Transportation Forum 2014

Developing a Methodology to Incorporate Transit, Pedestrian and Bicycle Design Features into Highway and Bridge Projects during the Planning and Design Phases of Project Development in Pennsylvania

Transportation Forum 2014

Research Team

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Purpose of Research Project

National Current Standards and Practices

PennDOT current practice and use of Checklist

Five (5) Current Methodologies used by DOTs and MPOs

Methods of Analysis and Testing of Three Potential Methodologies

Research Findings and Recommendations

Purpose of Research Project

- Current method only evaluates multi-modal design features relative to their function as accessory uses
- The checklist process does not have a validation system behind it; the process is largely qualitative
- The goal of the project was to develop a more quantitative means of assessing the need for bicycle, pedestrian, and transit facilities

Purpose of Research Project

A new process is to determine several key project details:

- An appropriate project scope, based on land use and demand for various transportation modes;
- The extent to which various modes of transportation should be accommodated and the value of such accommodations; which results in
- A more accurate project cost estimate

National Current Standards and Practices

Sources Evaluated Included:

- The Manual on Uniform Traffic Control Devices (MUTCD)
- The Transportation Research Board - The Highway Capacity Manual
- American Association of State Highway and Transportation Officials (AASHTO)
- State Departments of Transportation (DOTs), Metropolitan Planning Organizations (MPO) and Cities

National Current Standards and Practices

Significant National Standards and Practices

- Bicycle Compatibility Index (BCI) FHWA, 1998
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities (GPF)
- AASHTO Guide for the Development of Bicycle Facilities (GBF)

National Current Standards and Practices

State DOTs and MPOs policies consider the following factors:

- Connectivity;
- Public Input;
- Latent Demand Analysis;
- Level of Service Determination;
- Safety History;

National Current Standards and Practices

State DOTs and MPOs policies consider the following factors:

- Demographics;
- Land Use/Zoning;
- Public Education;
- Average Daily Traffic (ADT)
- 85th Percentile Speed;
- Benefit-Cost Ratio

PennDOT Current Practice and use of Checklist

Development of Current Policy

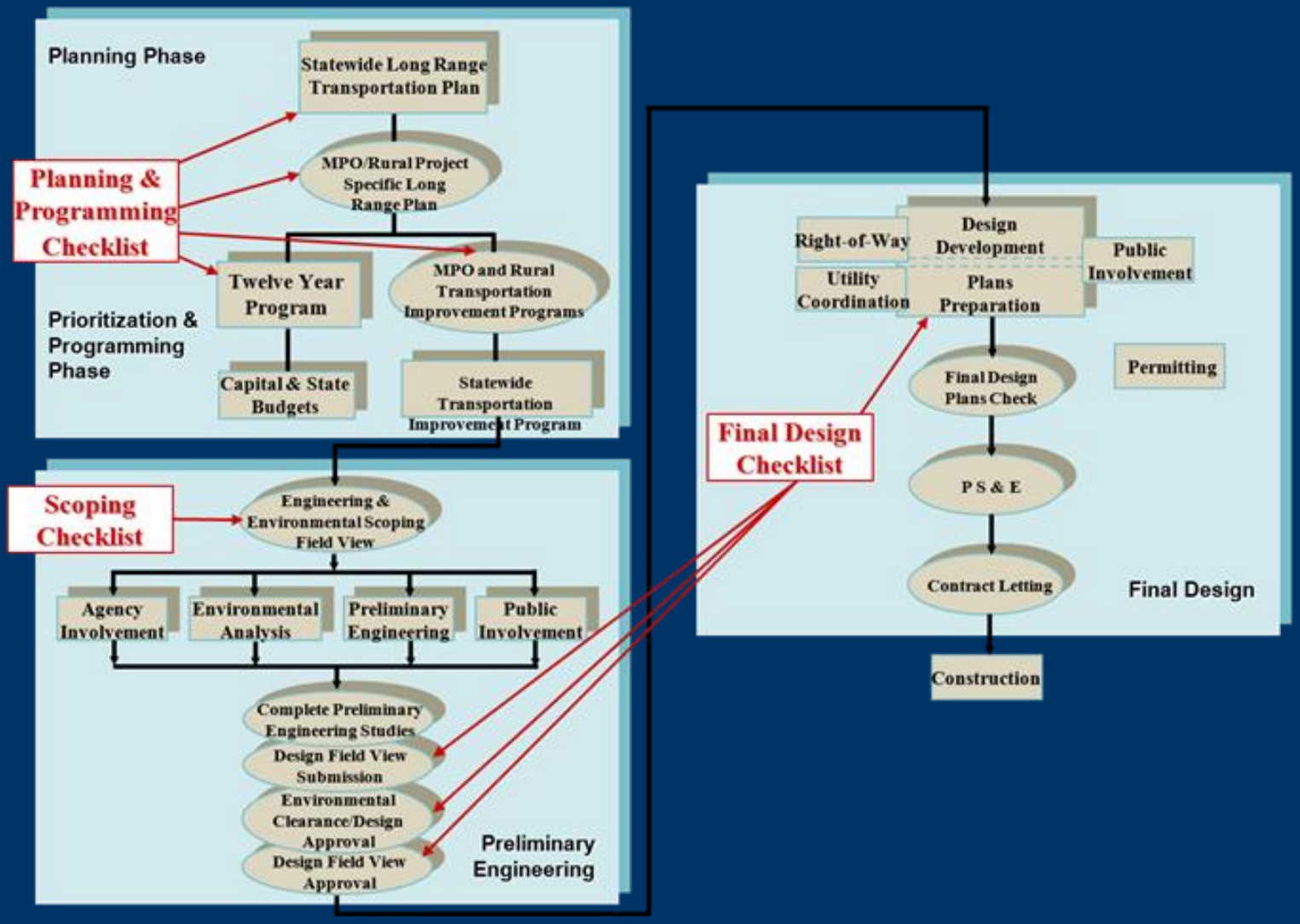
- TEA-21 and ISTEA required the mainstreaming of bicycle and pedestrian projects;
- The bicycle and pedestrian checklist was created to ensure that appropriate multi-modal features are considered

