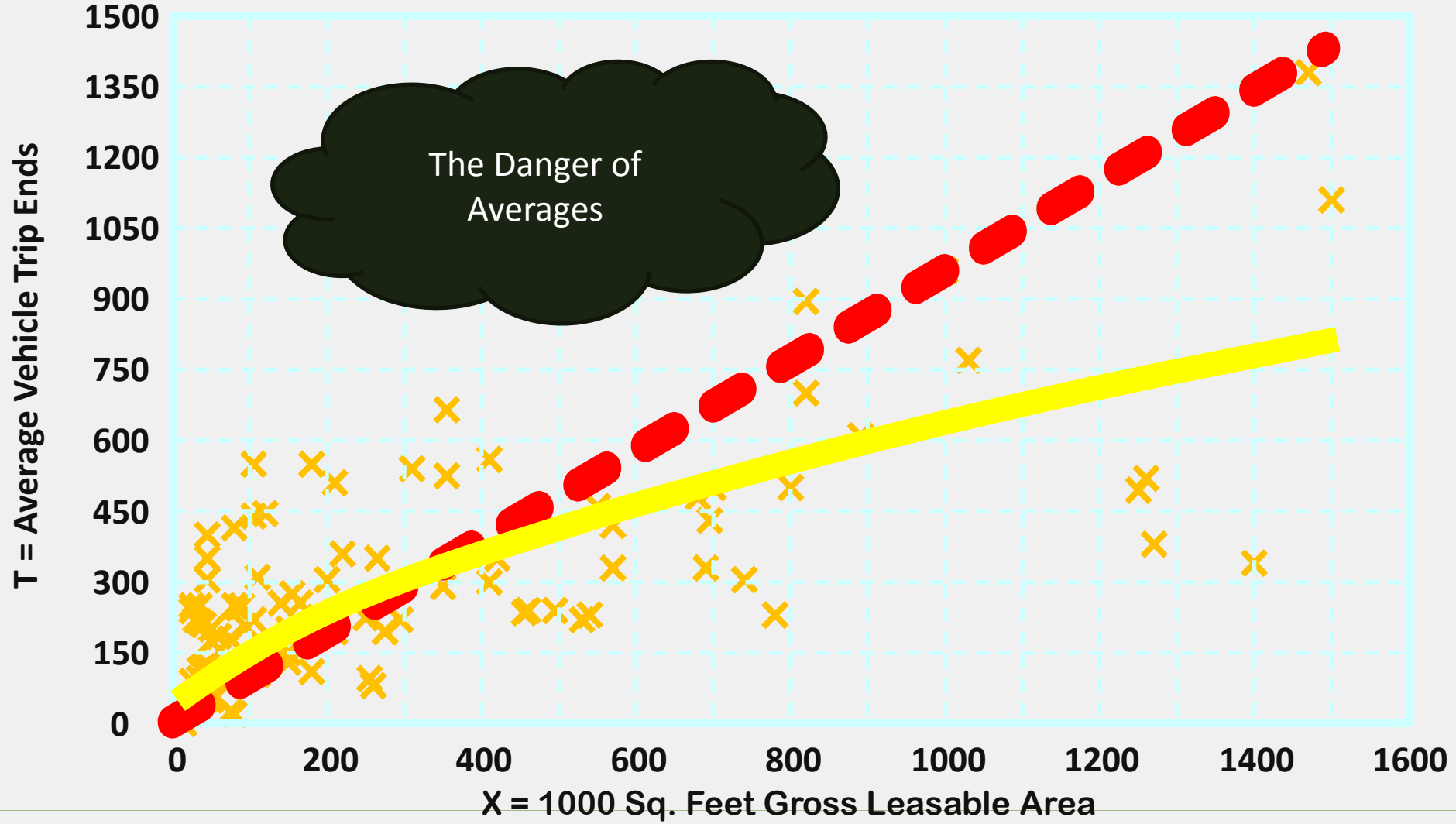
ANALYSIS PERIOD

Need, Model Practice & Recommendation

- Peak Hours: AM/PM/maybe Saturday
- 24-hour model
  - With a “weaker” PM Peak Hour
- AM, PM & Off-peak
  - Strengthen calibration
- Not “Dynamic Traffic Assignment”

TRIP GENERATION

Shopping Center – Land Use Code 820
Average Vehicle Trip Ends vs. 1,000 square feet Gross Leasable Area on a WEEKDAY AM Peak Hour of Adjacent Street



X Actual Data Points Fitted Curve Average Rate

Fitted Curve Equation: Ln (T) = 0.61 Ln (X) + 2.24 R^2 = 0.56

Shopping Center – Land Use Code 820
Weekday AM Peak Hour of Adjacent Street

WEIGHTED AVERAGE RATE:	**0.96**
AVERAGE OF RATES	**2.06**

WEIGHTED AVERAGE RATE IS 118% LESS THAN AVERAGE OF RATES

Need, Practice & Recommendation

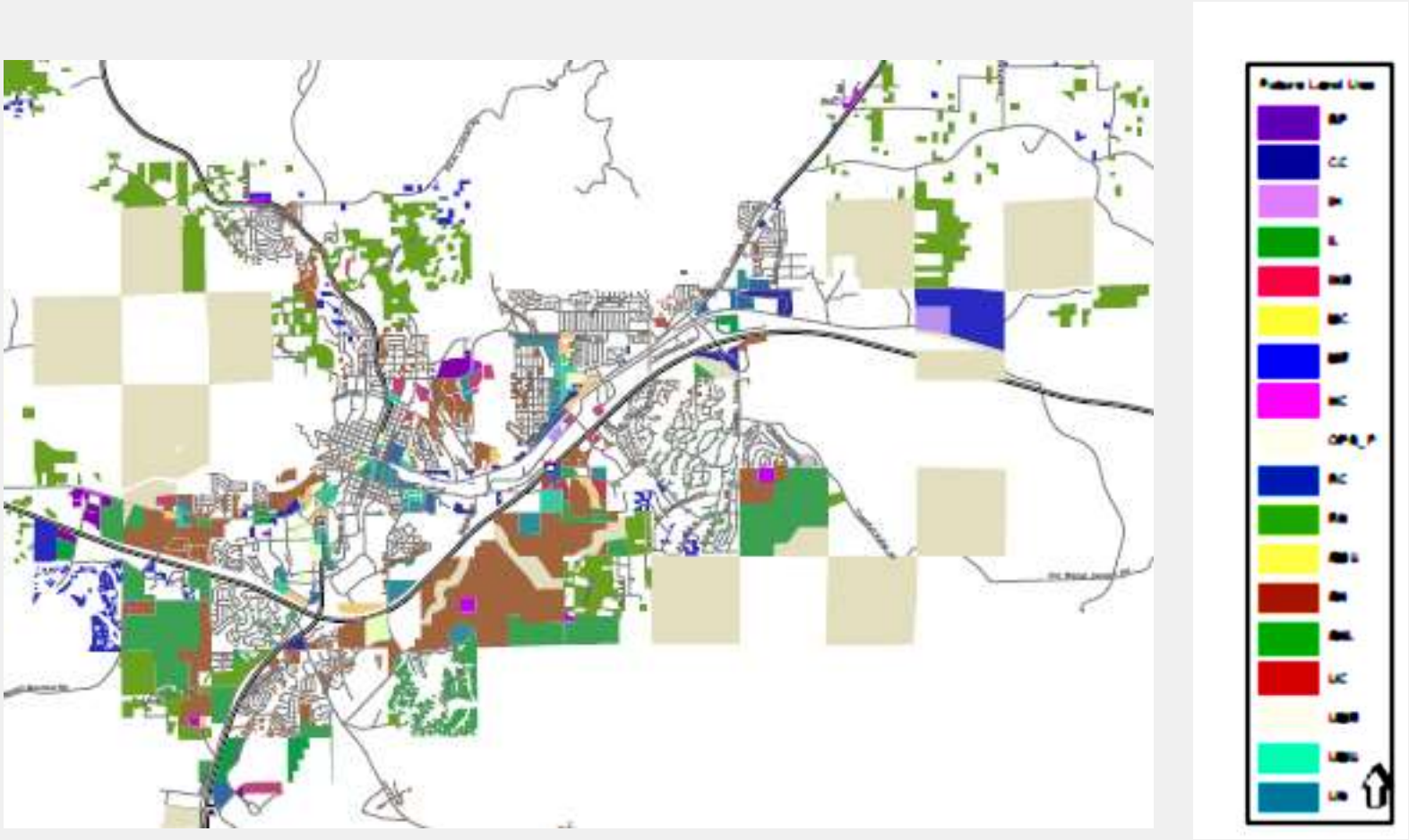
- ITE Trip Rates
- ITE Trip Rates
  - 60 uses & 5 trip purposes
  - Ability to change to more effective uses
- Population & Employment (SE) Data
  - Introduce cross-classification
  - Introduce K-12 trip purpose

