ASSEMBLAGE: A RECOMMENDED DESIGN PROCESS

Getting Started

This section provides the recommended process for using this manual to assemble a Complete Street design for a roadway project. For ease of use, the design process is divided into two three-step phases, Design Evaluation and Design Development. Each phase includes considerations for place, mode and link.

5a

The intent of the Complete Streets design process is that, at each step in the design process, the designer will work "from the outside in" – examining each piece of the process for place, mode, and link considerations, until one Complete Street design is assembled. When the Complete Street design is assembled, the designer is asked to articulate its impacts on place, mode, and link. If the impacts are not acceptable, the designer should generate new alternatives until all trade-offs for place, mode, and link meet the design objectives.

Note that, while this process is intended to be undertaken by roadway designers, it also can be used for design review by agencies that have adopted Complete Street policies to assess whether proposed projects meet the intent of the policy; if being used for review, substitute "reviewer" for "designer" in the process description below. Chapters 2 through 4 contain information to be referenced throughout the design process; these chapters will be particularly useful in the design development phase.

PHASE 1: DESIGN EVALUATION 5.1

Design evaluation is the process used to scope the Complete Streets design. The primary tasks to be completed during design evaluation include assessment of existing conditions, evaluation of planned conditions, and articulation of design objectives.

STEP 1: EXISTING CONDITIONS

To evaluate existing conditions, designers should review plans and reports (discussed in section 2.1) and collect field data. The Existing Conditions Checklist can be used to assist in completing this step.

PLACE Evaluate existing land use characteristics.

MODE Evaluate the existing use by all modes.

LINK Evaluate the existing cross-section, intersections, crossings, posted speed, and traffic volume.

STEP 2: PLANNED CONDITIONS

To evaluate the planned conditions, designers should collect and assess relevant planning information. The Planned Conditions Checklist can be used to assist in completing this step.

PLACE Evaluate zoning codes, district plans, comprehensive plans, and environmental considerations.

MODE Evaluate system plans for all modes; check corridor recommendations in local, regional and agency plans.

LINK Evaluate projected multimodal targets and traffic volumes; consider the potential for right-of-way expansion versus right-of-way constraints; identify bridges, crossings and underpasses; check utility plans; identify aging infrastructure; check whether the corridor is programmed in capital improvement plans (CIP) or transportation improvement plans (TIP).

STEP 3: DESIGN OBJECTIVES

To develop design objectives, designers should look carefully at the existing conditions and planned conditions to decide which characteristics of place, mode, and link should be supported and can potentially be achieved through a Complete Street design. The Design Objectives Checklist can be used to assist in completing this step.

PLACE Define which existing conditions should be supported and which planned conditions can be achieved.

MODE Define which existing modes should be supported and which planned modes should be accommodated; select a target design vehicle (or vehicles).

LINK Define which existing conditions should be supported and which planned conditions can be achieved; select a target design speed.

PHASE 2: DESIGN DEVELOPMENT 5.2

The design development phase is used to develop the Complete Streets design. The primary tasks to be completed during design development include design definition, creating the preferred design alternative, and making trade-offs between conflicting design priorities.

STEP 4: DESIGN DEFINITION

The design definition step articulates the outcome from the design evaluation step described above, using the terms described in Chapter 2, Typologies. This step in the process will form the basis for developing a Complete Street design and articulating trade-offs.

CONTEXT ZONE Using the results of the place evaluation, select the appropriate land form/development pattern (urban/suburban) and land use (residential, commercial, mixed, single use); where applicable, select an appropriate overlay zone.

MODE HIERARCHY Using the results of the mode evaluation, define a prioritized mode hierarchy as the basis for design decisions and modal trade-offs. (For example: Pedestrian – Transit – Bicycle – Motor Vehicle). Chapter 2 provides starting points for establishing mode hierarchy based on context and street typology. On the following pages, there is a blank tool for defining mode hierarchy based on designer preferences and project requirements (See Table 5.2).

STREET TYPOLOGY Using the results of the link evaluation, select an appropriate street typology: Boulevard, avenue, one-way avenue, street, one-way street, or alley.

STEP 5: DESIGN ALTERNATIVES

The preferred design alternative step is used to integrate all of the collected information into one Complete Street design and to articulate trade-offs. If there are varying dimensions or constraints within the project, it is essential to develop a preferred cross section or series of cross sections. Depending on the results of Step 6: Trade-offs, multiple iterations of the preferred design may be required. When the final cross section(s) are developed, including modal geometric allocations and selected amenities, construction documents can be generated.

COMPLETE STREET Create a proposed cross section of a Complete Street based on the selected design definitions for context zone, mode hierarchy, and street typology, referencing information in chapters 2, 3, and 4. Chapter 2 contains tables of guidelines for each street typology and context variation. Chapter 3 presents information on components for modal allocations. Chapter 4 describes amenities for populating the project and creating livable places.

FEEDBACK LOOP As each iteration of the preferred design alternative is developed, consider impacts, review trade-offs and revise the design as needed until impacts are acceptable and design objectives are achieved.

STEP 6: TRADE-OFFS

The trade-off step asks the designer to review the outcomes of the preferred design alternative and describe deficiencies based on the design objectives. The trade-off step requires detailed evaluation of the Complete Street design's impacts on place, mode, and link objectives.

PLACE IMPACT Evaluate whether the preferred design alternative is acceptable based on design objectives for place. If trade-offs are necessary, repeat step 5.

MODE IMPACT Evaluate whether the preferred design alternative is acceptable based on design objectives for mode. If trade-offs are necessary, repeat step 5.

LINK IMPACT Evaluate whether the preferred design alternative is acceptable based on design objectives for link. If trade-offs are necessary, repeat step 5.

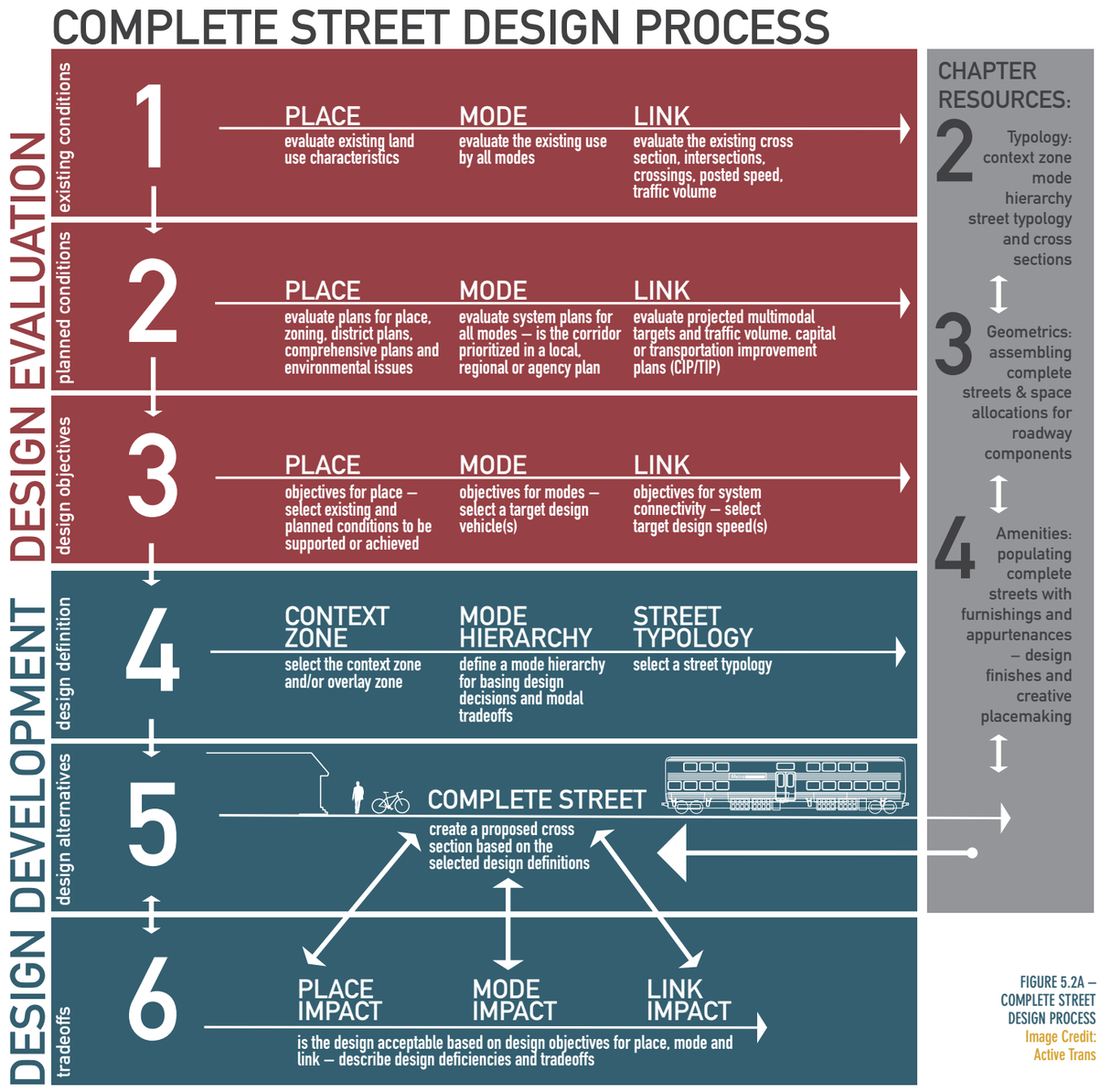


FIGURE 5.2A – COMPLETE STREET DESIGN PROCESS
Image Credit: Active Trans

TABLE 5A ROADWAY TYPOLOGIES

		Urban Context Zones				Suburban Context Zones					Rural Context Zones				Places: Context Zone Overlays for Specific Districts												
		Commercial		Residential		Commercial		Residential		Mixed Use		Residential		Village		Pedestrian Priority		Entertainment/ Cultural		TOD's		Business Districts		Park Zones		School Zones		Home Zones	
Boulevards	Lanes: 4 to 6 Speed: 30–40 mph Blocks: 660 to 1320 ft. ADT: 30–50k	Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk	
		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike	
		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit	
		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto	
Avenues	Lanes: 2 to 5 Speed: 25–35 mph Blocks: 300 to 660 ft. ADT: 5–30k	Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk	
		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike	
		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit	
		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto	
Streets	Lanes: 2 to 3 Speed: 20–25 mph Blocks: 300 to 660 ft. ADT: 1–10k	Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk		Walk	
		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike		Bike	
		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit		Transit	
		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto		Auto	

*Characteristics will vary by context zone

MODE HIERARCHY TOOL INSTRUCTIONS

Please order (1-4) the priority level for the street typology placement of each mode in varying context zones.

1) Place a 1, 2, 3, or 4 in the box next to either walk, bike, transit, or auto in each context zone.

2) Place a "1" next to the highest priority. Order the other modes as "2-4."

3) This tool is intended to help each designer to individually adjust Mode Hierarchy based on contexts within your agency or jurisdiction.

4) Reference chapter 2 - Typologies for examples of context zones, street typologies, and a suggestions for mode hierarchy.

5) Only fill out the sections which you are comfortable responding; otherwise use the Mode Hierarchy guideline provided in Chapter 2 as a starting point.

6) An example of how to fill out the worksheet is included at right.

EXAMPLE: MODE HIERARCHY TOOL

ROADWAY TYPOLOGIES		Urban Context Zones			
		Commercial		Residential	
Boulevards	Lanes: 4 to 6 Speed: 30–40 mph Blocks: 660 to 1320 ft. ADT: 30–50k	1	Walk	1	Walk
		4	Bike	2	Bike
		2	Transit	4	Transit
		3	Auto	3	Auto
Avenues	Lanes: 2 to 5 Speed: 25–35 mph Blocks: 300 to 660 ft. ADT: 5–30k	1	Walk	1	Walk
		2	Bike	3	Bike
		3	Transit	4	Transit
		4	Auto	2	Auto
Streets	Lanes: 2 to 3 Speed: 20–25 mph Blocks: 300 to 660 ft. ADT: 1–10k	1	Walk	1	Walk
		3	Bike	2	Bike
		2	Transit	4	Transit
		4	Auto	3	Auto

Complete Streets Checklist

The intent of the Complete Streets design process is that, at each step in the design process, the designer will work "from the outside in"—examining each piece of the process for place, mode, and link considerations, until one Complete Street design is assembled. When the Complete Street design is assembled, the designer is asked to articulate its impacts on place, mode, and link. If the impacts are not acceptable, the designer should generate new alternatives until all trade-offs for place, mode, and link meet the design objectives.