PennDOT Current Practice and use of Checklist

Development of Current Policy

- The current checklist created by PennDOT in 2000;
- In 2007 the checklist was incorporated in the Design Manual

PennDOT Current Practice and use of Checklist



PennDOT Current Practice and use of Checklist

Review of PennDOT recent use of Checklist

- Research Team conducted a review of five projects that utilized the checklist;
- Projects varied in their location (urban and rural),scale and type of project (bridge and highway);
- None of the projects reviewed had checklists completed for the design phase;

PennDOT Current Practice and use of Checklist

Review of PennDOT use of Checklist

- The checklist is being used in the early stages of project development;
- Issues of ADA compliance and safety also appear to be taking precedent over the incorporation of pedestrian and bicycle features; and
- Coordination with the MPO or RPO appears to be limited during the planning and programming phase.

Five (5) Current Methodologies used by DOTs and MPOs

Research team identified five potential methodologies that could be used by PennDOT that take very different approaches to the issue

- Arizona DOT;
- Colorado DOT;
- Georgia DOT;
- Oregon DOT; and
- Richmond MPO

Five (5) Current Methodologies used by DOTs and MPOs

Arizona DOT

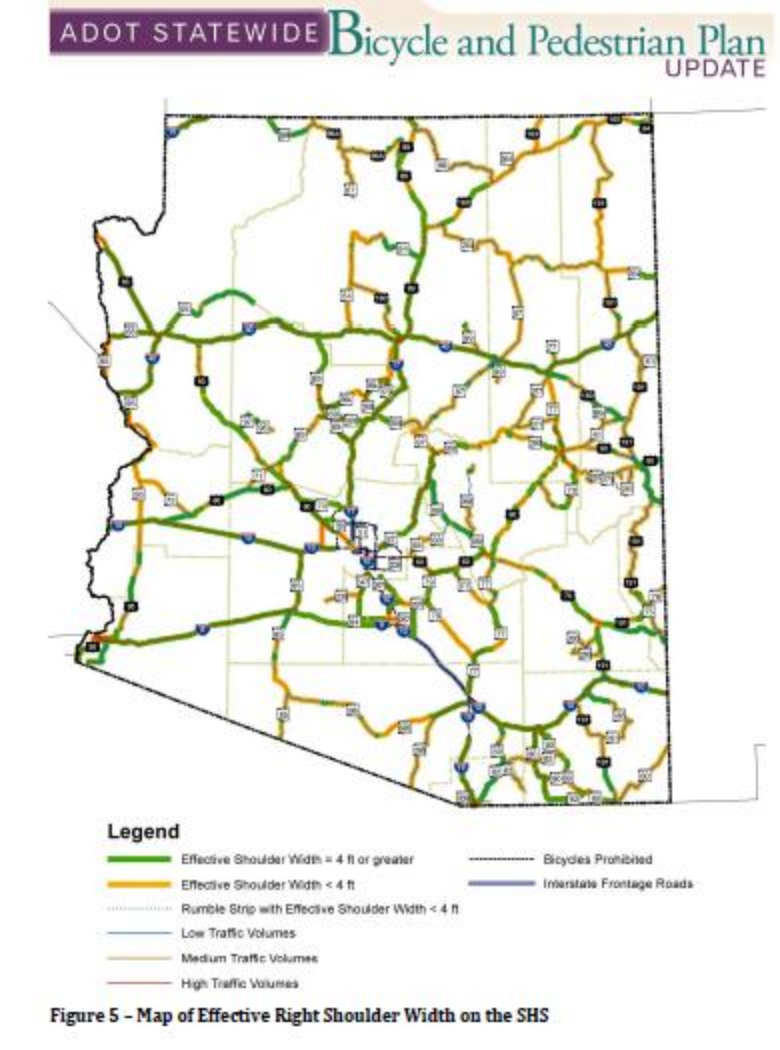


Figure 5 – Map of Effective Right Shoulder Width on the SHS

Source: Arizona DOT

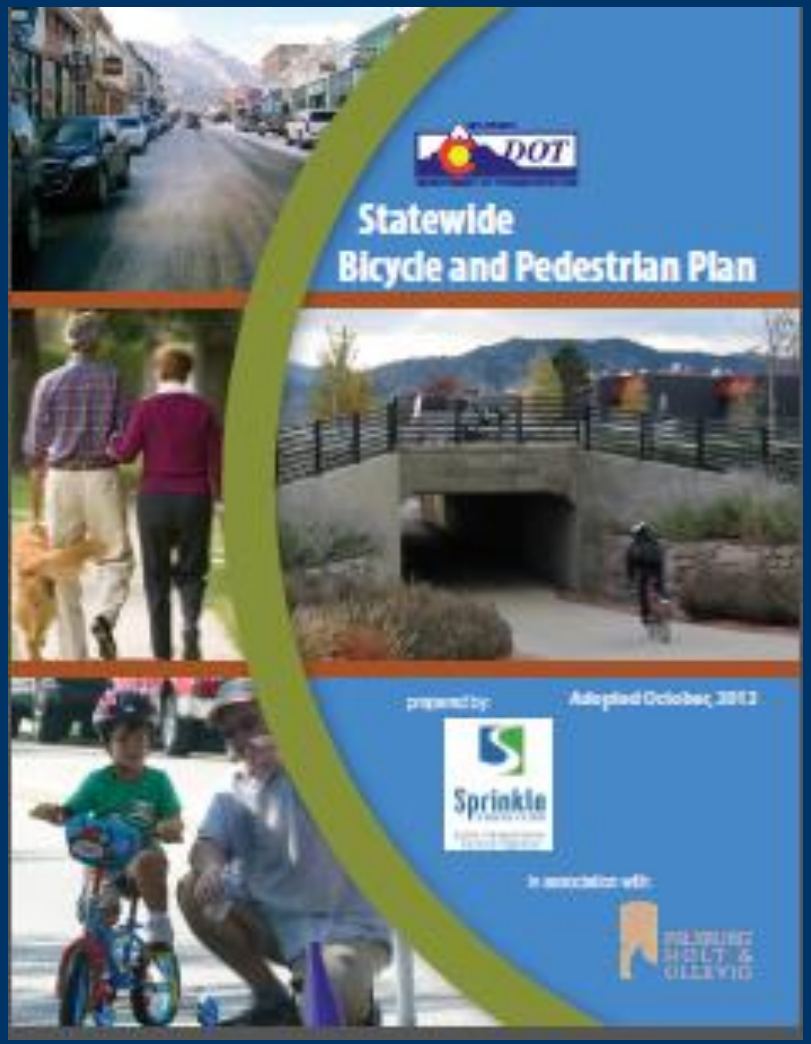
Five (5) Current Methodologies used by DOTs and MPOs

Arizona DOT

- The requirement is based on the access classifications of the highway
- Project location within defined urban and rural areas;
- Major new construction and reconstruction in urban areas, ADOT requires that the design provide a minimum 4-foot wide shoulder for bicycles (AASHTO standard); and
- Sidewalks should be provided if origin/destinations are within 1.5 miles walking distance

Five (5) Current Methodologies used by DOTs and MPOs

Colorado DOT



Source: Colorado DOT

Five (5) Current Methodologies used by DOTs and MPOs

Colorado DOT

- Methodology is geared towards evaluating competing bicycle and pedestrian projects;
- Uses a rating system to evaluate projects that is similar to the FHWA bicycle compatibility index;
- 14-foot wide curb lanes may be used in lieu of a four foot paved shoulder to accommodate bicycles; and
- For projects in urban areas, pedestrian accommodations will be 5-foot width sidewalks