Why Land Use & Not SE

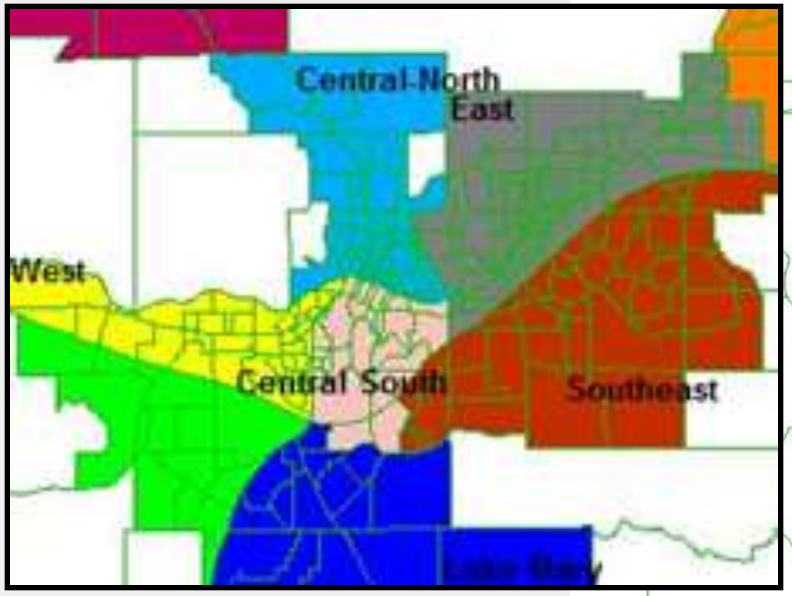
- Current Land Use
  - 60 land uses with associated ITE trip rates
  - Derived from Assessor Data
  - Aggregated to TAZ's

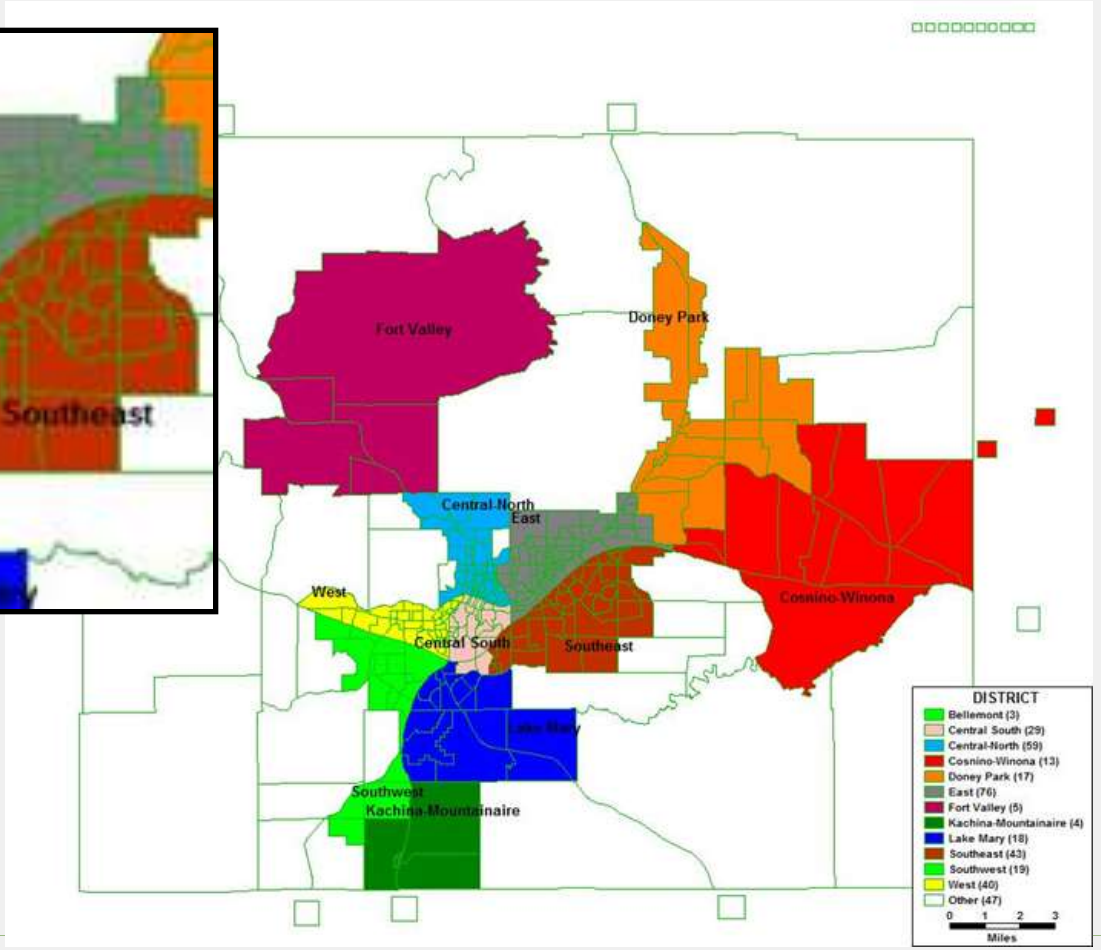
- Build Out & Horizon Years
  - Twenty place-types with population density and job intensity assumptions
  - Place-types converted to Land Use Model codes
  - A Build Out year based on state growth rates.
  - Regional districts assigned low to high low growth rates
  - Interpolations for years 2020, 2030 and 2040

Build Out Land Use in FMPO



Transportation Districts





TRIP GENERATION

TRIP REDUCTION

TRIP REDUCTION (or credit)