PURPOSE

Complete Streets are those that can be safely accessed and crossed by all users of the roadway regardless of their age, ability, or travel mode. This means accommodating pedestrians, bicyclists, and transit users as well as motorists. There is a nationwide movement by agencies at all levels of government to ensure that all future roadway projects support the development of a connected network of Compete Streets throughout their jurisdictions. Many have adopted Complete Streets legislation or other policies committing them to this goal.

This checklist provides a process for transportation professionals to plan and review roadway projects with the following outcomes:

- **Develop context sensitive design based on the existing and planned land use, mode, and roadway conditions**
- **Develop a project that supports modeshift goals and crash reduction targets**
- **Determine whether projects and designs comply with applicable Complete Streets policies**

WHAT YOU'LL NEED

In preparation for comprehensive design development and/or review, here is a list of things that you'll want to gather before starting on the process.

- **Your community's Complete Streets policy, and those of any other agencies with jurisdiction of the project area**
- **Any other internal policies governing modeshift targets**
- **Relevant plans: Comprehensive or sub-area plans, plans dealing with local developments, zoning, sustainability, utilities, vehicle travel and/or multimodal transportation**
- **Proposals and drawings for any current developments and nearby roadway projects**
- **Results of project area site visits**
- **Traffic and transportation studies performed**
- **Crash studies that include the project area**

ADDITIONAL GUIDANCE

This process checklist was developed as a companion to Complete Streets Complete Networks design guidelines developed by the Active Transportation Alliance. The guidelines contain a detailed discussion of the concepts and principles referred to in this checklist.

Applicable chapters from the guide are available for free download at ATpolicy.org/design.

STEP 1: EXISTING CONDITIONS

PROJECT NAME: _____ PROJECT MANAGER: _____

AGENCY: _____ PROJECT AREA & BOUNDARIES: _____

PLACE

DEVELOPMENT PATTERN

CHARACTER OF THE AREA:

☐ Rural ☐ Suburban ☐ Urban

Population Density: _____

Avg. Block Length: _____

NETWORK CHARACTERISTICS:

☐ Traditional Urban Grid

☐ Conventional Suburban

LAND USE

LAND USE MIX:

☐ Residential: _____

☐ Commercial: _____

☐ Mixed Use: _____

☐ Single Use: _____

DISTRICT/ZONING

CLASSIFICATIONS, SITE PLANS, RELATED ORDINANCES

_____

_____

_____

LIST NEARBY DESTINATIONS

(e.g., schools, parks, trails, retail centers, transit stations, office campuses, etc.)

_____

_____

MODE

SITE VISITS

DATE/TITLE FINDINGS

_____

_____

_____

_____

TRANSIT SERVICE

CLASSIFICATIONS, SITE PLANS, RELATED ORDINANCES

_____

_____

_____

_____

TRAVEL MODES USED:

☐ Pedestrian ☐ Bicycle ☐ Private Vehicles ☐ Freight

☐ High Occupancy Vehicles ☐ Recreational Vehicles

☐ Farm Equipment ☐ Equestrian ☐ Other: _____

TRANSPORTATION STUDIES/COUNTS

On existing transit route? ☐ Yes ☐ No

Within ¼ mile of bus stop? ☐ Yes ☐ No

Within ½ mile of rail stop? ☐ Yes ☐ No

Within 3 miles of rail stop? ☐ Yes ☐ No

PROJECT AREA CRASH AVERAGES

Motor Vehicle Crashes: _____ Data Year(s): _____

Bicycle Crashes: _____ Data Year(s): _____

Pedestrian Crashes: _____ Data Year(s): _____

Other incidents: _____ Data Year(s): _____

Hot Spots: _____

BIKEWAYS CONNECTIVITY

No. of direct on-street bikeways connections: _____

No. of on-street bikeways within 3 miles: _____

No. of direct off-street trail connections: _____

No. of off-street trail connections within 3 miles: _____

LINK

Jurisdiction: _____

Agency Contact: _____

_____

Total ROW Width: _____

Curb-to-curb Width: _____

Posted Speed: _____

Typical Vehicle Speed at 85th Percentile: _____

Bridges/Underpasses: _____

Average Daily Traffic: _____

Multi-modal Level of Service: _____

Pedestrian Level of Service: _____

Bicycle Level of Service: _____

Vehicle Level of Service: _____

FUNCTIONAL CLASSIFICATION:

☐ Principal/Primary Arterial

☐ Secondary Arterial

☐ Collector

☐ Local Street

EXISTING CROSS SECTION

DIRECTION 1: ☐ N. BOUND ☐ S. BOUND ☐ E. BOUND ☐ W. BOUND

Sidewalk ☐ No ☐ Yes
No. of Gaps ____
Total Width _____
Curb Zone _____ ft.
Furniture Zone _____ ft.
Pedestrian Zone _____ ft.
Frontage Zone _____ ft.

Shared Use Path ☐ No ☐ Yes
No. of Gaps ____
Total Width _____
Permitted Users:
☐ Pedestrians ☐ Equestrian
☐ Bikes ☐ Other _____

Traffic Buffer: ☐ No ☐ Yes
☐ Planting Strip _____ ft.
☐ Vehicle Parking _____ft.
☐ Bicycle Facility _____ ft.
☐ Other _____
_____

Lighting: ☐ Yes ☐ No
☐ Pedestrian Scale
☐ Street Scale ☐ Combined
Signage: ☐ Yes ☐ No
Street Trees: ☐ Yes ☐ No
Utilities: ☐ Yes ☐ No

Modal Conflict Points
(non-intersection)
No. of Driveways _____
No. of Alleys _____
Other _____
_____

Transit ☐ Yes ☐ No
No. of Stops _____
Sheltered Stops _____
Sidewalk Access _____
Near a Crosswalk _____

On-street Bikeway
☐ Yes ☐ No
No. of Gaps____
Shared Lane
☐ Yes ☐ No Width _____
Separated Bikeways
☐ Yes ☐ No Width _____
Protected Bikeways
☐ Yes ☐ No

Vehicle/Travel Lanes

qty.	ft.	ft.	ft.	ft.

Dedicated Transit Lanes
☐ No ☐ Yes
Describe:
_____
_____
_____

DIRECTION 2: ☐ N. BOUND ☐ S. BOUND ☐ E. BOUND ☐ W. BOUND

Sidewalk ☐ No ☐ Yes
No. of Gaps ____
Total Width _____
Curb Zone _____ ft.
Furniture Zone _____ ft.
Pedestrian Zone _____ ft.
Frontage Zone _____ ft.

Shared Use Path ☐ No ☐ Yes
No. of Gaps ____
Total Width _____
Permitted Users:
☐ Pedestrians ☐ Equestrian
☐ Bikes ☐ Other _____

Traffic Buffer: ☐ No ☐ Yes
☐ Planting Strip _____ ft.
☐ Vehicle Parking _____ ft.
☐ Bicycle Facility _____ ft.
☐ Other _____
_____

Lighting: ☐ Yes ☐ No
☐ Pedestrian Scale
☐ Street Scale ☐ Combined
Signage: ☐ Yes ☐ No
Street Trees: ☐ Yes ☐ No
Utilities: ☐ Yes ☐ No

Modal Conflict Points
(non-intersection)
No. of Driveways _____
No. of Alleys _____
Other _____
_____

Transit ☐ Yes ☐ No
No. of Stops _____
Sheltered Stops _____
Sidewalk Access _____
Near a Crosswalk _____

On-street Bikeway
☐ Yes ☐ No
No. of Gaps____
Designated Bike Lane
☐ Yes ☐ No Width _____
Separated Bikeways
☐ Yes ☐ No Width _____
Protected Bikeways
☐ Yes ☐ No

Shared Travel Lanes

qty.	ft.	ft.	ft.	ft.

Dedicated Transit Lanes
☐ No ☐ Yes
Describe:
_____
_____
_____

TRANSITIONS

DIRECTION 1: ☐ N. BOUND ☐ S. BOUND ☐ E. BOUND ☐ W. BOUND

☐ Gateways Locations: _____
☐ Mixing Zones: Dashed Transitional Markings ☐ Yes ☐ No
☐ Narrowing Lanes: Location & Dimensions:
_____
_____
☐ Medians: ☐ Painted ☐ Raised ☐ Continuous
☐ Curbing ☐ Yes ☐ No ☐ Partial _____
☐ Mid-block Bulb-outs _____
☐ Chicanes _____
_____
☐ Speed Humps: Qty. ___ Locations: _____
☐ Bollards and Railings Locations: _____
☐ Street Signs ☐ Wayfinding Signs ☐ Identity Signs

DIRECTION 2: ☐ N. BOUND ☐ S. BOUND ☐ E. BOUND ☐ W. BOUND

☐ Gateways Locations: _____
☐ Mixing Zones: Dashed Transitional Markings ☐ Yes ☐ No
☐ Narrowing lanes: Location & Dimensions:
_____
_____
☐ Medians: ☐ Painted ☐ Raised ☐ Continuous
☐ Curbing ☐ Yes ☐ No ☐ Partial _____
☐ Mid-block Bulb-outs _____
☐ Chicanes _____
_____
☐ Speed Humps: Qty. ___ Locations: _____
☐ Bollards and Railings Locations: _____
☐ Street Signs ☐ Wayfinding Signs ☐ Identity Signs

EXISTING INTERSECTIONS AND MID-BLOCK CROSSING TREATMENT

[PRINT EXTRA PAGES FOR EACH INTERSECTION LEG/CROSSING]

Location: _____

Controlled: ☐ Yes ☐ No ☐ Signalized ☐ Stop Sign ☐ Other ____

Leg/Crossing: _____

Convergence: ☐ 3 way ☐ 4 way ☐ 6 way ☐ Other ____

CROSSING & SIGNALIZATION

Crossing Distance: ____ft.
Advance Stop Bar: ____ ft.
Marked Crosswalk
☐ No ☐ Yes Width: ____ ft.

Crosswalk Style:
☐ Longitudinal Lines
☐ Diagonal Lines
☐ "Ladder"
☐ Colored
☐ Stamped
☐ Other_____

Other Features:
☐ Raised crossing
☐ Painted Median
☐ Crossing Island
☐ Right Turn Island
☐ Curb Ramps Both Sides
☐ ADA Compliant Ramps

Pedestrian Indicator
☐ Yes ☐ No
Timing: _____ ft. /sec.
☐ Automated ☐ Actuated

Accessible Push Button:
☐ Yes ☐ No
☐ Countdown Indicator
☐ Lead Pedestrian Interval
☐ Caution Signage
☐ Flashing Beacon
☐ Pedestrian Hybrid Beacon
☐ Rapid Flash Beacon

Bicycle-only Indicator:
☐ Yes ☐ No
☐ Automated ☐ Actuated

LANE CONFIGURATION

Shared Through Lanes

qty.	ft.	ft.	ft.	ft.

Shared Left Turn Lanes

qty.	ft.	ft.	ft.	ft.

Shared Right Turn Lanes

qty.	ft.	ft.	ft.	ft.