Five (5) Current Methodologies used by DOTs and MPOs

Georgia DOT

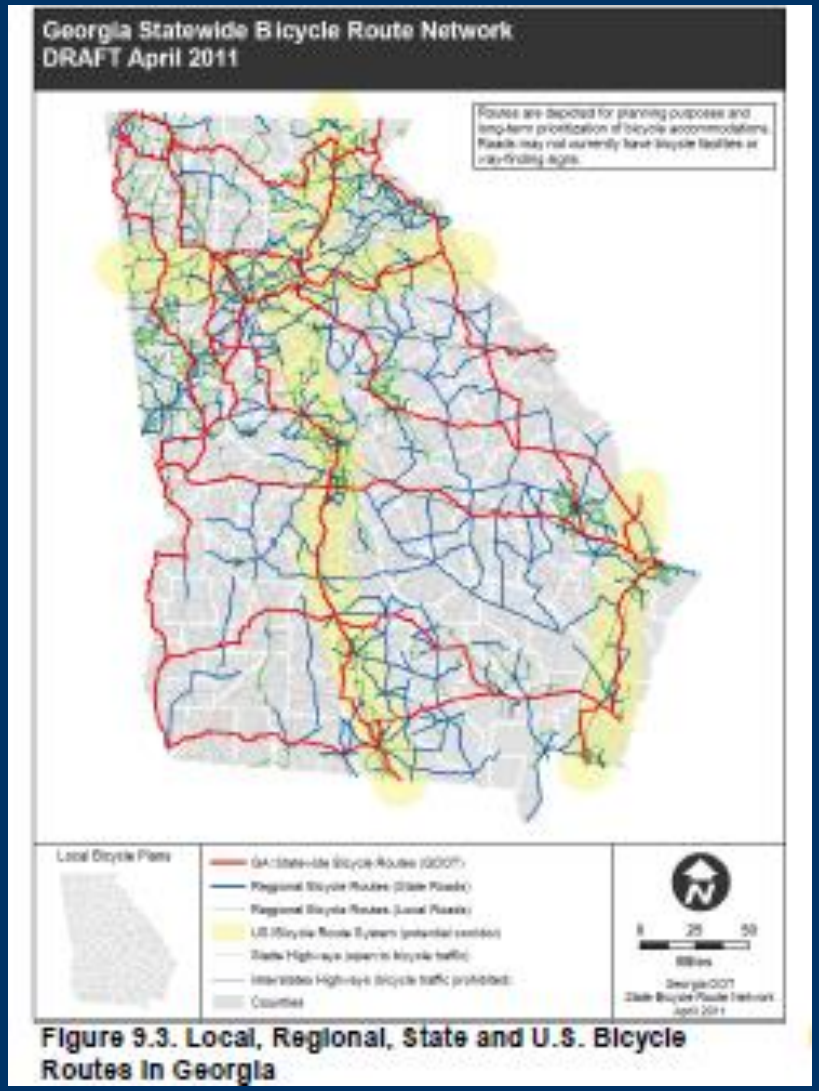


Figure 9.3. Local, Regional, State and U.S. Bicycle Routes in Georgia

Source: Georgia DOT

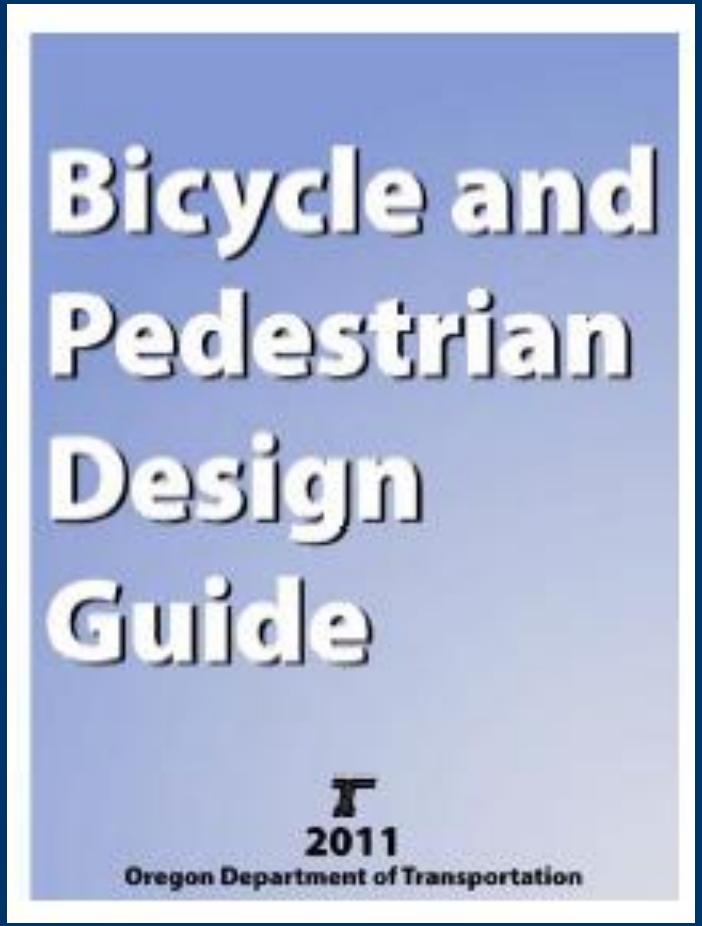
Five (5) Current Methodologies used by DOTs and MPOs

Georgia DOT