JUSTIFY EACH DEDUCTION SEPARATELY

TRANSIT – Sufficient frequency and seats

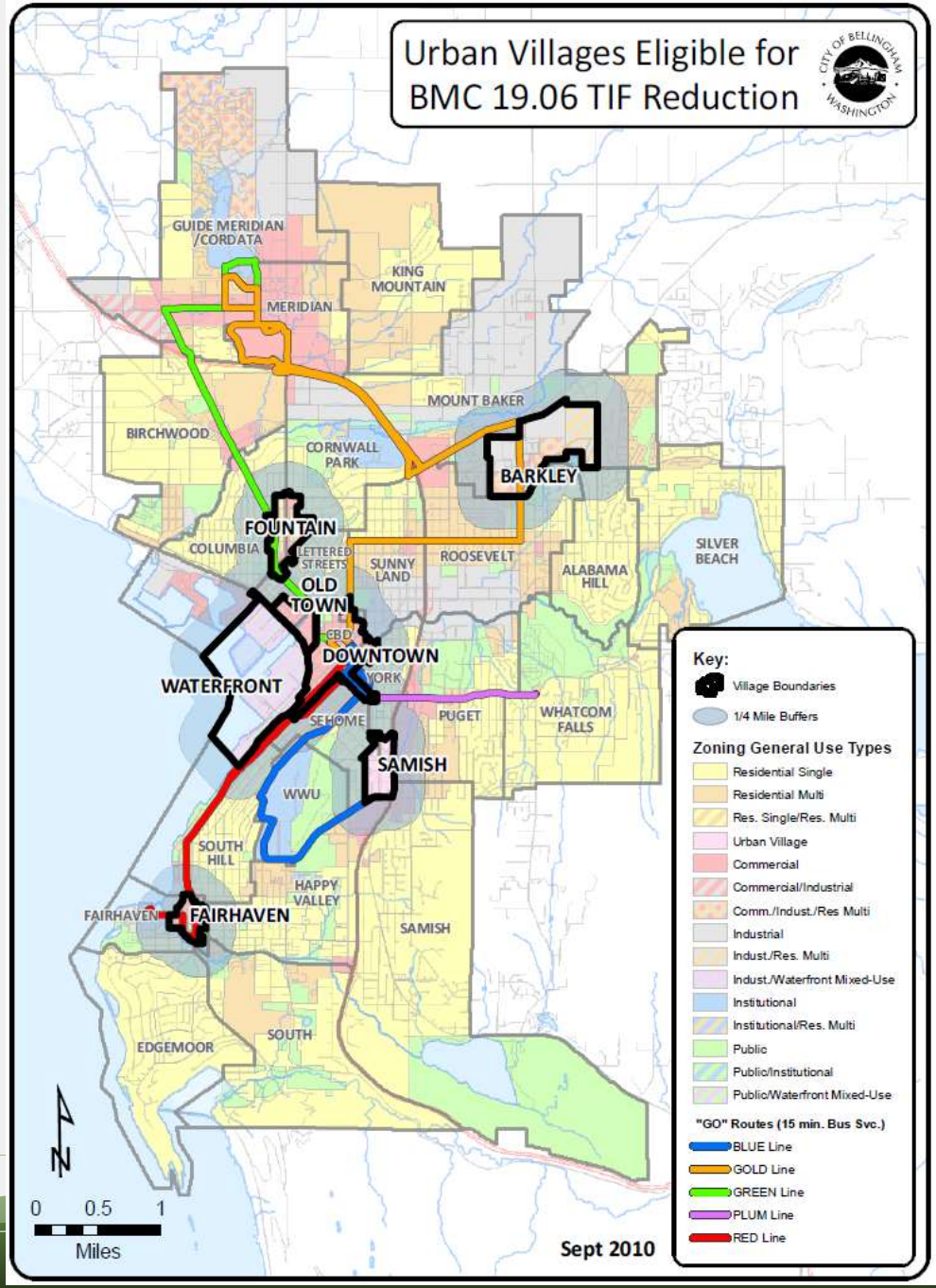
BICYCLES – Adequate bicycle parking and incentives

PEDESTRIANS – Adequate sidewalks and destinations

INTERNAL CAPTURE – Corresponding land uses

URBAN IN-FILL – High current traffic

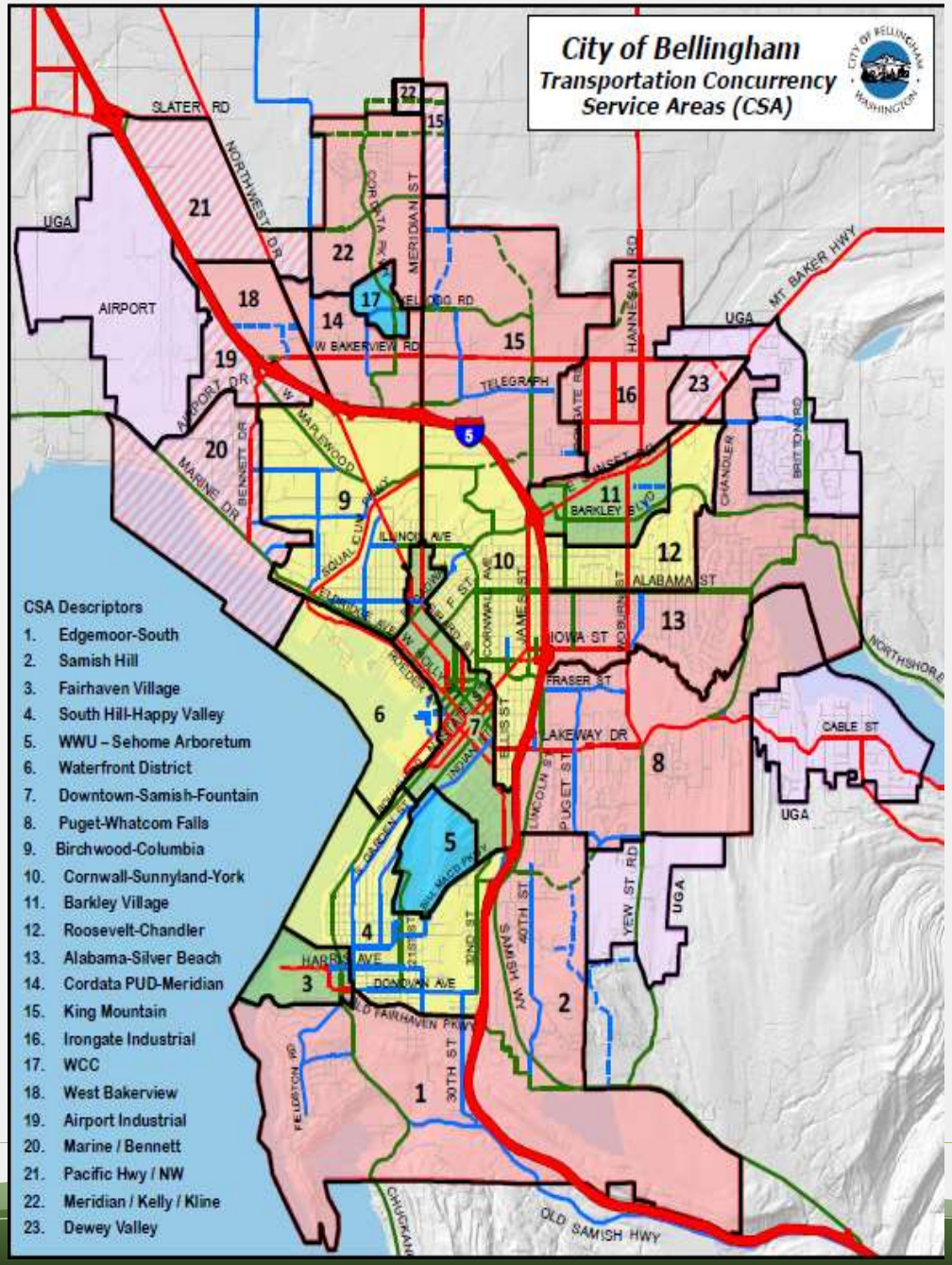
PASS-BY – Independent of urban in-fill



Land Use Goals

- **Prioritize Infill Over Sprawl**
- **Several master-planned mixed use "Urban Villages"**
- **All well-connected with**

✓ **High-frequency (15 min) transit**
✓ **ADA Pedestrian Sidewalks**
✓ **Marked Arterial Bike Lanes**
✓ **Multi-use "Greenways" Trails**
✓ **Multimodal Arterial Streets**