Bicycle Through Lanes
☐ No ☐ Yes, ____ft.
☐ Dedicated
☐ Marked Shared

☐ Bike Box
☐ Transitional Dashing
☐ Colored Pavement

Transit Through Lanes
☐ No ☐ Yes ____ft.
☐ Dedicated
☐ Marked Shared

Transit Stops:
☐ Near Side ☐ Far Side
☐ None

Inbound Turn Radius
☐ Wide ☐ Tight
Outbound Turn Radius
☐ Wide ☐ Tight

INSERT INTERSECTION DIAGRAM:

STEP 2: PLANNED CONDITIONS

PROJECT NAME: ______________________ PROJECT MANAGER: ______________________
AGENCY: ______________________ PROJECT AREA & BOUNDARIES: ______________________

PLACE: CONTEXT & LAND USE PLANS

Plan Name: ______________________
☐ Comprehensive ☐ Community/Subarea Plan ☐ Development ☐ Sustainability ☐ Zoning ☐ Utility ☐ Other ____________
Agency: ______________________ Date Adopted: ____________
Plan Objectives: ______________________
Plan Relevance: ______________________
Relevant Strategies: ______________________

Plan Name: ______________________
☐ Comprehensive ☐ Community/Subarea Plan ☐ Development ☐ Sustainability ☐ Zoning ☐ Utility ☐ Other ____________
Agency: ______________________ Date Adopted: ____________
Plan Objectives: ______________________
Plan Relevance: ______________________
Relevant Strategies: ______________________

Plan Name: ______________________
☐ Comprehensive ☐ Community/Subarea Plan ☐ Development ☐ Sustainability ☐ Zoning ☐ Utility ☐ Other ____________
Agency: ______________________ Date Adopted: ____________
Plan Objectives: ______________________
Plan Relevance: ______________________
Relevant Strategies: ______________________

NOTABLE DEVELOPMENTS WITHIN OR NEAR PROJECT AREA

Development Name: ______________________
Location: ______________________
Project Type: ☐ Commercial ☐ Industrial ☐ Residential
☐ Open Space/Recreational ☐ Mixed Use ☐ PUD ☐ Other
Scale: No. of Parcels _______ Acreage _______
Network Characteristics:
☐ Traditional Urban Grid ☐ Conventional Suburban
Notes: ______________________
____
Project Status: ☐ Proposed ☐ Approved ☐ In Process
Target Completion Date: ______________________
Accessibility Elements:
☐ Sidewalks ☐ Crosswalks ☐ Bikeways ☐ Bike Parking
☐ Transit Stops ☐ Other______________________

Describe existing land use and future land use changes:
____
____
Relevant Plans: ______________________

Describe existing traffic volumes and projected change:
____
____
Traffic Studies Cited: ______________________

Development Name: ______________________
Location: ______________________
Project Type: ☐ Commercial ☐ Industrial ☐ Residential
☐ Open Space/Recreational ☐ Mixed Use ☐ PUD ☐ Other
Scale: No. of Parcels _______ Acreage _______
Network Characteristics:
☐ Traditional Urban Grid ☐ Conventional Suburban
Notes: ______________________
____
Project Status: ☐ Proposed ☐ Approved ☐ In Process
Target Completion Date: ______________________
Accessibility Elements:
☐ Sidewalks ☐ Crosswalks ☐ Bikeways ☐ Bike Parking
☐ Transit Stops ☐ Other______________________

Describe existing land use and future land use changes:
____
____
Relevant Plans: ______________________

Describe existing traffic volumes and projected change:
____
____
Traffic Studies Cited: ______________________

MODE: EXISTING TRANSPORTATION SYSTEM PLANS

Plan Name: ______________________________
☐ Transportation ☐ Multi-modal ☐ Pedestrian ☐ Bicycle ☐ Transit ☐ Other ______________
Agency: ______________________________ Date Adopted: __________
Plan Objectives: ______________________________
Plan Relevance: ______________________________
Relevant Strategies: ______________________________

Plan Name: ______________________________
☐ Transportation ☐ Multi-modal ☐ Pedestrian ☐ Bicycle ☐ Transit ☐ Other ______________
Agency: ______________________________ Date Adopted: __________
Plan Objectives: ______________________________
Plan Relevance: ______________________________
Relevant Strategies: ______________________________

Plan Name: ______________________________
☐ Transportation ☐ Multi-modal ☐ Pedestrian ☐ Bicycle ☐ Transit ☐ Other ______________
Agency: ______________________________ Date Adopted: __________
Plan Objectives: ______________________________
Plan Relevance: ______________________________
Relevant Strategies: ______________________________

RELEVANT PLANNED/PROGRAMMED ROADWAY PROJECTS

Project Name: ______________________________
Location: ______________________________
Project Type: ☐ New Construction ☐ Reconstruction
☐ Resurfacing ☐ Other ______________________
Notes: ______________________________
____
Project Status: ☐ Planned ☐ Programmed ☐ In Process
☐ CIP ☐ TIP Target Completion Date: ____________

Existing Functional Classification	Future Functional Classification
☐ Primary Arterial ☐ Secondary Arterial ☐ Collector ☐ Local Street	☐ Same as Existing ☐ Primary Arterial ☐ Secondary Arterial ☐ Collector ☐ Local Street

Facilities	Included	Improved	Degraded
Pedestrian	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Bicycle	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Transit	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

Project Name: ______________________________
Location: ______________________________
Project Type: ☐ New Construction ☐ Reconstruction
☐ Resurfacing ☐ Other ______________________
Notes: ______________________________
____
Project Status: ☐ Planned ☐ Programmed ☐ In Process
☐ CIP ☐ TIP Target Completion Date: ____________

Existing Functional Classification	Future Functional Classification
☐ Primary Arterial ☐ Secondary Arterial ☐ Collector ☐ Local Street	☐ Same as Existing ☐ Primary Arterial ☐ Secondary Arterial ☐ Collector ☐ Local Street

Facilities	Included	Improved	Degraded
Pedestrian	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Bicycle	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Transit	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

Describe existing roadway conditions: ______________________________
____
____
____

Describe projected traffic impacts: ______________________________
____
____
____

LINK: TRAFFIC STUDIES AND PROJECTIONS

Study Name: _____
Agency: _____ Date Adopted: _____
Findings: _____
Project Impacts: _____

Study Name: _____
Agency: _____ Date Adopted: _____
Findings: _____
Project Impacts: _____

Study Name: _____
Agency: _____ Date Adopted: _____
Findings: _____
Project Impacts: _____

SAFETY IMPACT CALCULATION

CRASH REDUCTION GOALS

Does your community or Complete Streets policy have a crash reduction goal? ☐ No ☐ Yes _____%

EXISTING CRASH AVERAGES (See existing conditions analysis)

User Type	Average	Data Year(S)
Motor Vehicle Crashes		
Bicycle Crashes		
Pedestrian Crashes		
Other Incidents		

Select a crash reduction goal for this project _____%

TOTAL CRASH AVERAGES _____

CALCULATE: _____X_____ = _____
(Target Reduction) X (Total of Crash Averages) = Crashes Prevented

Based on this number will you be including unique design consideration for crash reduction?
☐ Yes ☐ No _____
Based on existing conditions safety analysis, are there any crash hot spots that will be treated?
☐ Yes ☐ No _____
Describe: _____
_____

MODESHIFT AND TRAFFIC IMPACTS

Does your community or Complete Streets policy have a modeshift target? ☐ No ☐ Yes _____%

Select a modeshift target for this project: _____%

TRAFFIC VOLUME	ADT	Source
Existing Traffic Volume		
Projected Traffic Volume		

Select a traffic volume multiplier for this project: ☐ Existing ADT ☐ Projected ADT ☐ Other _____

CALCULATE: _____X_____ = _____
(Project Modeshift Target) X (Selected Traffic Volume) = Planned Traffic Volume

Does the planned traffic volume calculation show that designing to a modeshift target has eliminated or reduced the need for right-of-way acquisition? ☐ YES ☐ NO
Describe: _____
_____

STEP 3: DESIGN OBJECTIVES

PROJECT NAME: _____ PROJECT MANAGER: _____

AGENCY: _____ PROJECT AREA & BOUNDARIES: _____

PLACE

Based on place assessment, what are the most important existing or planned land use conditions to support?

_____

_____

_____

_____

How can this project achieve any goals outlined in specific land use plans?

_____

_____

_____

_____

Write one or two design objectives that support land use goals:

Objective 1: _____

_____

_____

_____

Objective 2: _____

_____

_____

_____

MODE

Based on the modal assessment, what are the most important existing or planned modes to support?

Pedestrian: _____

Bicycle: _____

Transit: _____

How can this project support modeshift targets and/or multimodal transportation?

_____

_____

_____

_____

Write one or two design objectives that support multimodal goals:

Objective 1: _____

_____

_____

_____

Objective 2: _____

_____

_____

_____

LINK

Based on link assessment, what are the most important existing or planned roadway conditions to support?
Pedestrian: _____
Bicycle: _____
Transit: _____
Safety:_____
Vehicle Volumes:_____

How can this project achieve goals outlined in specific transportation plans?

_____
_____
_____
_____

Select the target speed for this project: _____ MPH

Select the target design vehicle for the project: ☐ Delivery Van (SU-30) ☐ Other:_____

Are there specific intersections that should be designed for different vehicles with different needs? ☐ Yes ☐ No

INTERSECTION LOCATIONS	DESIGN VEHICLE	DETAILS

Write one or two design objectives addressing supported conditions, goals, design vehicle, and design speed for link:

Objective 1: _____
_____
_____
_____

Objective 2: _____
_____
_____
_____

DESIGN DEFINITION

PROJECT NAME: _____
AGENCY: _____
PROJECT LOCATION & BOUNDARIES: _____

PROJECT MANAGER: _____
COMMUNITY AREA/WARD: _____

PLACE

Based on existing and planned conditions, select a context zone for this project:

☐ Urban Commercial/Mixed Use ☐ Urban Residential
☐ Urban Single Use ☐ Suburban Commercial
☐ Suburban Residential ☐ Suburban Mixed Use
☐ Suburban Single Use ☐ Rural Residential/Agricultural
☐ Rural Village

Will an overlay zone be used for this project?

☐ Pedestrian Priority Area
☐ Transit Oriented Development Area
☐ Entertainment/Cultural District
☐ Green Street
☐ Schools Zone/Campus
☐ Park Zone
☐ Home Zone/Social Zone

MODE

Select the mode hierarchy for this project. Assign a rank (1-5) to each mode according to how it will be prioritized in this project:

____ Pedestrian
____ Bicycle
____ Transit
____ Vehicle
____ Other _____

LINK

Define a street typology for this project:

☐ Boulevard
☐ Avenue
☐ One-Way Avenue
☐ Street
☐ One-Way Street
☐ Alley

PROPOSED CROSS SECTION WORKSHEET

DIRECTION 1: ☐ N. BOUND ☐ S. BOUND ☐ E. BOUND ☐ W. BOUND

Sidewalk: ☐ Yes ☐ No
Total Width _____ ft.
Curb Zone _____ ft.
Furniture Zone _____ ft.
Pedestrian Zone _____ ft.
Frontage Zone ____ ft.

Modal Conflict Points (non-intersection)
No. of Driveways _____
No. of Alleys _____
Other _____
_____

AMENITIES
☐ Lighting _____
_____
☐ Furnishings _____
_____
☐ Green Infrastructure _____
_____
☐ Signing _____
_____
☐ Textures and Markings _____
_____

Traffic Buffer: ☐ Yes ☐ No
☐ Planting Strip _____ ft.
☐ Vehicle Parking _____ ft.
☐ Bicycle Facility _____ ft.
☐ Other _____
_____

Transit: ☐ Yes ☐ No
No. of Stops _____
Sheltered Stops _____
Sidewalk Access _____
Near a Crosswalk _____

DIRECTION 2: ☐ N. BOUND ☐ S. BOUND ☐ E. BOUND ☐ W. BOUND

Sidewalk: ☐ Yes ☐ No
Total Width _____ ft.
Curb Zone _____ ft.
Furniture Zone _____ ft.
Pedestrian Zone _____ ft.
Frontage Zone ____ ft.