- Policy that assumes new facilities and major reconstruction projects should anticipate bicycle and pedestrian traffic;
- Warrant-based methodology which has established both standards and guidelines

Five (5) Current Methodologies used by DOTs and MPOs

Oregon DOT



Source: Oregon DOT

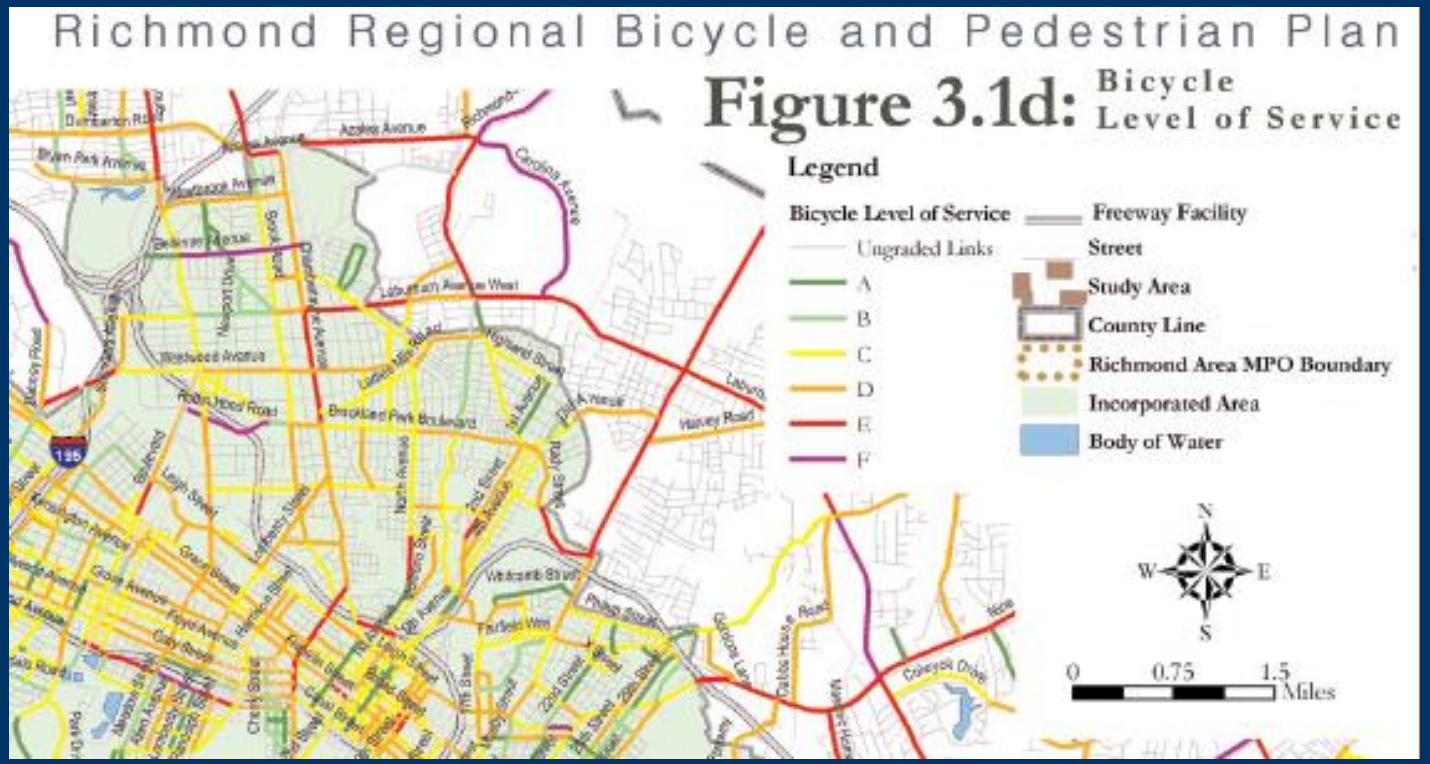
Five (5) Current Methodologies used by DOTs and MPOs