Concurrency Service Areas (CSA)

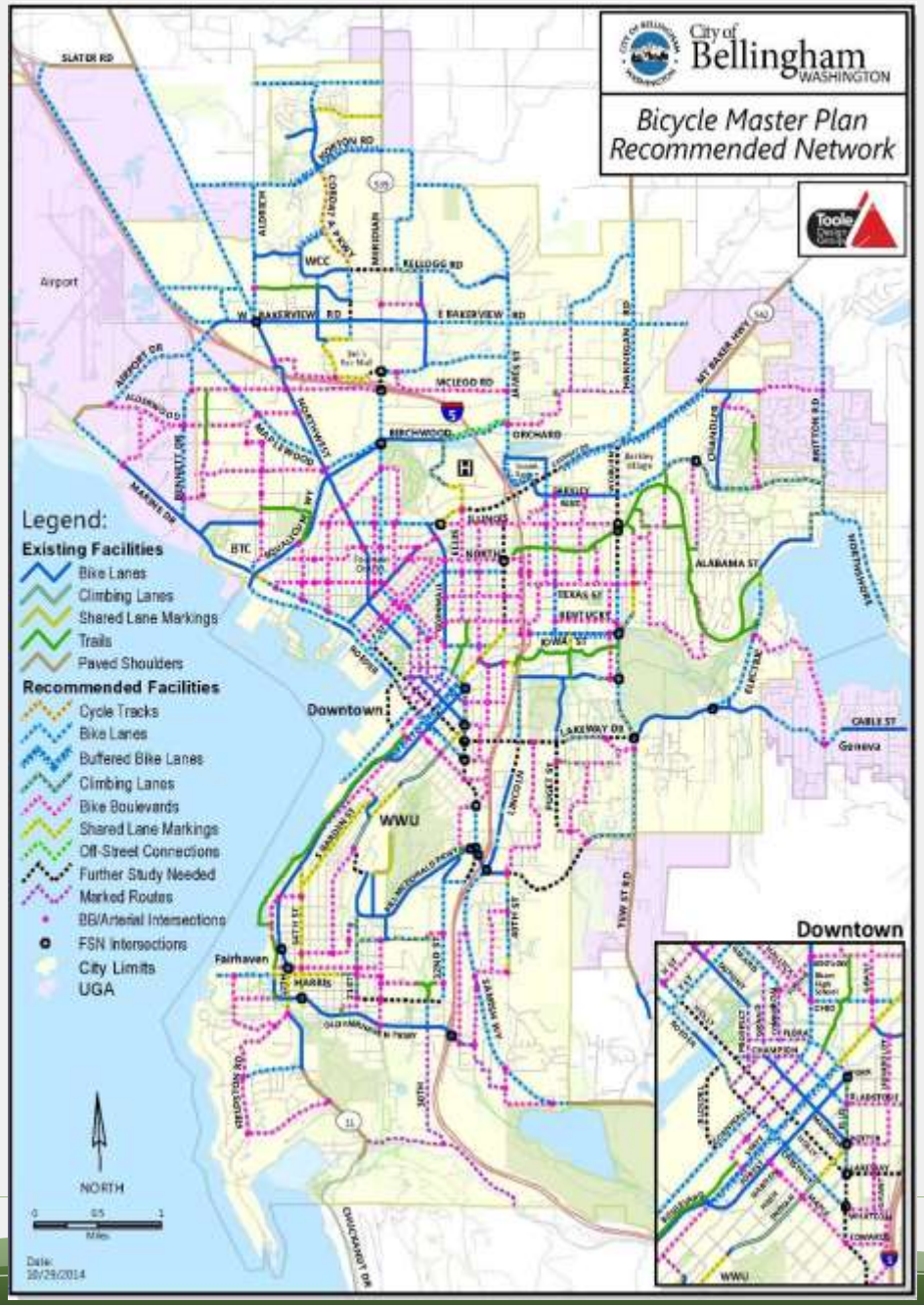
"Mobility-Sheds"
based on land use context

3 Urban Village (Type 1) Green
Higher density mixed use urban

2 Urban Institutional (Type 1A)
Western Washington University
Whatcom Community College

5 Transition (Type 2) Yellow
Moderate density neighborhoods

7 Suburban (Type 3) Red
Lower density neighborhoods
Auto-centric commercial (north)



Non-Motorized Plans

Pedestrian Master Plan

- 266-mile pedestrian network
- ~ 170 miles (64%) complete
- Identifies pedestrian needs
- Prioritizes improvements

Bicycle Master Plan

- 170-mile bicycle network
- ~ 68 miles (40%) complete
- Identifies bicycle needs
- Prioritizes improvements

Multiuse Greenways Trails

- Extensive citywide trail system
- 65 existing trail miles

Mode Share & Goals

Mode	2008-2012[1]	2015[2]	2022[2]
Pedestrian	8.2%	11%	13%
Bicycle	4.1%	6%	6%
Transit Bus	5.8%	4%	6%
Automobile	75.9%	80%	75%
Work at Home	5.0%	~	~

Notes: (1) 2008-2012 American Community Survey (U.S. Census) data
(2) Bellingham Comprehensive Plan Transportation Element

Creating Multimodal Concurrency Measurements

- **2008 – transpogroup consultants help City study 15 alternative methods, develop preferred alternative, & implement Jan 1, 2009**
- **"Plan-based" - Concurrency Service Areas (CSA) *["Mobility Sheds"]***
  Variable typology & weighting factors based on land use context
- **Pedestrian = % completeness of network in Pedestrian Master Plan**
- **Bicycle = % completeness of network in Bicycle Master Plan**
- **Multiuse Trails = % completeness relative to Ped & Bike networks**
- **Transit = WTA seated 2-way capacity, frequency, & ridership counts**
- **Vehicles = pm peak 2-way arterial volume-to-capacity (v/c) – HCM LOS**

5 measurements instead of traditional auto-only v/c LOS

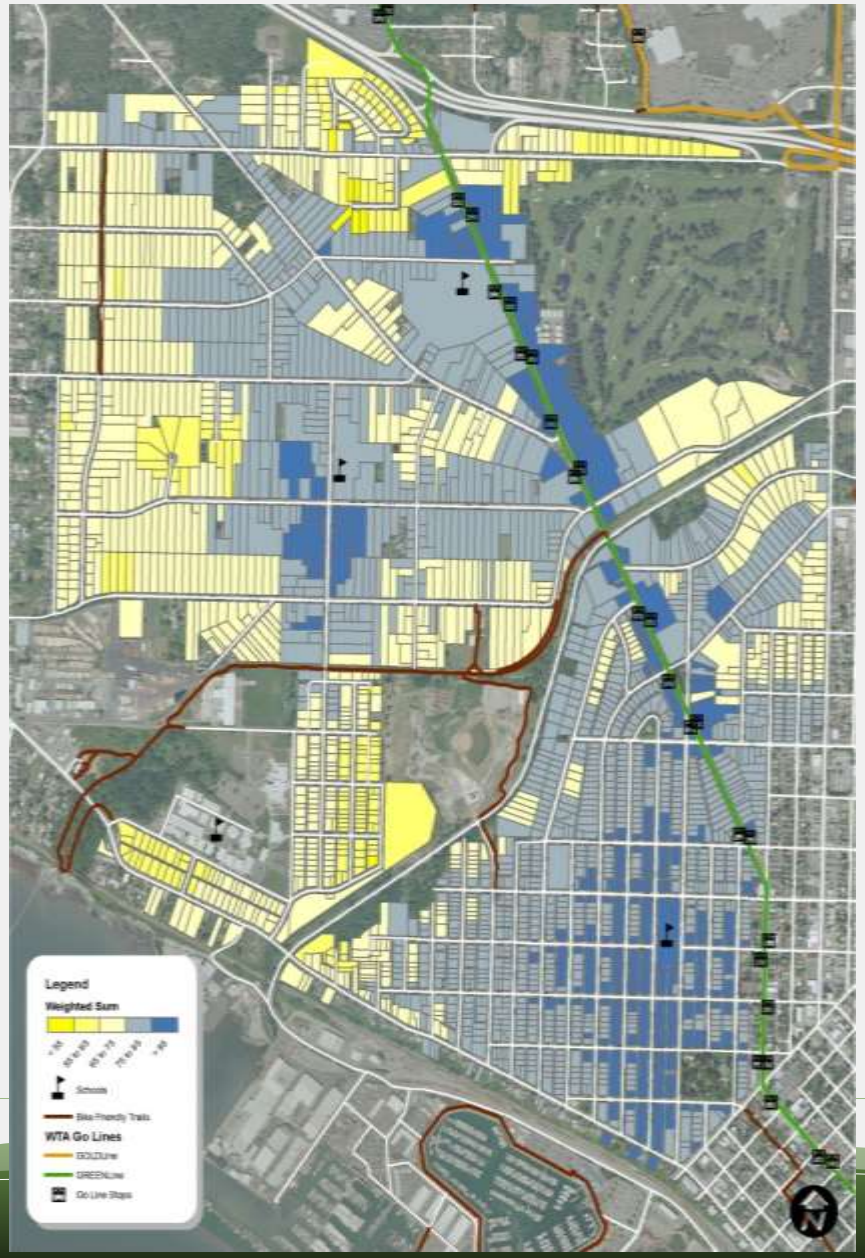
"Policy Dials"