Modal Conflict Points (non-intersection)
No. of Driveways _____
No. of Alleys _____
Other _____
_____

AMENITIES
☐ Lighting _____
_____
☐ Furnishings _____
_____
☐ Green Infrastructure _____
_____
☐ Signing _____
_____
☐ Textures and Markings _____
_____

Traffic Buffer: ☐ Yes ☐ No
☐ Planting Strip _____ ft.
☐ Vehicle Parking _____ ft.
☐ Bicycle Facility _____ ft.
☐ Other _____
_____

Transit: ☐ Yes ☐ No
No. of Stops _____
Sheltered Stops _____
Sidewalk Access _____
Near a Crosswalk _____

PROPOSED CROSS SECTION WORKSHEET, CONTINUED

DIRECTION 1: ☐ N. BOUND ☐ S. BOUND ☐ E. BOUND ☐ W. BOUND			DIRECTION 2: ☐ N. BOUND ☐ S. BOUND ☐ E. BOUND ☐ W. BOUND		
BICYCLE WAYS	Y/N	ft.	BICYCLE WAYS	Y/N	ft.
Shared Use Path Use: ☐ Bike ☐ Ped ☐ Equestrian ☐ Other_____			Shared Use Path Use: ☐ Bike ☐ Ped ☐ Equestrian ☐ Other_____		
Trail Use: ☐ Bike ☐ Ped ☐ Equestrian ☐ Other_____			Trail Use: ☐ Bike ☐ Ped ☐ Equestrian ☐ Other_____		
Shared Lane			Shared Lane		
Paved Shoulder			Paved Shoulder		
Wide Curb Lane			Wide Curb Lane		
Signed Route			Signed Route		
Bike Lane			Bike Lane		
Marked Shared Lane			Marked Shared Lane		
Bike-Bus Lane			Bike-Bus Lane		
Bike Boulevard/Neighborhood Greenway			Bike Boulevard/Neighborhood Greenway		
Contraflow Bike Lane			Contraflow Bike Lane		
Left Side Bike Lane			Left Side Bike Lane		
Colored Pavement Bike Lane			Colored Pavement Bike Lane		
Buffered Bike Lane			Buffered Bike Lane		
Double Bike Lane			Double Bike Lane		
Cycle Track Inside Parking			Cycle Track Inside Parking		
Cycle Track One Direction			Cycle Track One Direction		
Cycle Track Two Direction			Cycle Track Two Direction		
Cycle Track Center			Cycle Track Center		
Urban Greenways			Urban Greenways		
Floating Bike Lane			Floating Bike Lane		
Advisory Bike Lane			Advisory Bike Lane		
Other:			Other:		
TRANSIT WAYS			TRANSIT WAYS		
Bike-Bus Lanes			Bike-Bus Lanes		
Dedicated Lanes			Dedicated Lanes		
Separated Lanes			Separated Lanes		
Bus Rapid Transit			Bus Rapid Transit		
HOV Lanes			HOV Lanes		
Rail-Transit			Rail-Transit		
Modern Streetcars			Modern Streetcars		
Green Lanes			Green Lanes		
Other:			Other:		

VEHICLE/TRAVEL LANES	qty.	ft.	ft.	ft.	ft.	VEHICLE/TRAVEL LANES	qty.	ft.	ft.	ft.	ft.
Vehicle Lanes						Vehicle Lanes					
Turning Lanes						Turning Lanes					
Parking Lanes						Parking Lanes					
Other:						Other:					

NOTES:

PROPOSED TRANSITIONS WORKSHEET

DIRECTION 1: ☐ N. BOUND ☐ S. BOUND ☐ E. BOUND ☐ W. BOUND

☐ Gateways Locations: _____
☐ Mixing Zones: Dashed Transitional Markings ☐ Yes ☐ No
☐ Narrowing lanes: Location & Dimensions: _____

_____

☐ Medians: ☐ Painted ☐ Raised ☐ Continuous
☐ Curbing: ☐ Yes ☐ No ☐ Partial _____
☐ Mid-block Curb Extensions_____
☐ Chicanes _____

_____

☐ Speed Humps: Qty. ___ Locations: _____
☐ Bollards and Railings Locations: _____
☐ Street signs ☐ Wayfinding signs ☐ Identity Signs

DIRECTION 2: ☐ N. BOUND ☐ S. BOUND ☐ E. BOUND ☐ W. BOUND

☐ Gateways Locations: _____
☐ Mixing Zones: Dashed Transitional Markings ☐ Yes ☐ No
☐ Narrowing lanes: Location & Dimensions: _____

_____

☐ Medians: ☐ Painted ☐ Raised ☐ Continuous
☐ Curbing: ☐ Yes ☐ No ☐ Partial _____
☐ Mid-block Curb Extensions_____
☐ Chicanes _____

_____

☐ Speed Humps: Qty. ___ Locations: _____
☐ Bollards and Railings Locations: _____
☐ Street signs ☐ Wayfinding signs ☐ Identity Signs

PROPOSED INTERSECTIONS & MID-BLOCK CROSSING TREATMENT

[PRINT EXTRA PAGES FOR EACH INTERSECTION LEG/CROSSING]

Location: _____
Controlled: ☐ Yes ☐ No ☐ Signalized ☐ Stop Sign ☐ Other ____

Leg/Crossing: _____
Convergence: ☐ 3-way ☐ 4-way ☐ 6-way ☐ Other ____

CROSSING & SIGNALIZATION

Crossing Distance: ____ft.
Advance Stop Bar: ____ ft.
Marked crosswalk
☐ No ☐ Yes Width: ____ ft.
Crosswalk Style:
☐ Longitudinal Lines
☐ Diagonal Lines
☐ "Ladder"
☐ Colored
☐ Stamped
☐ Other_____
Other Treatments:
☐ Raised Crossing
☐ Painted Median
☐ Crossing Island
☐ Right Turn Island
☐ Curb Ramps Both Sides
☐ Ada Compliant Ramps

Crossing Time: ____ ft. /sec.
Pedestrian Indicator ☐ Yes ☐ No
☐ Automated ☐ Actuated
☐ Accessible Push Button
☐ Countdown Indicator
☐ Leading Pedestrian Interval
☐ Caution Signage
☐ Flashing Beacon
☐ Pedestrian Hybrid Beacon
☐ Rapid Flash Beacon
Bicycle-Only Indicator:
☐ Yes ☐ No
☐ Automated ☐ Actuated
Transit Signal Prioritization
☐ Yes ☐ No
Vehicle Indicators:
Left Turn Arrow ☐ Yes ☐ No
Right Turn Arrow ☐ Yes ☐ No
Right Turn on Red Permitted?
☐ Yes ☐ No

LANE CONFIGURATION

Shared Through Lanes

qty.	ft.	ft.	ft.	ft.

Shared Left Turn Lanes

qty.	ft.	ft.	ft.	ft.

Shared Right Turn Lanes

qty.	ft.	ft.	ft.	ft.

Inbound Turn Radius
☐ Wide ☐ Tight
Outbound Turn Radius
☐ Wide ☐ Tight

BICYCLE TREATMENTS
Through Lanes
☐ No ☐ Yes, ____ft.
☐ Dedicated
☐ Marked Shared
☐ Left Turn Access
☐ Right Turn Priority
☐ Bike Box
☐ Box Turn Access
☐ Transitional Dashing
☐ Colored Pavement
☐ Other _____

_____

TRANSIT TREATMENTS
Through Lanes ☐ No ☐ Yes ____ft. ☐ Dedicated ☐ Separated
Transit Stops: ☐ Near Side ☐ Far Side ☐ None
☐ Bus Pull-Off ☐ Bus Pad ☐ Transitional Dashing
☐ Colored Pavement

NOTES:

TRADE OFFS

PLACE IMPACT: IS THE DESIGN ACCEPTABLE BASED ON DESIGN OBJECTIVES FOR PLACE? □YES □NO

How will the proposed design support projected traffic volumes resulting from any surrounding planned developments?

_____
_____
_____
_____

MODE IMPACT: IS THE DESIGN ACCEPTABLE BASED ON DESIGN OBJECTIVES FOR MODES? □YES □NO

For which modes will new facilities be installed? □ Pedestrian □ Bicycle □ Transit (Check all that apply)

_____
_____
_____
_____

For which modes will existing facilities be preserved or improved? □ Pedestrian □ Bicycle □ Transit (Check all that apply)

_____
_____
_____
_____
_____

Are there any modes that are not being accommodated and why? Do these reasons qualify as exceptions under the community's Complete Streets policy?

_____
_____
_____
_____
_____ Authorized by: _____

LINK IMPACT: IS THE DESIGN ACCEPTABLE BASED ON DESIGN OBJECTIVES FOR LINKS? □YES □NO

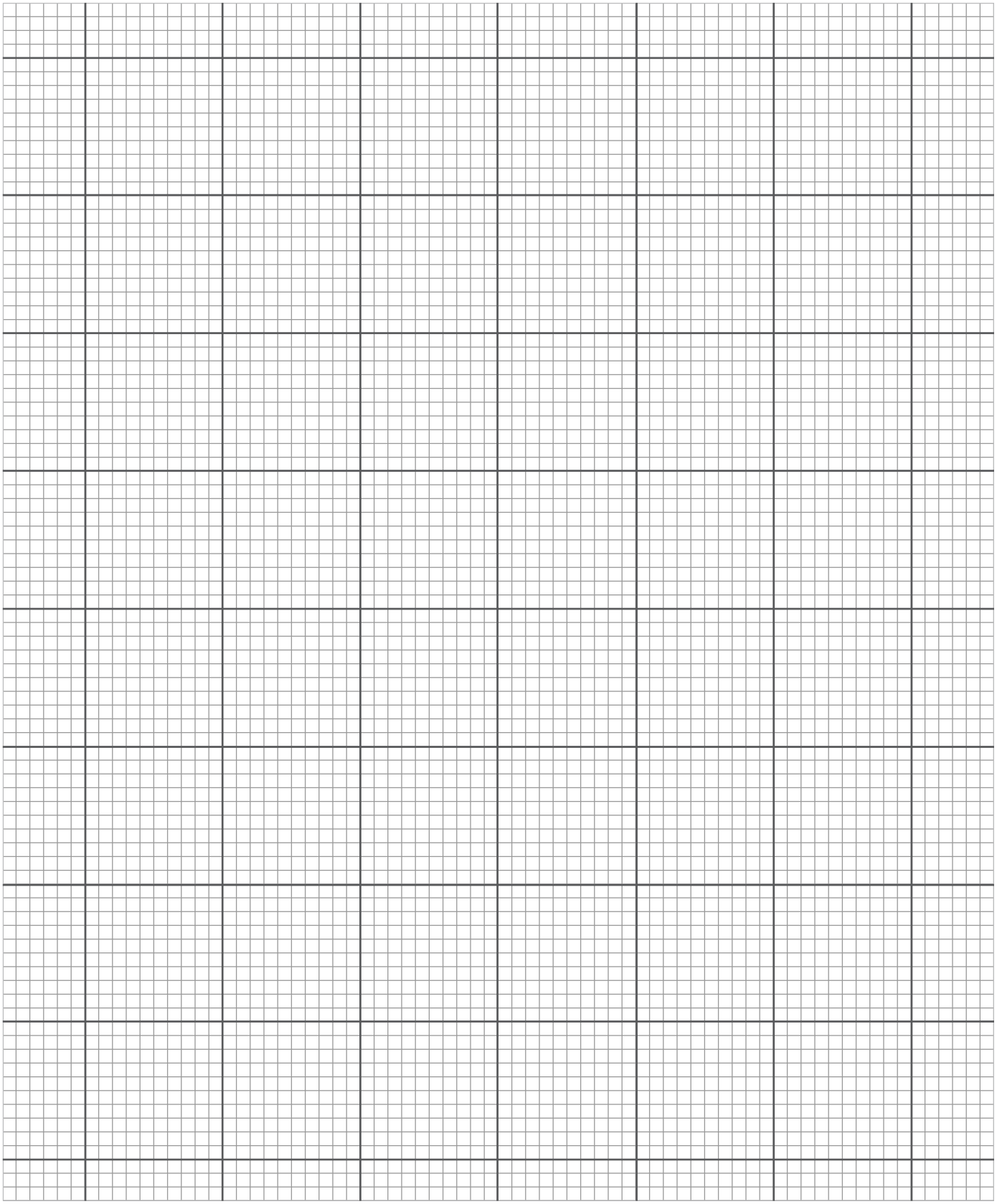
How will the proposed design accommodate the selected design vehicle(s)?

_____
_____
_____
_____

How does the design support the target speed of the roadway?