Oregon DOT

- Oregon approach to bicycles and pedestrians is to accommodate all modes where possible;
- The Oregon Bicycle and Pedestrian Design Guide provides very specific design guidelines; and
- Relies on a policy of all accommodation and using local jurisdiction bicycle and pedestrian plans.

Five (5) Current Methodologies used by DOTs and MPOs

Richmond Virginia MPO



Source: VDOT

Five (5) Current Methodologies used by DOTs and MPOs

Richmond Virginia MPO

- Regional rather than statewide approach;
- Unique approach to estimating latent demand for bicycle and pedestrian facilities;
- Estimates relative latent demand based upon land use projections from the MPO travel demand model.

Five (5) Current Methodologies used by DOTs and MPOs

Comparison of 5 Methodologies to PennDOT Method

Similarities include the following:

- The Colorado DOT method considers very broad information to be used; and
- A design emphasis is used by Oregon similar to the portions of the current PennDOT checklist

Five (5) Current Methodologies used by DOTs and MPOs

Comparison of 5 Methodologies to PennDOT Method

Differences between the PennDOT approach and the methods reviewed include:

- An analytic method of measuring LOS for bicycles and pedestrians is used;
- A decision process based on specific warrants; and
- Many states use developed master plans for bicycle and pedestrian facilities for decision making

Methods of Analysis
of Three Potential Methodologies

Three methods selected for adaptation to Pennsylvania and testing:

- Arizona;
- Colorado; and
- Georgia

Methods of Analysis
of Three Potential Methodologies

Arizona Method (Smart Functional Classifications)

- Identify primary objective of project. (Full reconstruction, rehabilitation, preventative maintenance);
- Collect data such as community character ,bicycle and pedestrian crash data, roadway classification, bicycle master plans etc.; and
- Determine accommodations to be provided for pedestrians/bikes/transit based on type of project and roadway classification

Methods of Analysis
of Three Potential Methodologies

Arizona Method (Smart Functional Classifications)

Roadway Type	Bike Lane	Sidewalk
Regional Arterial ADT 10,000-40,000	Suburban/Urban Context –Recommended	Suburban or Urban - Recommended
Community Arterial ADT 5,000-25,000	Urban Context – Recommended Suburban - evaluate shared roadway conditions	Suburban or Urban - Recommended
Community Collector ADT 5,000-15,000	Urban Context – Recommended Suburban Context – Consider shared roadway accommodations	Suburban or Urban - Recommended
Neighborhood Collector ADT <6,000	Not Recommended, Consider shared roadway accommodations	Suburban or Urban - Recommended
Local ADT <3,000	Typically not needed	Suburban or Urban - Recommended

Methods of Analysis
of Three Potential Methodologies

Colorado Method (Compatibility Index)

Table 2. Goals, Criteria, and Project-Level Performance Measures

Goals and Investment Decision Criteria	Project-Level Performance Measures
Enhance Safety	
Reduce crash rate or potential threat of crashes	• Project would result in safety improvement as quantified by Crash Modification Factors[12]
Increase Bicycling and Walking Activity	
Improve (corridor) bicycling or walking conditions	• Quality of improvement, measured as the change in bicycle or pedestrian LOS (primary benefit evaluation component)
Expand permanent data collection infrastructure	• Project includes installation of permanent bike/ped counting device
Expand Recreational Opportunities and Enhance Quality of Life	
Enhance Scenic Byways	• Project is located along a Scenic Byway (Yes/No)
Create access to public lands	• Project provides direct access to public lands (Yes/No)
Provide multi-use pathways near populations	• Project is a multi-use pathway (Yes/No) • Relative population of project area
Preserve and enhance downtown character	• Project is located in defined downtown or "Main Street" area
Improve Public Health	
Reduce disease/obesity in children, adults, and seniors	• Mode shift and induced recreational travel • Obesity rate in project county
Improve Environment, Air Quality, and Fossil Fuel Independence	
Reduce carbon-based vehicle miles traveled through increased bicycling and walking	• Mode shift
Provide Transportation Equity	
Provide mobility options to underserved populations	• Project is located in an area of underserved population (low-income or minority)