Mode Weight Factors

Based on Land Use Typology

	Transportation Concurrency Service Areas		
Mode	**Type 1[1]**	**Type 2[2]**	**Type 3[3]**
Motorized			
Auto			
Mode weight factor[4]	**0.70**	**0.80**	**0.90**
Transit			
Mode weight factor[5]	**1.00**	**1.00**	**0.80**
Non-Motorized			
Pedestrian			
Percent threshold for minimum system complete[6]	**50%**	**50%**	**50%**
Person trip credit for 1% greater than minimum threshold[7]	**20**	**20**	**20**
Mode weight factor[8]	**1.00**	**0.90**	**0.80**
Bicycle			
Percent threshold for minimum system complete	**50%**	**50%**	**50%**
Person trip credit for 1% greater than threshold	**20**	**20**	**20**
Mode weight factor[9]	**1.00**	**0.90**	**0.80**
Multi-Use Trails[10]			
Person trip credit for 1% greater than threshold[11]	**10**	**10**	**10**
Mode weight factor[12]	**1.00**	**0.90**	**0.80**

What's Next? Connectivity Metrics

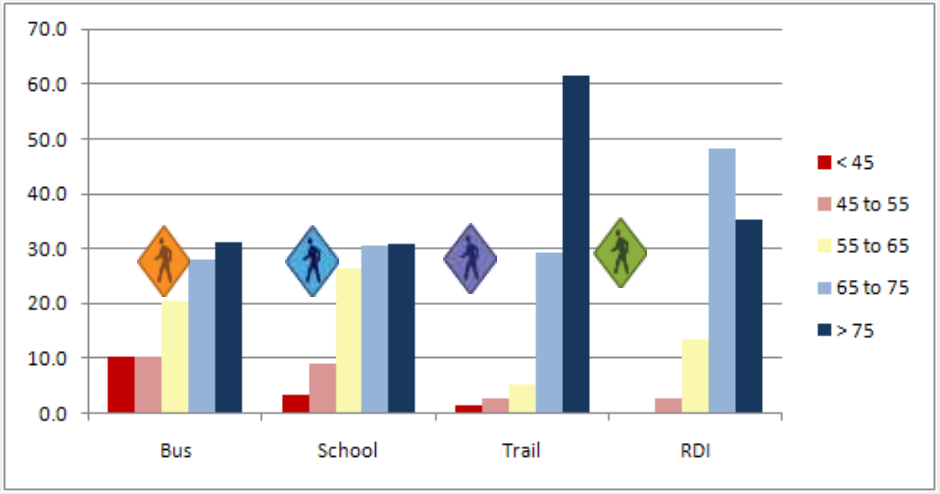


transpogroup ViaCity

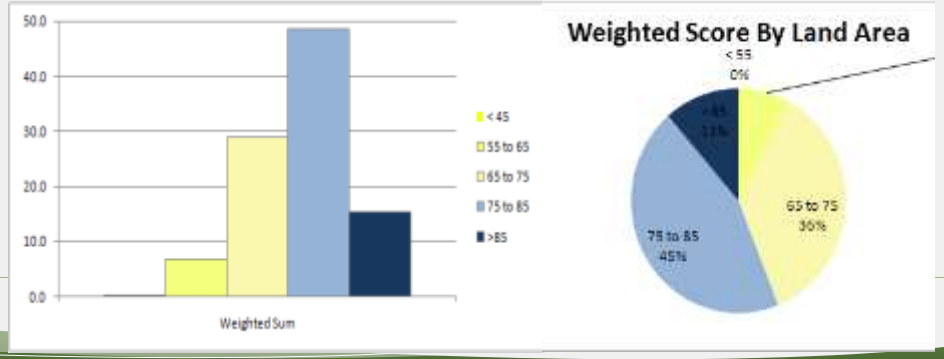
Route Directness Index (RDI)

CSA #9 Composite Scores

Connectivity Indices



Composite Scoring



BMC 19.06 Urban Village Vehicle Trip Reduction Credits

TABLE 2 – URBAN VILLAGE VEHICLE TRIP REDUCTION CREDITS	CREDIT
Menu of Location Factors and Performance Measures to Reduce Vehicle Trips	
Note: Reductions below are additive and may not exceed a total of 50%	
1.) MIXED USE URBAN VILLAGE LOCATION	**15%**
(Based on ITE Internal Trip Capture - Mixed Use Urban Environment)	
2.) WTA TRANSIT PROXIMITY (Only one transit proximity reduction below may be used)	
Development fronts on a high-frequency WTA GO Line	**10%**
Development within 1/4-mile of WTA GO Line	**7%**
Development fronts on standard WTA Route (30 - 60 min)	**5%**
Development within 1/4-mile5 of standard WTA Route (30 - 60 min)	**2%**
3.) EMPLOYER MANDATORY COMMITMENT TO COMMUTE TRIP REDUCTION (CTR)	
CTR/TDM commitment combining economic incentives with transportation services	**10%**
4.) VOLUNTARY ANNUAL WTA TRANSIT PASS PROVISION (Non-CTR)	
2-year transit pass provided for residential units = 1% per unit pass	**1%**
2-year transit pass provided for employees = 1% per employee pass	**1%**
5.) VOLUNTARY CAR SHARE PARTICIPATION OR PROVISION (Non-CTR)	
Car Share Vehicle(s) Parked On Residential or Employment Site = 2% per vehicle	**2%**
Car Share membership fee provided for residential units = 2% per unit	**2%**
Car Share membership fee provided for employees = 2% per employee	**2%**

“3D”: Density, Diversity & Design DESIGN

- The model includes design through the inclusion of separate pedestrian, bicycle and transit level-of-service variables.
- LOS scores, to date, are subjective or “empiridotal”