_____
_____
_____
_____

DRAW CROSS-SECTIONS BELOW



COORDINATING WITH PROCEDURAL MANUALS & STANDARDS

5b

Rethinking the Status Quo

Roadway designers, engineers, planners, and administrators depend on street manuals for guidance in designing new streets and retrofitting and modifying existing streets. Along with land use planning, street manuals play a large role in determining urban form, serving as the "DNA" of a community's streets and potentially providing a framework for the development of livable, healthy, sustainable neighborhoods and communities that support active transportation and encourage transit use.

FLEXIBLE STANDARDS 5.3

Many of the street manuals used by jurisdictions today are based on the principle that the primary role of a street is to serve as a thoroughfare for motor vehicle traffic. The result has been the construction of many wide, high-speed streets that prioritize traffic movement but compromise other important community goals and work against present-day community needs. Common direct outcomes of existing manuals include:

- Streets that unsafe safe for bicycling, walking, or even driving
- Streets that encourage high speeds
- Streets that are unsightly and uninviting, devaluing surrounding land uses
- Sidewalks too narrow for comfortable pedestrian use, or no sidewalks at all
- Streets that are difficult or dangerous for pedestrians to cross
- Street crossings that are inconveniently located
- Absent or poorly selected street trees
- Heat-island effects caused by excessive exposed hardscape
- Streetwater runoff that overwhelms storm drain systems and contributes to waterway pollution
- Auto-oriented land uses that are uninviting to people walking, biking, and using transit

Street manuals that prioritize motor vehicle use and fail to encourage transit use or accommodate active transportation have led to a number of serious problems for communities nationwide, including:

- Sedentary lifestyles that contribute strongly to rising rates of obesity-related disease, including diabetes, heart disease, cancer, and other negative health outcomes
- Extremely limited transportation options for people without access to cars, who encounter serious obstacles created by wide, high-speed roadways without sidewalks, pedestrian crossings or bicycle facilities; long distances to mass transit; and shopping and other amenities designed solely for motor vehicle access
- Economic hardships for local businesses, especially in downtown districts that cannot offer the easy automobile access and massive parking lots of outlying commercial strips and shopping malls
- Economic hardships for people who lack affordable alternatives to motor vehicles when gasoline prices rise
- Increased rates of childhood obesity linked to limited physical activity and dependence on car transportation instead of walking or bicycling
- Increased rates of childhood asthma linked to motor vehicle-related air pollution, especially in urban neighborhoods
- Reliance on motor vehicles for short-distance trips, resulting in ever-increasing consumption of petroleum and rising emissions of greenhouse gases
- Extensive use of asphalt and cement pavement to provide wide, high-speed roadways and immense parking lots, resulting in large volumes of streetwater runoff that pollute waterways, deplete groundwater and leave streetscape areas unnaturally dehydrated
- Isolated neighborhoods that lack livability and vibrancy

In contrast, this manual is based on Complete Streets principles: Streets are for people of all ages and physical abilities and should accommodate all travel modes. This manual presents methods for achieving complete networks to ensure that roadways promote economic vibrancy, equity, environmental sustainability, aesthetics, and opportunities for active transportation.

This manual focuses on network design and roadway design and supports flexibility in developing detailed design solutions appropriate to each neighborhood and community. In adopting this manual, it is recommended that jurisdictions also reference the highly detailed national best practices for design provided in the Federal Highway Administration (FHWA) Manual of Uniform Traffic Control Devices (MUTCD), and the American Association of State Highway and Transportation Officials (AASHTO) publication, A Policy on the Geometric Design of Highways and Streets (aka the Green Book).

FHWA MUTCD 5.4

The MUTCD provides standards and guidance for the application of traffic control devices, including roadway markings, traffic signs, and signals. The FHWA oversees application of the MUTCD.

The rules and requirements for the use of traffic control devices differ from street design criteria. Under Federal rules, the MUTCD serves as the basis for state laws governing traffic control devices, resulting in limited flexibility for local jurisdictions to deviate from the Manual. The MUTCD does allow some flexibility within its general provisions for items such as application of standard traffic control devices, use of custom signs for unique situations, traffic sign sizes, and sign placement specifics. However, agencies generally may not develop signs that are similar in purpose to signs within the Manual but use different colors, shapes, or legends. Agencies also are not authorized to establish traffic regulations that are not specifically allowed by, or are in conflict with, state law.

FHWA has procedures in place that allow local agencies to experiment with traffic control devices not included in the current MUTCD. It is not difficult for local agencies to get permission from FHWA to test new devices, especially as they relate to pedestrian and bicycle facilities. However, the requesting agency must agree to conduct adequate before-and-after studies, to submit frequent reports on the performance of the experimental device, and to remove the device if early results are not promising.

The MUTCD establishes warrants for the use of some traffic control devices. For example, stop signs, traffic signals and flashing beacons are limited to applications that meet specific minimum thresholds for such criteria as number of vehicles, number of pedestrians or other users, distance to other devices and crash history. These warrants often constrain local engineers from applying these devices in areas where they could be used to improve safety, such as trail and/or pedestrian crossings of busy, wide, high-speed arterials.

As with street design guidelines, cities may establish their own warrants or modify those suggested by the MUTCD to suit their context and allow use of certain traffic control devices. In special circumstances that deviate from their own warrants, cities must document the reasons for granting exceptions. For example, a city may specify that trail crossings or school crossings qualify for certain traffic control devices.

AASHTO POLICY ON THE GEOMETRIC DESIGN OF HIGHWAYS AND STREETS (THE GREEN BOOK) 5.5

The Green Book provides guidance for design elements such as geometric alignment, street width, lane width, shoulder width, medians, curbs, and other features. FHWA has determined that the Green Book applies to all streets receiving Federal funding, including streets and roads that are part of the National Highway System (NHS). The NHS includes the Interstate Highway System, principal routes connecting to those highways, and roads important to strategic defense; in total, the NHS comprises about 4% of all roadway miles.

It is important to note that the Green Book provides guidance that states and cities often unnecessarily treat as standards. The Green Book actually encourages flexibility in design within certain parameters, as evidenced by the AASHTO publication, A Guide for Achieving Flexibility in Highway Design. For example, many jurisdictions prohibit 10-foot lane widths, citing concerns about deviating from federal standards; in fact, 10-foot lanes are allowed under AASHTO guidelines.

VERTICAL ALIGNMENT

The Green Book provides acceptable values for designing vertical curves for streets. The values used in vertical curve design should be selected based on the selected target speed appropriate to the street context. Using higher values can contribute to increased vehicle speeds and may require increased modification to the natural terrain, increasing negative environmental impacts.

HORIZONTAL ALIGNMENT

The Green Book provides appropriate values for designing horizontal curves for Complete Streets. The values used in horizontal curve design should be selected based on the target speed appropriate to the street context. Larger horizontal curves create a more suburban or rural highway feel and require more right-of-way; using higher values for horizontal curve design can contribute to increased vehicle speeds and detract from the street character, especially in urban settings.

STOPPING SIGHT DISTANCE

The Green Book provides appropriate values for designing stopping sight distance for Complete Streets. The 2004 AASHTO Guide for Achieving Flexibility in Highway Design is based on the latest research concerning safe stopping sight distance. The document states that the established values for stopping sight distance are very conservative and provide adequate flexibility without creating increased crash risk. Consequently, selecting appropriate target speed is critical to avoid negative impacts, such as unnecessarily limiting or removing on-street parking and trees.

INTERSECTION SIGHT DISTANCE

Intersection sight distance should be calculated in accordance with the AASHTO Green Book, using the appropriate target speed. When executing a crossing or turning maneuver onto a street after stopping or yielding at a stop sign, yield sign, stop bar, or crosswalk, drivers typically move slowly forward to obtain sight distance without intruding into the crossing travel lane, stopping a second time as necessary. Where curb extensions or on-street parking are in place, motorists can be expected to move forward in a second-step movement to check for traffic clearance before crossing or turning. The increased sight distance provided by the two-step movement allows location of on-street parking closer to the intersection.

HORIZONTAL CLEARANCE/CLEAR ZONE

Horizontal clearance is the lateral distance from a specified point on the roadway, such as the edge of the travel lane or curb face, to a roadside feature or object. The clear zone is a relatively flat, unobstructed area provided for errant vehicles.

Horizontal clearance based on clear zone requirements for rural highways is not practical in urban areas characterized by more bicyclists and pedestrians, lower speeds, denser abutting development, restricted right-of-way, and closer-spaced intersections and access points. Urban streets with curbs and gutters do not have sufficiently wide roadsides to provide clear zones. In urban areas, the minimum horizontal clearance is 1.5 feet, measured from the face of the curb. The minimum horizontal clearance on urban streets is primarily intended to facilitate normal operation; for example, clearance is required for sign posts and poles, to make sure they are not hit by car doors and large vehicles with overhangs maneuvering close to the curbside.

PEDESTRIAN GUIDE AND BICYCLE GUIDE

AASHTO also publishes guides specifically for the development of pedestrian and bicycle facilities. The Guide for the Development of Bicycle Facilities and the Guide for the Development of Pedestrian Facilities provide detailed considerations for the design of transportation systems for pedestrians and bicycles, including information on geometric guidelines for the bicycle and pedestrian facilities discussed in Chapter 3.

LOCAL MANUALS AND LIABILITY PROTECTIONS 5.6

Cities are authorized to adopt or modify many of their own street design practices, standards, and guidelines. However, local jurisdictions typically follow State standards, partly because they may lack the resources to develop their own localized set of standards and practices, but also because alignment with State standards may provide protection from liability.

In lawsuits against municipalities arising from traffic-related crashes, one fundamental question is: "Did the municipality follow established or prevailing designs, standards, and guidance?" It should be noted, however, that State standards are not the only design guidelines that can confer protection from liability. The changes to streets discussed in this manual fall within the range of the guidelines or recommended practices of nationally recognized organizations such as AASHTO, the Institute of Transportation Engineers (ITE), NACTO, Urban Land Institute (ULI), and Congress for the New Urbanism (CNU). Adoption of design guidance from this manual, the Green Book and/or other nationally recognized authorities can address municipalities' liability concerns where street designs deviate from State manuals. Where municipalities adopt standards that differ from the Green Book but generally fall within the range of acceptable practice allowed by nationally recognized design standards, the adopting agencies are protected from liability to the same extent that they would be if they applied the Green Book.

It should be noted that the Green Book is silent on many design features, and that it does not consider design needs within unique, site-specific contexts. In these cases, cities can develop their own guidelines and standards.

LOCAL MANUALS AND LIABILITY PROTECTIONS (CONTINUED) 5.6

Working within previously established regional guidelines that incorporate equivalents or practices from other cities generally should result in a design that is protected from liability. Cities also may adopt the guidance in this manual, which compiles national best practices in creating safe, user-oriented streets.

Cities also may use designs that fall outside the ranges specified by nationally accepted guidelines and standards; unless done with great care, these practices can potentially increase liability. Where agencies elect to use designs that fall outside the guidelines of nationally recognized authorities, they should provide internal documentation to avoid exposure to increased liability. Such documentation must clearly state the rationale or evidence of reasonableness underlying the design decisions.

In some cases, AASHTO design guidelines may not provide information on innovative or experimental treatments that have shown great promise in early applications. As noted above, deviation from the range of designs provided in the AASHTO guide requires agencies to use greater care and diligence to document their justification for the design deviation, the precautions taken to ensure its safety and effectiveness, and the process that led to the determination to implement a design that does not align with the guidelines. These include consideration/analysis and approval by a registered engineer qualified to sign the plans, as well as certification by the city council or reviewing body clearly indicating the agency's intent. This process documents the engineering judgment that went into the design.

Local jurisdictions may conduct experimental projects to test innovative designs and treatments. Often, these experimental projects are conducted by a design engineer to test a new or evolved design that may be safer or may address a design challenge more effectively than existing solutions available under prevailing standards and guidelines. When conducting these projects, agencies should provide documentation showing that: The experiment design is based on sound engineering judgment; the experiment is expected to improve user safety and/or promote community goals; the experiment is based on the best information reasonably available at the time; the development and implementation of the experiment is logical and reasonable; the results of the experiment are monitored closely, and, the experiment is modified in response to data collected during the monitoring process. This documentation will give the local agency a basis to defend a design as reasonable in the face of litigation, even if the design does not align with a nationally published guideline or recommendation.