Source: Colorado DOT

Testing of Three Potential Methodologies

Georgia Method (Standards and Guidelines)

- GDOT's basic assumptions are that new facilities should anticipate bicycle and pedestrian uses; and
- GDOT has established standard and guideline warrants

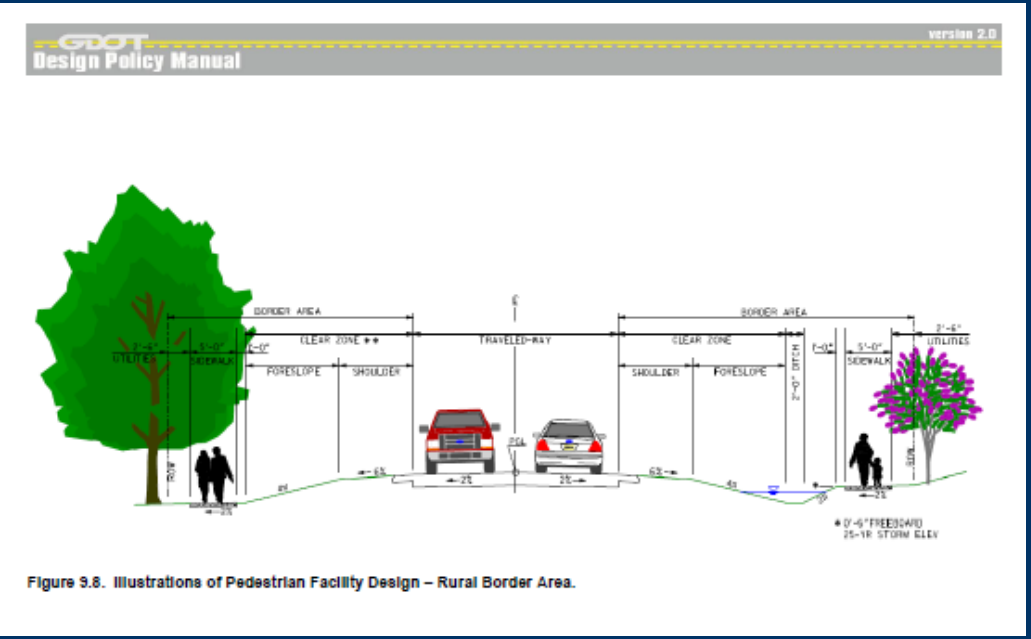


Figure 9.8. Illustrations of Pedestrian Facility Design – Rural Border Area.

Source: Georgia DOT

Testing of Three Potential Methodologies

Georgia Method (Standards and Guidelines)

- Bicycle Accommodation Warrants – Example (Where there is an occurrence of reported bicycle crashes which equals or exceeds a rate of five for a 1-mile segment of roadway)
- Pedestrian Accommodation Warrants – Example (Along corridors with 2-3 types pedestrian travel generators and destinations)
- Transit Accommodation Warrants – Example (For pedestrian transit users: within the ½-mile pedestrian catchment area of an existing fixed-route transit facility)

Testing of Three Potential Methodologies

The projects selected:

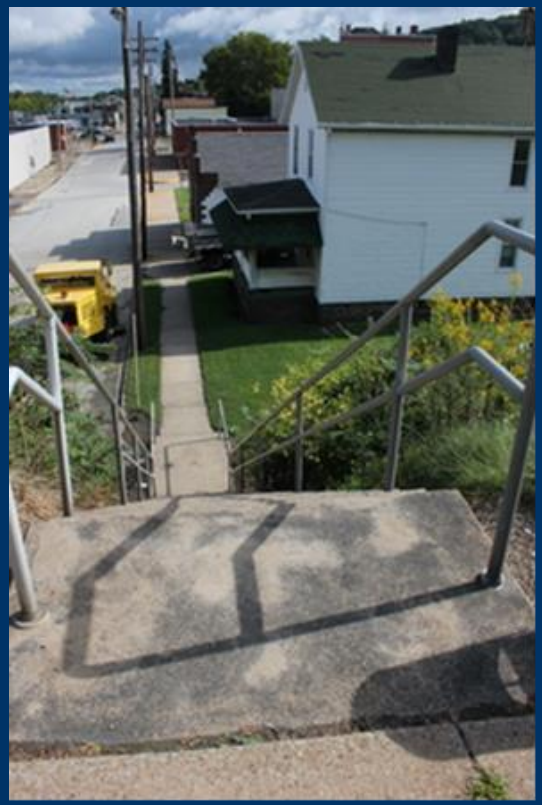
- Kenmawr Bridge (11-0) - Planning Phase for a Bridge Replacement