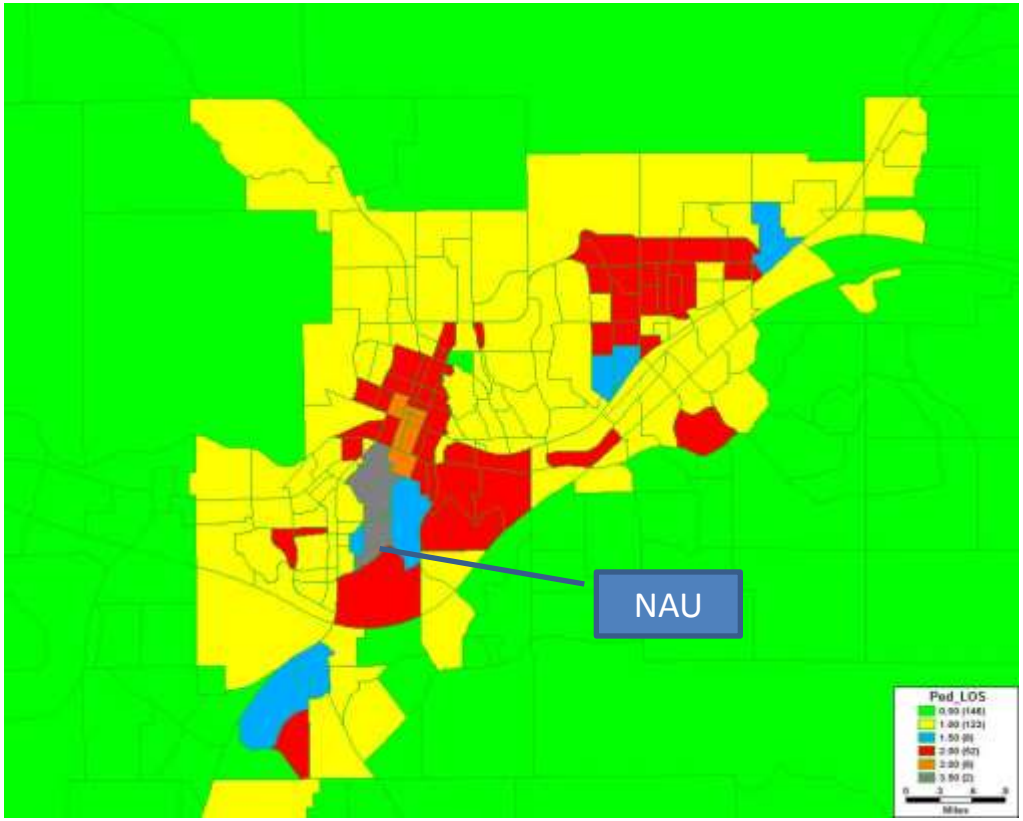
Modal LOS: Ped, Bike & Transit

Ped LOS Variables:

- Missing sidewalks, street or intersection density, crossing or cross-walk density weighted by type

Bike LOS Variables:

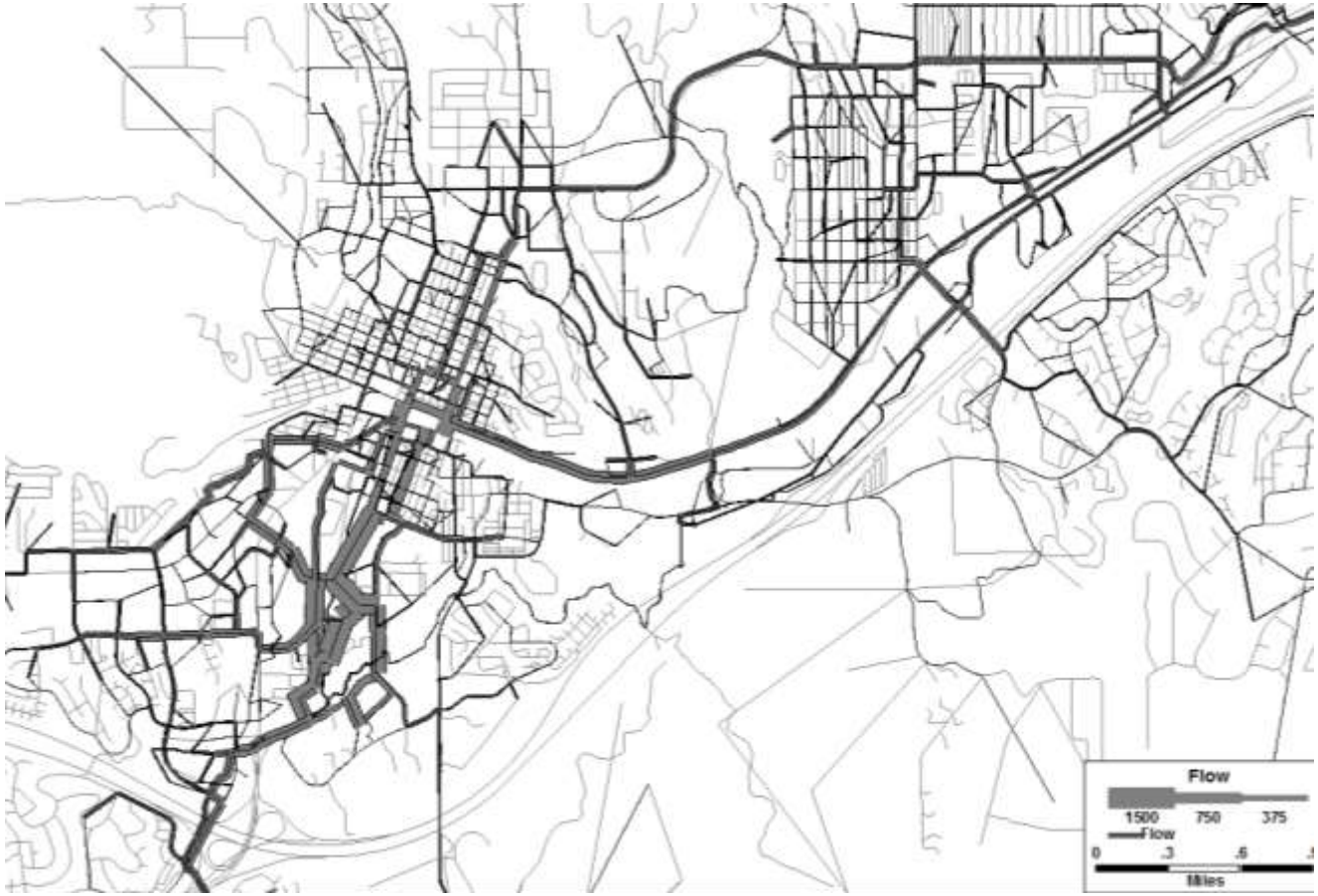
- BCI, Crossings, Street or intersection density, missing links



Transit LOS Variables:

- Proximity to bus stops (1/4 and 3/8 mile); Frequency of service. Influenced heavily by walk share