Local agencies may use other reports and documents to guide their roadway design and transportation planning. These informational documents do not set standards, but they do provide valuable procedure and reference data. A local authority often has the flexibility to selectively define, endorse, or modify the incorporation of these informational documents into its engineering and planning processes.

There is no way to prevent all collisions, nor all lawsuits, but adoption of widely accepted policies, guidelines, and standards, combined with reasonable precaution in embarking on experimental projects, will yield an approach that is both adequately flexible and legally defensible. The design approaches presented in this manual are intended to improve safety and livability for all people who use the street; as a result, implementation of these features should generally reduce liability.

MEASURING PROGRESS

Getting Started

When embarking upon implementation of a Complete Streets policy, agencies should closely consider how to measure the policy's success. To fully implement Complete Streets policy, communities should identify appropriate metrics and adopt specific, appropriate benchmarks.

5C

PERFORMANCE MEASURES 5.7

Performance measures should be linked to the desired outcome of the policy. As mentioned at several points in this manual, conventional street design applies motor vehicle-centric performance measures. The most commonly used performance measure is the Level of Service (LOS), which prioritizes smooth vehicular flow. Using LOS as the basis for design choices leads to widening of streets and intersections, removal of on-street parking, and other strategies to accommodate and hasten motor vehicle traffic – all of which undermine the goals and tenets of Complete Streets and complete networks. Instead of relying on performance measures that focus narrowly on the needs of motorists, organizations implementing Complete Streets should:

Set targets for budget and staff time dedicated to Complete Streets policy implementation.

Define an evaluation process to measure performance at specified regular intervals.

Evaluate for all modes, through multimodal level of service (MLOS), bicycle level of service (BLOS), and pedestrian level of service (PLOS) evaluations.

Set targets for commonly measured performance metrics that include reduction of pedestrian and bicycle crash incidents and increased modeshift to pedestrian, bicycle, and transit trips.

Set infrastructure targets for miles of new pedestrian, bicycle, and/or transit infrastructure to be constructed within a specific time frame.

Performance measures may be discussed in broad terms, to allow for subjective evaluations, or may be tied to specific targets and related to specific metrics. Periodic comparisons may be made if baselines are established at the onset of implementation.

BENCHMARKS 5.8

MULTIMODAL COMFORT A complete network should make every street and neighborhood comfortable for walking and bicycling.

SCHOOL ACCESS A complete network should provide every child within a 2-mile radius with a safe route to walk or bike to and from school. This benchmark includes safe and convenient crossings of busy streets, as these thoroughfares are often barriers to safe school access.

SAFETY FOR ALL A complete network should provide options for seniors, children, and people with disabilities to cross all streets safely and comfortably.

ACTIVE TRANSPORTATION ACCESS A complete network should provide opportunities for all residents to use active transportation modes.

CRASH REDUCTION A complete network should reduce numbers of crashes, injuries and fatalities for all types of users.

CRIME REDUCTION A complete network should reduce opportunity for index crime and encourage "eyes on the street."

POSITIVE ENVIRONMENTAL IMPACT A complete network should reduce negative impacts on the environment through green infrastructure design; local CO2 emissions should be reduced, and no unfiltered stormwater should flow into local waterways.

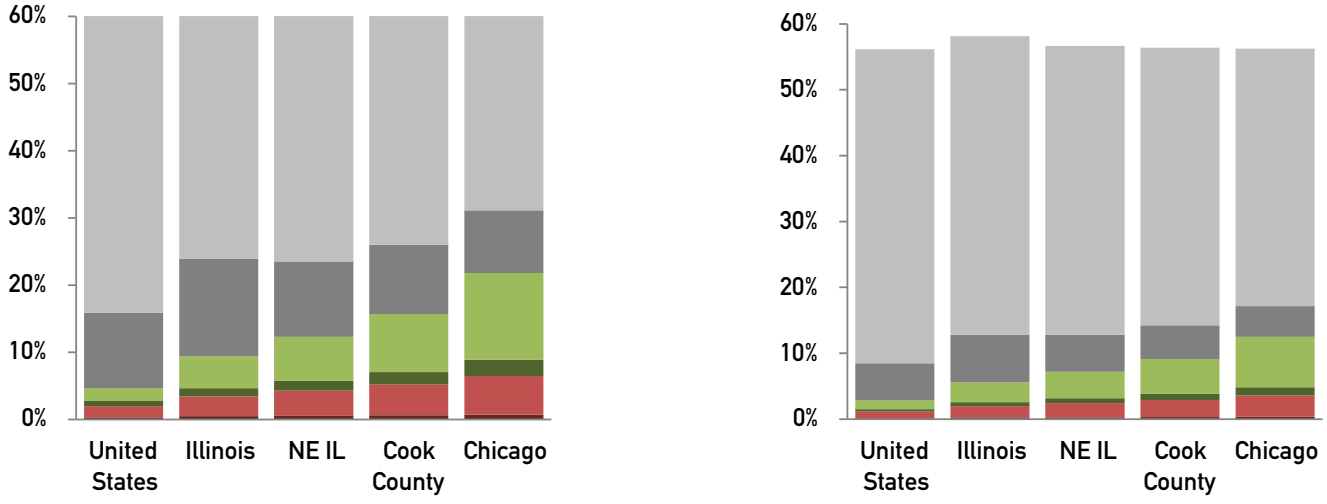
ECONOMIC VITALITY A complete network should contribute to the economic vitality of the region; retail streets should become popular destinations for residents and visitors.

METRICS 5.9

- Number of blocks with new or repaired sidewalks
- Number of new or repainted crosswalks
- Improvements in pavement conditions
- Number of new countdown pedestrian signals
- Number of new or repaired accessible, ADA-compliant curb cuts
- Miles of new bicycle facilities
- Percentage of planned bicycle network implemented
- Increase in percentage of neighborhood destinations accessible by active transportation
- Decrease in number of street injuries and fatalities across all modes for all age groups
- Improved transit headways
- Increase in transit ridership
- Increase in number of trips by walking, cycling, and transit
- Increase in the walk/bike/or transit score of a community or project
- Improved interconnection of traffic signals
- Increase in jurisdiction coordination
- Reduced motor vehicle travel
- A decrease in prevailing speeds of motor vehicles
- A decrease in the number of index crimes
- Increase in the number of street trees planted
- A reduction in streetwater runoff
- Improved water quality in nearby waterways
- Improved local air quality/reduced greenhouse gas emissions
- Increase in retail sales
- Increase in tourism revenue
- Increase in resident, business and customer satisfaction

5.10A

Target 2040 Crash Rate



United States	Illinois	NE IL	Cook County	Chicago		United States	Illinois	NE IL	Cook County	Chicago
84.15%	76.06%	76.46%	74.01%	68.88%	Injured Vehicle Occupants	47.68%	45.31%	43.85%	42.15%	39.11%
11.21%	14.55%	11.24%	10.29%	9.33%	Fatal or Incapacitated Vehicle Occupants	5.61%	7.28%	5.62%	5.15%	4.67%
1.87%	4.72%	6.50%	8.64%	12.87%	Injured Pedestrians	1.33%	2.98%	4.01%	5.26%	7.66%
0.79%	1.24%	1.53%	1.88%	2.44%	Fatal or Incapacitated Pedestrians	0.40%	0.62%	0.76%	0.94%	1.22%
1.69%	2.95%	3.73%	4.55%	5.75%	Injured Pedalcyclist	0.98%	1.71%	2.14%	2.59%	3.24%
0.28%	0.47%	0.54%	0.63%	0.73%	Fatal or Incapacitated Pedalcyclist	0.14%	0.24%	0.27%	0.31%	0.36%
2,427,664	99,441	63,147	43,097	23,644	Total Injured or Killed Occupants	1,362,892	57,809	35,775	24,307	13,300

To calculate the Target 2040 Crash Rates, half of all current fatal or incapacitated persons were considered only possible or non-incapacitating. In turn, half of all possible or non-incapacitated persons were not involved in a crash. NE IL includes Cook, DuPage, Kane, Lake, McHenry and Will County.

United States Crash Data Source: National Highway Traffic Safety Administration – Traffic Safety Facts; Illinois Crash Data Source: Illinois Department of Transportation

CRASH REDUCTION TARGETS & MODESHIFT TARGETS 5.10

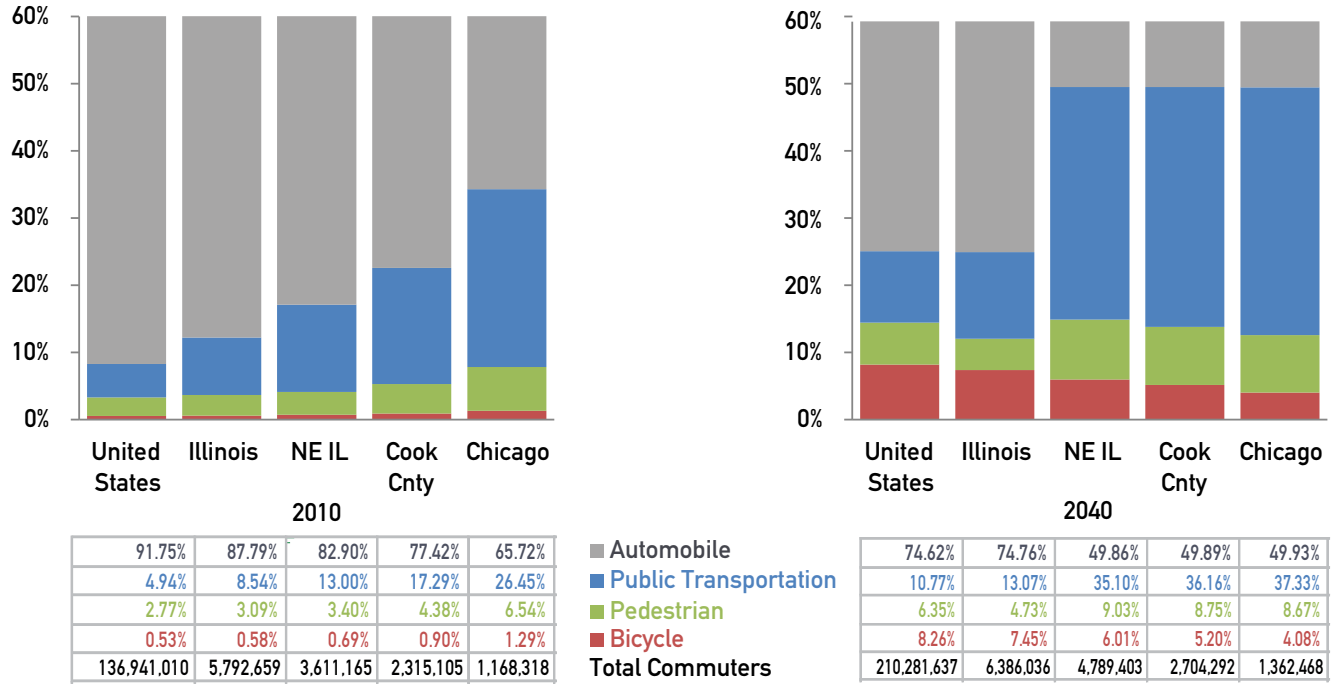
This manual recommends including crash reduction targets and modeshift targets as performance measures in all Complete Streets policies. Dedicating resources to measuring progress toward these two goals will have a positive impact on creating Complete Streets and complete networks. Example targets for crash reduction and modeshift include:

CRASH REDUCTION TARGET The number of bicycle and pedestrian crashes will be reduced by 50% by the year 2040.

MODESHIFT TARGET Travel patterns will change so that 50% of all trips will be made by walking, bicycling and/or transit by 2040.

If an adopted policy lacks specific targets for crash reduction and modeshift, targets can be selected on a project-by-project basis. Additionally, designers should be encouraged to select targets higher than those of the adopted policy for projects that are particularly suited to Complete Streets implementation.