Testing of Three Potential Methodologies

- Freeport Road (11-0) – Planning Phase for Traffic Signal Coordination Project

Testing of Three Potential Methodologies

- Derry Bridge (12-0) – Preliminary Design for a Bridge Replacement

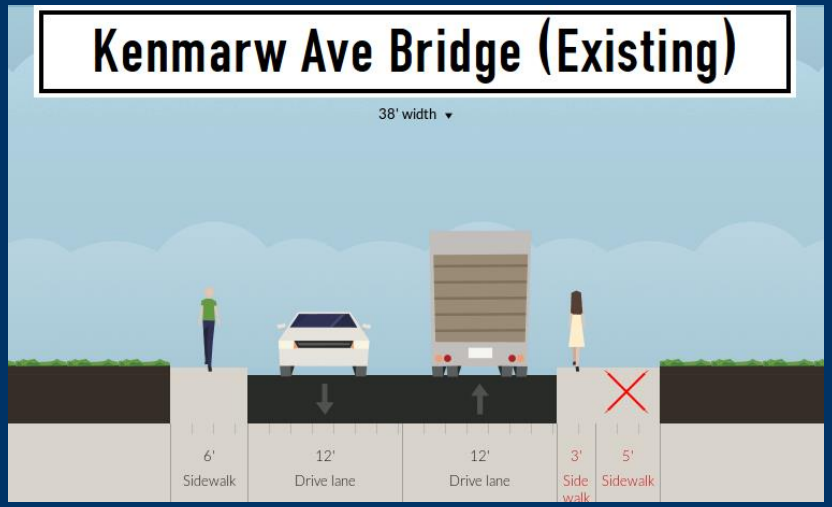


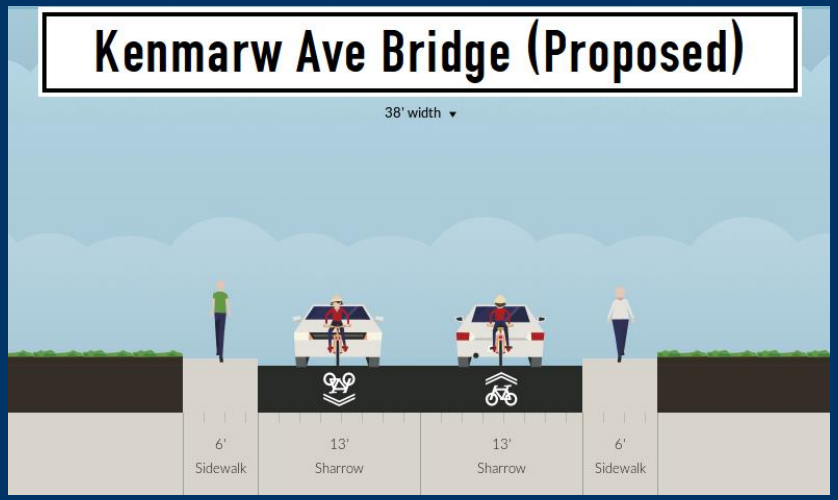
Testing of Three Potential Methodologies

- Freeport Bridge (10-0 and 12-0) – In Construction as a Bridge Rehabilitation

Testing of Three Potential Methodologies

Testing Methods - LOS





Testing of Three Potential Methodologies

Testing Methods – Colorado Index

	Kenmawr Ave Bridge	Derry Bridge	Freeport Bridge	Freeport Rd
Volume data (cars, trucks, bicycles, pedestrians) and geometric data to conduct Level of Service Analysis for Before and After Scenario.	10489	9850	9021	15289
Detailed Crash Analysis. Number of bicycle/pedestrian crasher per number miles traveled.	0	0	0	5
Roadway Functional Class	Community Collector	Community Collector	Community Arterial	Community Arterial
Population Data (low income)	42.60%	18.93%	7.76%	7.15%
Population Data (minority)	78.36%	1.07%	0.83%	6.05%
Population Data (+65 population)	11.30%	18.60%	14.58%	22.83%
Surrounding land use (Scenic Byway or Public Byway access; downtown area, Park and Ride facilities, Access to Schools)	Urban Residential	Rural CBD	Rural	Urban Mixed Use
Network Connectivity (other facilities)	Yes	Yes	Yes	Yes
Shared Use Path in study area?	No	No	No	No
Transit Route located in study area?	Yes	Yes	No	Yes
County Tourism Revenue	53000000000	366000000	366000000	53000000000
Is project a Tourism Investment?	No	No	Yes	No
Does Community have a dedicated marketing campaign?	No	No	No	No
County Obesity Rate	FALSE	TRUE	TRUE	FALSE

Testing of Three Potential Methodologies

Testing Methods – Colorado Index

Candidate Project Evaluator Calculator - Colorado DOT		
VARIABLE	RATING TYPE	RATING
Bicycle/Walking LOS Before Project	LOS	1-5 (F=1)
Bicycle/Walking LOS After Project	LOS	1-10 (F=1, D=3 etc.)
Crash Rate Reduction Potential	0-10	1-5 based upon guidance from the highway safety manual
Motor Vehicle LOS	LOS	1-5 (F=1)
Roadway Functional Class	Classification Type	1-5 (limited access=0)
Population Employment in Surrounding Area	0-5	Based on census track data, higher density = 5
Corridor Aesthetics	0-5	Subjective
Count Devices Included in Project	Yes/No	Yes=1
Designated Scenic Byway	Yes/No	Yes=10
Direct Access to Scenic Byway	Yes/No	Yes=5
Direct Access to Public Lands	Yes/No	Yes=5
Shared Use Path	Yes/No	Yes=10
Located in Designated Downtown Area	Yes/No	Yes, if designated as urban are = 5
County Obesity Rate	0-5	Higher than statewide average for county = 5
Minority/Low Income Population in Surrounding Area	0-5	Higher than statewide average for census track = 5
Access to Schools	Yes/No	Yes=10
Senior Population in Surrounding Area	0-5	Higher than statewide average for census track = 5
Closes Gap between 2 Existing Facilities	Yes/No	Yes=20
Extends Existing Facility	Yes/No	Yes=20
Fixed Route Transit Service	Yes/No	Yes=10
Access to Park and Ride Facility	Yes/No	Yes=5
County Tourism Revenue	0-5	Data available that confirms facilities create revenue = 5
Concerted Tourism Investment	Yes/No	County has tourism investment revenue = 5
Facility Construction Cost	Cost in $	< than 20% of project costs = 10