Bike Assignment by BCI



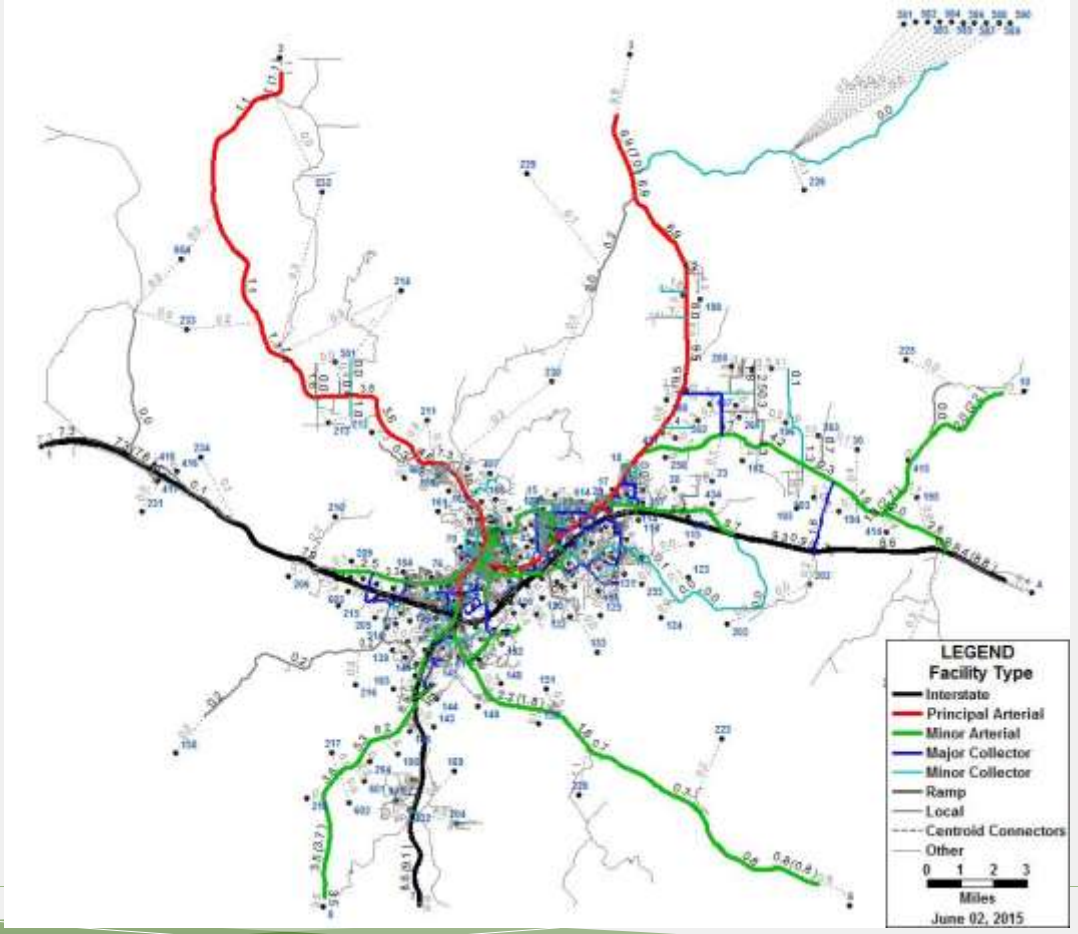
- Traffic speed
- Volume
- Bike lanes
- Lane Widths
- Paved Trail
- Unpaved Trail
- Width, etc.

Need, Practice & Recommendations

- Quantitative, Defensible
- Qualitative, Defendable
- Consider implementing a logit-based mode choice model within the overall model stream
  - Asserted parameters based FTA guidance make this a straightforward process
  - Route system, and non-motorized network coding would be required. The Bicycle Comfort Index (BCI) can fit into a logit model.
  - Jump into transit assignment
- Calibration data

TRIP DISTRIBUTION & ASSIGNMENT

Network by Facility Type



Centerline Miles by Facility Type

- Interstate: 82
- Mjr. Arterial: 40
- Mr. Arterial: 64
- Mjr. Collector: 33
- Mr. Collector: 57
- Local (model): 63
- Off model: 413

FMPO Trip Distribution Example

Readily mapped.

Use select link and select zone functions

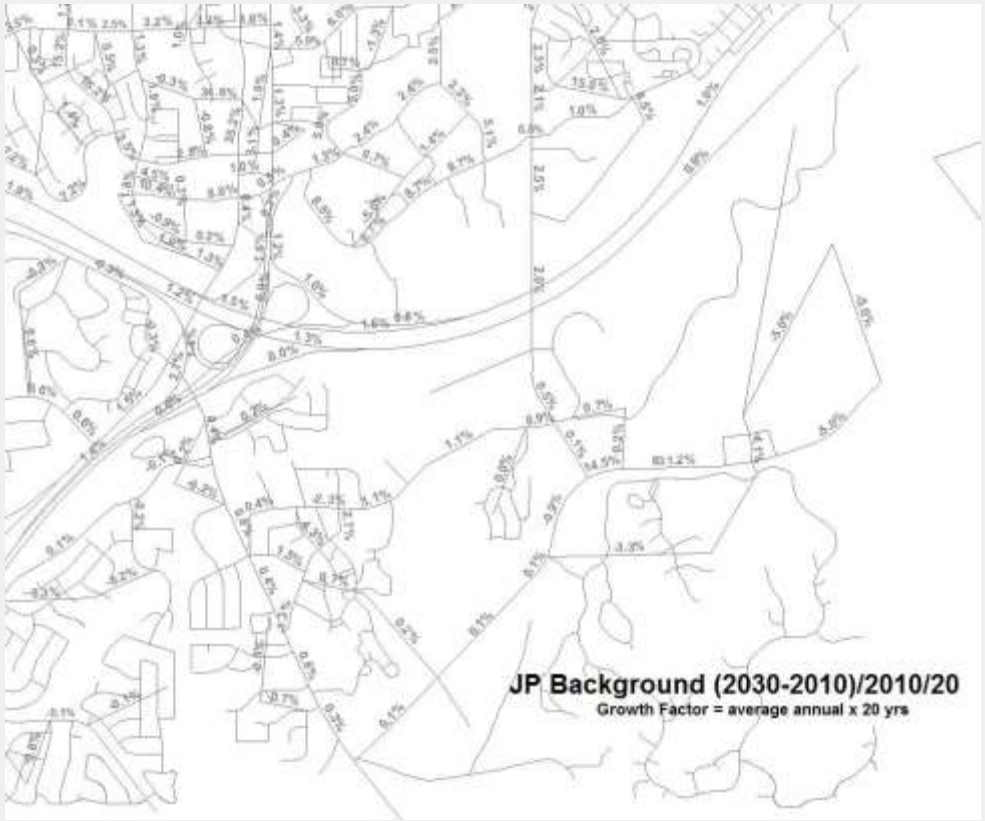
Need, Practice & Recommendations

- Circulation patterns
- Gravity Model
- Improve accuracy/assumptions:
  - Calibrate/Validate:
    - HH Survey: Flow between sub-areas
    - HBW vs. CTPP Journey-to-work flow
  - Speed feedback loop
  - Gravity Model transition to Destination Choice Model
  - Link Volume delay to Intersection delay