Target 2040 Mode Share



2010				
91.75%	87.79%	82.90%	77.42%	65.72%
4.94%	8.54%	13.00%	17.29%	26.45%
2.77%	3.09%	3.40%	4.38%	6.54%
0.53%	0.58%	0.69%	0.90%	1.29%
136,941,010	5,792,659	3,611,165	2,315,105	1,168,318

2040				
74.62%	74.76%	49.86%	49.89%	49.93%
10.77%	13.07%	35.10%	36.16%	37.33%
6.35%	4.73%	9.03%	8.75%	8.67%
8.26%	7.45%	6.01%	5.20%	4.08%
210,281,637	6,386,036	4,789,403	2,704,292	1,362,468

The Target 2040 Mode Share was calculated under several assumptions. The first assumption being that the same average percent of the population that commuted in 2000 and 2010 will commute in 2040 relative to the projected population. Next, public transportation, walking, and biking were all considered active transportation. The average ratio of public transportation, biking, and walking to active transportation in 2000 and 2010 was kept the same in 2040. Then, the ratio was adjusted to so that half of all commuting trips under 10 minutes were made by bicycle. NE IL includes Cook, DuPage, Kane, Lake, McHenry and Will County.

Current Mode Share & Population Data Source: 2000 Census SF3 & 2010 ACS 1 Year Estimates; United States & Illinois Population Projection Data Source: Census Population Projections; NE IL, Cook County, and Chicago Population Projection Data Source: CMAP GT2040 Population Forecast

FIGURE 5.10A
CRASH STATISTICS GRAPH
Image Credit: Active Trans

FIGURE 5.10B
MODESHARE STATISTICS GRAPH
Image Credit: Active Trans

USING MULTIMODAL LEVEL OF SERVICE (MMLOS) FOR DESIGN EVALUATION 5.11

Transportation planners and roadway designers use qualitative assessments to describe the perceived service a street provides to the people who use it. The quality of service conventionally has been measured using a Level of Service (LOS) metric. LOS assesses delay for motorists along a roadway section or at a signalized intersection, using a letter grade system that assigns an A for no delay and an F for greatest delay. This measurement considers quality of service only for motor vehicles using the roadway system.

The Highway Capacity Manual (HCM) provides details of the LOS computations for roadways and intersections. In its 2011 edition, the HCM also includes methods for calculating bicycle, pedestrian, and transit LOS, as well as corridor multimodal LOS (MMLOS). Because traveled ways serve different modes of transportation, it is recommended that planners and designer use MMLOS evaluations to compare service quality changes resulting from design decisions. The MMLOS methodology included in the HCM is limited in its usefulness, as it requires collection of numerous data to complete the calculations; the MMLOS methodology used by the Massachusetts Department of Transportation may be used as a substitute.

Originally, MMLOS was developed under National Cooperative Highway Research Program (NCHRP) Project 3-70. The MMLOS was developed for urban streets and is currently designed for analysis of steady-state conditions during a specified analysis period. MMLOS applies to all modes of travel (walking, motor vehicles, transit, and bicycles) on urban streets and assesses the impacts of facility design and operation on all users, except for commercial vehicles. The MMLOS analysis provides a tool to predict perceptions of quality of service. Bicycle Level of Service (BLOS) and Pedestrian Level of Service (PLOS) can be used to evaluate specific bicycle or pedestrian conditions; however, MMLOS is better suited to assess performance of networks serving multiple modes.

To conduct an MMLOS assessment, it is necessary to select a roadway segment that is used by bicyclists and pedestrians and that includes transit and five or six signalized intersections. The data required for conducting MMLOS includes street geometrics, such as the numbers of through lanes, turning lanes, signalized and unsignalized intersections and transit stops, and the widths of medians, travel lanes, bike lanes, parking lanes, shoulders and sidewalks. The methodology provides some basic default values for use.

Changes to alternative roadway designs can be evaluated using MMLOS methodology, which yields a separate numerical LOS rating for each mode. The numerical rating is then converted into an A-to-F letter grade system. LOS scales for different modes should be considered independently, allowing different target scores for each mode. For example, a D rating is a reasonable LOS target for motor vehicles on urban roadways, where drivers do not expect free-flowing traffic and higher LOS ratings for motor vehicles come with significant costs. However, a bicycle LOS target rating of C or higher should be set for all streets, with a rating of B or higher designated systems; for bicycles, a C rating represents a safely traversable surface – a baseline target for bicycle connectivity – and a B represents conditions more desirable for casual cyclists, who are more likely to ride on designated roadways. Higher targets for pedestrian LOS should be set in areas designated for improved walkability and transit prioritization, such as commercial districts, schools, and parks.

Using MMLOS instead of the traditional LOS assessment should lead to very different design decisions. When LOS is used as the only measurement of service quality, municipalities typically remedy low scores by widening streets, flaring intersections, and implementing other measures that improve motor traffic flow to the detriment of pedestrians and bicyclists. In contrast, conducting an MMLOS analysis of existing roadway segments will identify deficiencies in the system for all modes and lead to improvements for all users.

ADOPTING THIS MANUAL

Going the Distance

Now it's time to use this manual in your community or agency to implement Complete Streets.

5d

STAND-ALONE USES 5.12

This manual complements existing design guidance and can be used in conjunction with other documents. The geometric designs contained in this manual are consistent with the standards and guidelines recommended by national organizations such as the Federal Highway Administration, the American Association of State Highway and Transportation Officials, and the Institute of Transportation Engineers. This manual can be used for its recommendations on typology design processes and its summaries of geometrics and amenity tools for multimodal facilities. The actual standards referenced in an agency's final design selections may be derived from other sources.

DOCUMENT ADOPTION 5.13

This manual is suitable for adoption by local and regional agencies to guide planning and design of streets. By adopting this manual, agencies will have a formal policy guide in place for the design and implementation of Complete Streets. Adoption is a necessary first step in incorporating the provisions of this manual; however, agencies should take additional steps to ensure that their implementation practices are modified to reflect these recommendations. Internal policy development, project development process revisions and staff trainings are necessary to ensure integration of this manual's recommendations into the transportation decision-making process.

Agencies should review their stepwise approach to street design through all stages of the process, from advance planning through preliminary design, construction, and maintenance/operations. Critical implementation points for successful Complete Streets policy adoption include project identification, preliminary cost estimates for capital planning, and preparation of design drawings.

Jurisdictions should take steps to make sure that all relevant departments are using coordinated practices directed at achieving shared goals. These include agencies such as (but not limited to) public works, traffic engineering, transportation planning, street services, maintenance, signal operations, street lighting, planning, development review, and emergency services.

Adoption of this manual can provide justification for flexibility in applying state and national standards. This manual can give agencies the authority to choose which features and provisions should be prioritized and can help designers articulate their reasons for the application of engineering judgment.

Sources

Abu Dhabi Urban Planning Council. 2010. ABU DHABI URBAN STREET DESIGN MANUAL. Abu Dhabi.

Alta Planning + Design. 2003. CITY OF SAN FRANCISCO BICYCLE PLAN UPDATE: SUPPLEMENTAL DESIGN GUIDELINES. San Francisco, Calif.

American Association of State Highway and Transportation Officials. 1999. GUIDE FOR THE DEVELOPMENT OF BICYCLE FACILITIES. Washington, D.C.

American Association of State Highway and Transportation Officials. 2001. GUIDELINES FOR GEOMETRIC DESIGN OF VERY LOW-VOLUME LOCAL ROADS (ADT ≤ 400). Washington, D.C.

American Association of State Highway and Transportation Officials. 2004. GUIDE FOR THE PLANNING, DESIGN, AND OPERATION OF PEDESTRIAN FACILITIES. Washington, D.C.

American Association of State Highway and Transportation Officials and American Association of State Highway and Transportation Officials. 2004. GUIDE FOR HIGH-OCCUPANCY VEHICLE (HOV) FACILITIES. Washington, D.C.

American Association of State Highway and Transportation Officials and American Association of State Highway and Transportation Officials. 2004. GUIDE FOR PARK-AND-RIDE FACILITIES. Washington, D.C.

American Planning Association. 2006. PLANNING AND URBAN DESIGN STANDARDS. Hoboken, N.J: John Wiley and Sons.

Attarian, J. L. and City of Chicago. 2003. STREETSCAPES: STREETSCAPE GUIDELINES FOR THE CITY OF CHICAGO STREETSCAPE AND URBAN DESIGN PROGRAM. Chicago, Ill.

Bicycle Hotline. (n.d.). Cycle tracks. Retrieved September 17, 2011 from http://gettingaroundportland.com.

Bicyclinginfo.org. 2002, August 1. BIKE LANE DESIGN GUIDE. Retrieved December 6, 2011, from http://www.bicyclinginfo.org.

Bochner, B.S., J.M. Daisa, and B.B. Storey. January 01, 2011. WALKABLE URBAN THOROUGHFARES: FROM CONCEPT TO RECOMMENDED PRACTICE. Ite Journal, 81, 9.

California Department of Transportation. 2004. MUTCD 2003: CALIFORNIA SUPPLEMENT. Sacramento, Calif.

California Department of Transportation, Alta Planning + Design, and Cambridge Systematics. 2010. COMPLETE INTERSECTIONS: A GUIDE TO RECONSTRUCTING INTERSECTIONS AND INTERCHANGES FOR BICYCLISTS AND PEDESTRIANS. Sacramento, Calif.

Chicago Department of Construction and Permits and the Chicago Department of Transportation. 2002. KEY ACCESSIBILITY REQUIREMENTS FOR CONSTRUCTION CANOPIES, SCAFFOLDING AND TEMPORARY STRUCTURES ON PUBLIC WAYS. Chicago, Ill.

Chicago Department of Transportation. 2007. CHICAGO GREEN ALLEY HANDBOOK: AN ACTION GUIDE TO CREATE A GREENER, ENVIRONMENTALLY SUSTAINABLE CHICAGO. Chicago, Ill.

Chicago Department of Transportation. 2007. REGULATIONS FOR OPENINGS, CONSTRUCTION AND REPAIR IN THE PUBLIC WAY. Chicago, Ill.

Chicago Department of Transportation. 2007. STREET AND SITE PLAN DESIGN STANDARDS. Chicago, Ill.

Chicago Department of Transportation, Bureau of Highways. 2004. ROADWAY PLANT LIST. Chicago, Ill.

Chicago Department of Water Management. 2011. CHICAGO STORM WATER MANAGEMENT ORDINANCE MANUAL. Chicago, Ill.

Chicago Mayor's Bicycle Advisory Council. 2006. BIKE 2015 PLAN: CITY OF CHICAGO. Chicago, Ill.

Chicago Transit Authority. 2007. BUS FACILITIES HANDBOOK. Chicago, Ill.

Chicago Transit Authority. 2009. TRANSIT FRIENDLY DEVELOPMENT GUIDE: STATION AREA TYPOLOGY. Chicago, Ill.

City of Chicago. 2009. CHICAGO MUNICIPAL CODE REGARDING BICYCLES. Chicago, Ill.

City of Chicago and Wolff Clements and Associates. 2000. GUIDE TO THE CHICAGO LANDSCAPE ORDINANCE: REGULATIONS AND GUIDELINES RELATING TO TITLE 10, CHAPTER 32 AND TITLE 17, CHAPTER 194A OF THE CHICAGO MUNICIPAL CODE. Chicago, Ill.

City of Detroit Traffic Engineering Division and Department of Public Works. 2006. NON-MOTORIZED URBAN TRANSPORTATION MASTER PLAN. Detroit, Mich.

City of New Haven. 2010. CITY OF NEW HAVEN COMPLETE STREETS DESIGN MANUAL DRAFT. New Haven, Conn.

City of New York. 2010. NEW YORK CITY PEDESTRIAN SAFETY STUDY AND ACTION PLAN. New York, N.Y. New York City Department of Transportation.

City of New York. 2008. SUSTAINABLE STREETS: STRATEGIC PLAN FOR THE NEW YORK CITY DEPARTMENT OF TRANSPORTATION 2008 AND BEYOND. New York, N.Y. New York City Department of Transportation.