Testing of Three Potential Methodologies

Testing Methods- Georgia Method

	Kenmawr Ave Bridge		Derry Bridge		Freeport Bridge		Freeport Rd	
Pedestrian and/or bicycle generator and destinations in the study area	Yes		Yes		Yes		Yes	
Pedestrian and/or bicycle generator and destinations that are proposed prior to project design year	Yes		Yes		Yes		Yes	
Evidence of pedestrian traffic (such as worn path along roadside)	Yes		Yes		Yes		Yes	
Pedestrian crash rate (based on ½ mile segments of roadway over past 3 years)	0		0		0		3	
Bicycle crash rate (based on 1mile segment over past 3 years)	0		0		0		2	
Does the sideswipe crash rate for project corridor exceed statewide average?	N/A		N/A		N/A		N/A	

Testing of Three Potential Methodologies

Testing Summary

- Revealed many positive and negative aspects of each procedure;
- Provided and evaluation of the data requirements of each method as compared to available data sources;
- Benchmarked the potential applicability of each method to the PennDOT project development process.

Testing of Three Potential Methodologies

Testing Results

PROJECT	ARIZONA METHODOLOGY	COLORADO METHODOLOGY	GEORGIA METHODOLOGY
Kenmawr Bridge	5 Ft Sidewalks 4 Ft Shoulder for Bicycles	Rating 94	5.5 Ft Sidewalks 14 Ft Shared Bicycle Lane
Freeport Road	6-8 Ft Sidewalks 4 Ft Shoulder for Bicycles Transit Enhancements	Rating 57	4-5 Ft Sidewalks 14-Foot Shared Bicycle Lane Transit Enhancements
Derry Bridge	5.5 Ft Sidewalks; 4 Ft Shoulder for Bicycles Transit connection via Stairs	Rating 53	5 Ft Sidewalks 14-Foot Shared Lane Transit connection via Stairs
Freeport Bridge	8-10 Ft Shoulder for Pedestrians and Bicycles	Rating 41	5-Foot Sidewalks 4-Foot Shoulder (Less Rumble Strip Width) for Bike Travel

Research Findings and Recommendations

- Project development and the need for a more defined methodology was explored;
- For the programming phase of the project development process, the Arizona or Georgia method would appear to be adaptable to Pennsylvania; and
- Both methods use available data that is contextual based for the project environs and safety related

Research Findings and Recommendations

- One negative aspect of both of several methods is that no direct data is collected on existing pedestrian or bicycle users;
- Only the Colorado method requires this type of data to be collected and analyzed; and
- Research project did evaluate current data collections methods

Research Findings and Recommendations

Current data collections methods Summary

Technology	Modes Detected/ Differentiate between modes?	Type of Facility	Directional?	Costs	Time Period	Portability
Manual	All / Yes	All	Yes	• Labor Costs ($12-$50 /hour depending on overhead costs)	• 0 to 8 hours	Yes
Video (Manual or Computer Processing)	All / Yes	All	Yes	• Equipment Cost (Purchase or Rental) • Labor Cost or Service Cost to process video • $1800 to $8000	• 0 to 24 hours • Multiple Days	Yes
Active Infrared	Pedestrian and Bicycles / No	Separated Path / Sidewalk	No	• Equipment /Software Cost • $800 to $7000	• Multiple Days	Yes
Passive Infrared	Pedestrian and Bicycles / No	Separated Path / Sidewalk	Can be with proper equipment	• Equipment/Software Cost • $2000-$3000	• Multiple Days	Yes
Inductive Loops	Bicycles only	Separated Path/ Shared Road	Can be with proper setup	• Equipment / Software Cost • Installation Cost • $2000-$3000	• Multiple Days • Permanent	No
Pneumatic Tubes	Bicycles only	Separated Path / Shared Road	Can be with proper setup	• Equipment Cost (Purchase or Rental) • $350-$1500	• Multiple Days	Yes

Research Findings and Recommendations

- The Georgia method provides a more prescriptive methodology and incorporates crash criteria, specifically for pedestrians and bicycles.
- The GDOT has specific criteria for transit, which is lacking in the other two methods tested;

Research Findings and Recommendations

The researchers recommend consideration of the Georgia method with the following modifications:

- Require use of the method during the programming process;
- Adopt the AASHTO criteria for bicycle facilities and the Georgia standards for sidewalks during the design phase of the project development process;

Research Findings and Recommendations

The researchers recommend consideration of the Georgia method with the following modifications:

- Eliminate or modification of the guidelines for bicycle, pedestrian and transit facilities due to their qualitative nature; and
- Add criteria for both the pedestrian and bicycle standards that require direct data collection to establish current levels of usage.

Questions


BRIDGE
WEIGHT
LIMIT
6
TON
PAVEMENT
NARROWS
AHEAD


15
M.P.H.
SIDEWALK
CLOSED AHEAD