Outstanding Questions

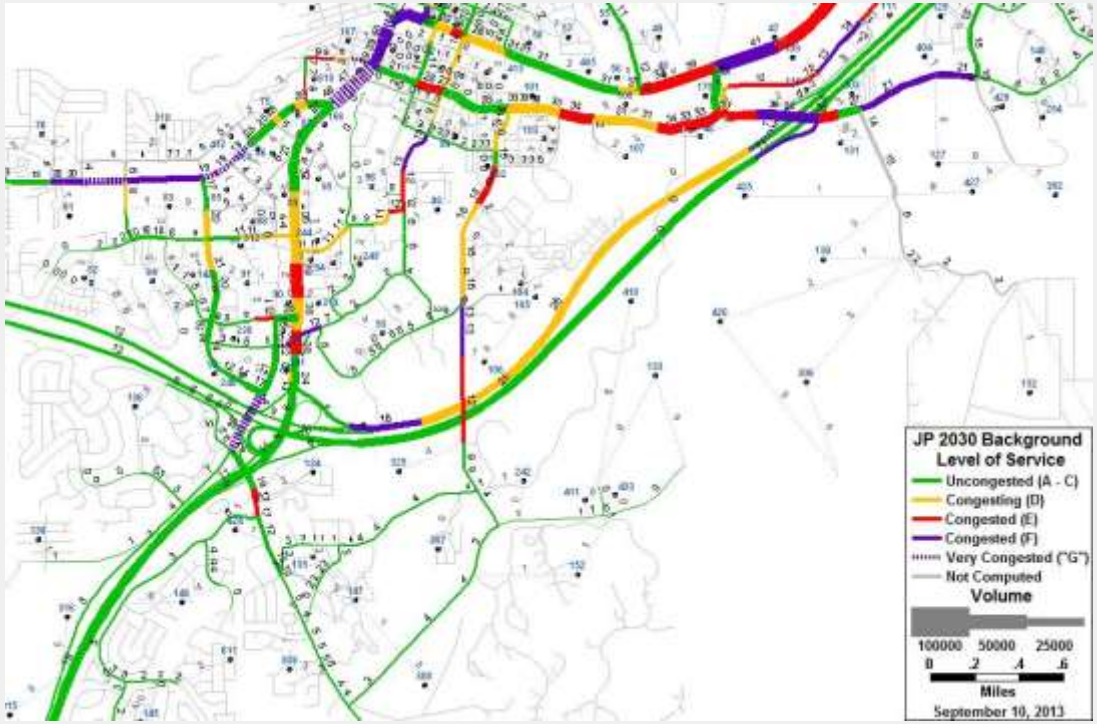
- Future Background Traffic
  - What does the TIA process gain from asking/answering this question?
  - What are the “right” and “logical” inputs to the model?
- Proportional share

Growth factors



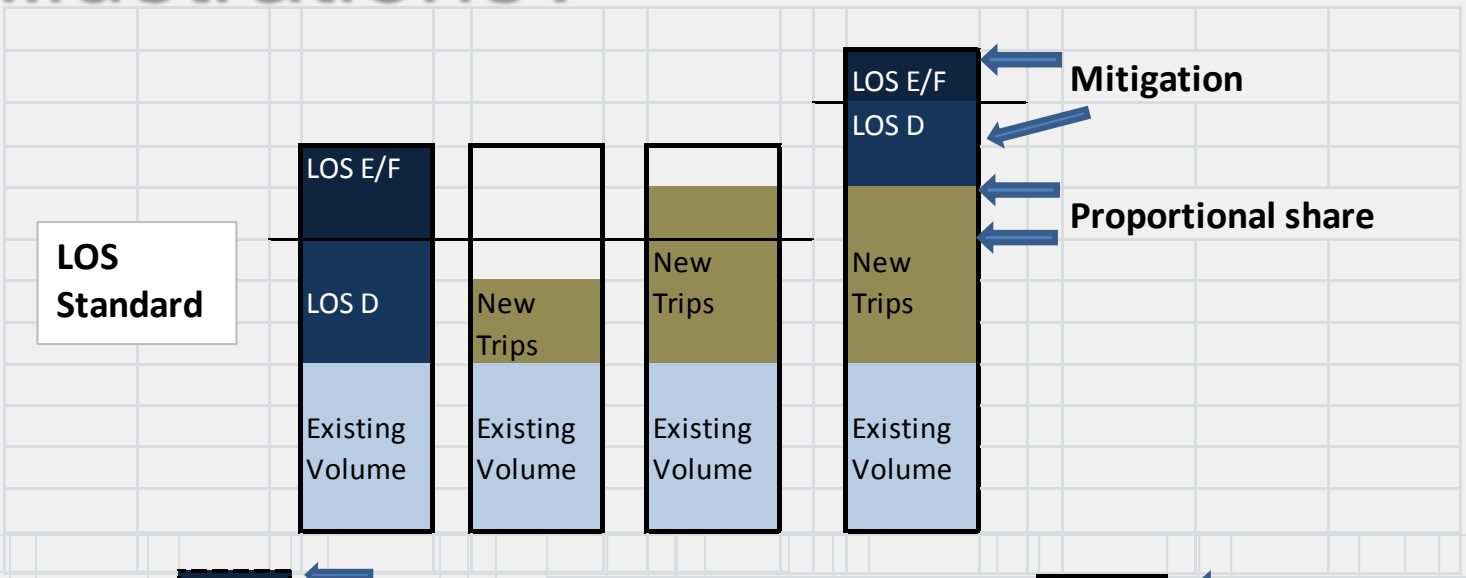
- Growth factors by facility type based on a comparison of present and future growth are provided to developers
- Used when future conditions forecasts are not robust
- Useful to recognize different growth rates across the region

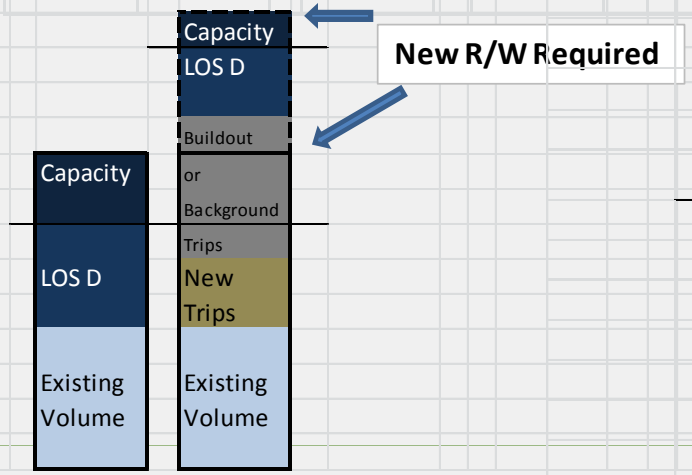
Background Level of Service

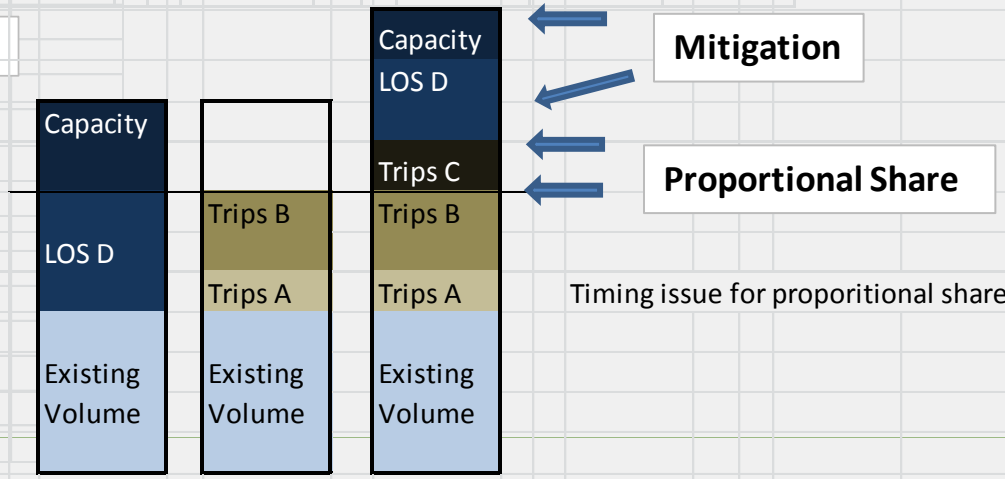


- Future LOS without the project (background traffic only) can help identify relevant capacity issues

How can we improve these illustrations?







TRIP GENERATION HANDBOOK, 3rd EDITION VERY BENEFICIAL ASPECTS

Comprehensive guidance and direction

Truck Trip Generation

Person-trips versus Vehicle-trips

Urban in-fill development

Pass-by Trips

Different Trip Generation calculation techniques

Disaggregate versus Aggregate considerations

Mixed-use development

Transit-friendly development

Recap

- Add value for member agencies
- Magnitude of private investment in transportation system
- Legal and financial implications for proportional share
- Getting the details right for non-motorized modes

Thank You!

The final report will be out soon.

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