City of New York, R.W. Giuliani, J.B. Rose, C.R. Lynn. 1997. NEW YORK CITY BICYCLE MASTER PLAN. New York, NY. New York Department of City Planning.

City of San Jose. 2010. TRAIL SIGNAGE GUIDELINES. San Jose, Calif.

Church, E. 2007. STREET SMARTS TASK FORCE BICYCLE FACILITIES TOOLBOX. Austin: Texas. Klotz Associates, Inc.

COMPLETE STREETS LOWER TRANSPORTATION COSTS. (n.d.). Complete Streets. Retrieved December 21, 2010, from http://www.completestreets.org.

Daisa, J.M., Institute of Transportation Engineers, and Congress for the New Urbanism. 2006. CONTEXT SENSITIVE SOLUTIONS IN DESIGNING MAJOR URBAN THOROUGHFARES FOR WALKABLE COMMUNITIES. Washington, D.C.

Ernst, M. and Transportation for America. 2011. DANGEROUS BY DESIGN 2011: SOLVING THE EPIDEMIC OF PREVENTABLE PEDESTRIAN DEATHS. Washington, D.C.

Ewing, R.H. and S.J. Brown. 2009. U.S. TRAFFIC CALMING MANUAL. Chicago, Ill. American Planning Association.

Farr, D. 2008. SUSTAINABLE URBANISM: URBAN DESIGN WITH NATURE. Hoboken, N.J. John Wiley & Sons.

Fischer, E. L., G. K. Rousseau, D. E. Wigle, C. V. Zegeer, S. M. Turner, E. J. Blais, et. al. 2010. PEDESTRIAN AND BICYCLISTS SAFETY AND MOBILITY IN EUROPE. Alexandria, Virginia. Federal Highway Administration.

Flusche, D., League of American Bicyclists, and Alliance for Biking and Walking. 2009. ECONOMIC BENEFITS OF BICYCLE INFRASTRUCTURE INVESTMENTS. Washington, D.C. League of American Bicyclists.

Goodridge, S. G. (n.d.). DESIGNING WOLs. Humantransport.org. Retrieved December 6, 2011, from http://www.humantransport.org/bicycle.

Gotschi, T. 2011. COSTS AND BENEFITS OF BICYCLING INVESTMENTS IN PORTLAND, OREGON. Journal of Physical Activity and Health, 8 (Sup.1):S49-S58. Human Kinetics.

Grabow, M., M. Hahn, and M. Whited. 2010. VALUING BICYCLING'S ECONOMIC AND HEALTH IMPACTS IN WISCONSIN. Madison, Wis. The Nelson Institute for Environmental Studies, Center for Sustainability and the Global Environment, University of Wisconsin-Madison.

GREAT STREETS PERFORMANCE MEASURE. 2011. New York, NY. Nelson/Nygaard Consulting Associates.

Gresham Smith and Partners. 2009. COMPLETE STREETS DESIGN GUIDELINES. 2009. Knoxville, Tenn.

Huang, H.F., J.R. Stewart, C.V. Zegeer, Turner-Fairbank Highway Research Center, and University of North Carolina. 2005. EVALUATION OF LANE REDUCTION "ROAD DIET" MEASURES AND THEIR EFFECTS ON CRASHES AND INJURIES. McLean, Virginia. U.S. Department of Transportation, Federal Highway Administration, and Turner-Fairbank Highway Research Center.

Hunter, W.W., L. Thomas, J. C. Stutts, University of North Carolina. 2006. COUNTERMEASURES. BIKESAFE: BICYCLE COUNTERMEASURE SELECTION SYSTEM. (pp. 51–140). Washington, D.C. Federal Highway Administration, Office of Safety Programs.

Illinois Department of Transportation. 2007. URBAN STREET DESIGN GUIDELINES. Springfield, Ill.

Institute of Transportation Engineers. 2010. DESIGNING WALKABLE URBAN THOROUGHFARES: A CONTEXT SENSITIVE APPROACH. Washington, D.C. Institute of Transportation Engineers.

Ivan, J. N., N. W. Garrick, G. Hanson, Connecticut, Connecticut Transportation Institute, Joint Highway Research Advisory Council, and Connecticut Cooperative Highway Research Program. 2009. DESIGNING ROADS THAT GUIDE DRIVERS TO CHOOSE SAFER SPEEDS. Storrs, Conn. University of Connecticut, Connecticut Transportation Institute.

Kimley-Horn and Associates. 2003. STATEWIDE BICYCLE AND PEDESTRIAN PLAN. Phoenix, Ariz.

King, M. and Pedestrian and Bicycle Information Center. 2002. BICYCLE FACILITY SELECTION: A COMPARISON OF APPROACHES. Chapel Hill, N.C. Highway Safety Research Center, University of North Carolina.

King, M.R., T.P. Williams, and R. Ewing. 2000. STATES FLEXING MAIN STREET DESIGN: A REPORT ON EFFORTS BY VARIOUS STATES TO 'FLEX' THEIR HIGHWAY STANDARDS TOWARD BETTER MAIN STREET DESIGN. New Brunswick: N.J. Rutgers Transport Policy Institute.

Krizek, K.J., National Research Council, National Cooperative Highway Research Program, and American Association of State Highway and Transportation Officials. 2006. GUIDELINES FOR ANALYSIS OF INVESTMENTS IN BICYCLE FACILITIES. Washington, D.C. Transportation Research Board.

Litman, T. 2010. QUANTIFYING THE BENEFITS OF NONMOTORIZED TRANSPORTATION FOR ACHIEVING MOBILITY MANAGEMENT OBJECTIVES. Washington, D.C. Victoria Transport Policy Institute.

Lydon, M., Z. Adelson, and T. Garcia. 2010, June 1. BICYCLING SMART CODE MODULE. Center for Applied Transect Studies. Retrieved June 27, 2011, from http://www.transect.org/modules.html.

Lusk, A., J. Harris, and R. Ryznar. 2010. PUSHING THE DESIGN BOUNDARIES: DESIGN INNOVATIONS FOR THE BUILT ENVIRONMENT. Boston, Mass. Harvard School of Public Health.

MANUAL ON UNIFORM CONTROL DEVICES FOR STREETS AND HIGHWAYS (MUTCD). 2009. Washington, D.C. U.S. Department of Transportation, Federal Highway Administration.

McCann, B.A. and S. Rynne. 2010. COMPLETE STREETS: BEST POLICY AND IMPLEMENTATION PRACTICES. Chicago, Ill. American Planning Association.

METRO LOUISVILLE COMPLETE STREETS MANUAL. 2007. Louisville, Ky. Louisville Planning and Design Services.

Metropolitan Planning Council. 2011. BUS RAPID TRANSIT: CHICAGO'S NEW ROUTE TO OPPORTUNITY. Chicago, Ill.

MULTI-MODAL CORRIDOR AND PUBLIC SPACE DESIGN GUIDELINES. 2008. Indianapolis, Ind. Storrow Kinsella Associates Inc.

New York City Department of Transportation. 2009. STREET DESIGN MANUAL. New York, N.Y.

National Association of City Transportation Officials. 2011. NACTO URBAN BIKEWAY DESIGN GUIDE. Washington, D.C.

National Research Council. 2010. HCM 2010: HIGHWAY CAPACITY MANUAL. Washington, D.C. Transportation Research Board.

Noland, R.B. January 01, 2003. TRAFFIC FATALITIES AND INJURIES: THE EFFECT OF CHANGES IN INFRASTRUCTURE AND OTHER TRENDS. Accident Analysis and Prevention, 35, 4.

Ohio Department of Transportation. 2005. OHIO STATE DESIGN GUIDANCE FOR ROADWAY-BASED BICYCLE FACILITIES. Columbus, Ohio.

POLICY ON INFRASTRUCTURE GUIDELINES FOR NON-MOTORIZED TRAVEL INVESTMENTS. 2010. Springfield, Ill. Lake County Division of Transportation.

PORTLAND BICYCLE COUNT REPORT 2009. 2010. PortlandOnline. Portland, Ore.

Portland Bureau of Transportation. 2010. PORTLAND BICYCLE PLAN FOR 2030. As adopted, February 11, 2010. Portland, Ore.

Portland Pedestrian Transportation Program. 1998. PORTLAND PEDESTRIAN DESIGN GUIDE. Portland, Ore.

Potts, I.B. 2005, June 27. LANE WIDTHS, CHANNELIZED RIGHT TURNS, AND RIGHT TURN DECELERATION LANES IN URBAN AND SUBURBAN AREAS. NCHRP 3-72. Lecture conducted by Midwest Research Institute. Kansas City, Mo.

Potts, I.B., D.W. Harwood and K.R. Richard. January 01, 2007. RELATIONSHIP OF LANE WIDTH TO SAFETY ON URBAN AND SUBURBAN ARTERIALS. Transportation Research Record, 2023, 63-82.

Massachusetts Department of Transportation. 2006. PROJECT DEVELOPMENT AND DESIGN GUIDE.

Puentes, R., A. Tomer, and Brookings Institution. 2008. THE ROAD...LESS TRAVELED: AN ANALYSIS OF VEHICLE MILES TRAVELED TRENDS IN THE U.S. Washington, D.C. Metropolitan Policy Program and Brookings Institution.

Ryan Snyder Associates. 2011. MODEL DESIGN MANUAL FOR LIVING STREETS: LOS ANGELES COUNTY. Los Angeles, Calif. Department of Health and Human Services.

Sacramento Transportation and Air Quality Collaborative. 2005. BICYCLE PLANNING AND FACILITY DESIGN BEST PRACTICES. Sacramento, Calif.

San Francisco County Transportation Authority and San Francisco Public Utilities Commission. 2010. SAN FRANCISCO BETTER STREETS PLAN: POLICIES AND GUIDELINES FOR THE PEDESTRIAN REALM: FINAL PLAN. San Francisco, Calif. San Francisco Planning Department.

San Francisco Planning Department. 2008. STREETSCAPE DESIGN MANUAL. San Francisco, Calif.

Santa Clara Valley Transportation Authority. 1999. VTA BICYCLE TECHNICAL GUIDELINES: A GUIDE FOR LOCAL AGENCIES IN THE PLANNING, DESIGN AND MAINTENANCE OF BICYCLE FACILITIES. San Jose, Calif.

Steele, K., M. Altmaier, Alliance for Biking and Walking, Center for Disease Control, Planet Bike, and Bikes Belong Coalition. 2010. BICYCLING AND WALKING IN THE UNITED STATES 2010. Washington, D.C. Alliance for Biking and Walking.

Toole, J. L., and B. Zimny. 1999. BICYCLE AND PEDESTRIAN FACILITIES. Transportation Planning Handbook (pp. 599-641). Washington, D.C. Institute of Transportation Engineers.

T.Y. Lin International and the Chicago Department of Transportation. 2010. COMPLETE STREETS POLICY IMPLEMENTATION. Chicago, Ill.

United States Department of Transportation, Federal Highway Administration. 2009. MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES: FOR STREETS AND HIGHWAYS. Washington, D.C.

Vermont Agency of Transportation. 2002. PEDESTRIAN AND BICYCLE FACILITY PLANNING AND DESIGN MANUAL (pp. 4:1-4:36). Montpelier, Vt.

Washington, D.C. Department of Transportation. 2005. DISTRICT OF COLUMBIA BICYCLE MASTER PLAN. Washington, D.C.

Walker, L., M. Tresidder, and M. Birk. 2009. FUNDAMENTALS OF BICYCLE BOULEVARD PLANNING AND DESIGN GUIDEBOOK. Portland, Ore. Initiative for Bicycle and Pedestrian Innovation, Portland State University.

Wren, C.D. and Congress for the New Urbanism. 2000. EMERGENCY RESPONSE AND STREET DESIGN INITIATIVE: STREET DESIGN, THE INTERNATIONAL FIRE CODE, 2012 AND BEYOND. Chicago, Ill. Congress for the New Urbanism.

Wright, L. and W. Hook. 2007. BUS RAPID TRANSIT PLANNING GUIDE. New York, N.Y. Institute for Transportation and Development Policy.