Contextually Complete Streets

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ABSTRACT

Throughout the US and worldwide, great places can be defined as attractive, active, open, walkable, entertaining and full of people. Key elements of a great place include great streets which have a "place" function. Great streets are accessible, livable, safe, comfortable, and interactive. Streets shape the character and function of a community and livable streets are walkable, safe, and improve health and quality of life. As practitioners, we need to pursue a multi-disciplinary and integrated approach to have "better than before" outcomes. More than 120 municipalities across the US have complete streets policies. A Contextually Complete Street is a multi-modal complete street reflecting the principles of context sensitivity and sustainability. In a Contextually Complete Street, the stakeholders and context define what is meant by "complete."

This paper will describe Contextually Complete Street principles and provide examples of these complete street solutions. Examples will include streets across the US, Canada, and Australia. Common themes of Contextually Complete Streets will be explored and tools that can be used in achieving a Contextually Complete Street will be highlighted. These tools include road diets, traffic calming, transit design features, intersection design, designing for pedestrians and bicyclists, lane restrictions, and green streets. Designing for a context sensitive multi-modal transportation system results in reduced greenhouse gas emissions and less vehicle miles traveled. This paper will also provide a summary of resources and research available to practitioners.

INTRODUCTION

Great streets rarely happen by accident and require vision, discipline, and leadership to make them happen. A movement to complete the streets is growing along with Complete Streets policies being adopted by public agencies. This section will provide a summary of the complete streets movement and an overview and definition of contextually complete streets.

Complete the Streets

In the US, the National Complete Streets Coalition defines Complete Streets as: "Complete Streets are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists and bus riders of all ages and abilities are able to safely move along and across a complete street."[1] The Complete the Streets movement helps municipalities with the adoption and implementation of complete streets policies. Several municipalities across the United States have adopted Complete Streets policies as well as the following States: Caltrans (California Department of Transportation), Florida, Massachusetts, Oregon, South Carolina, Illinois, Virginia, Kentucky, and Tennessee. US Secretary of Transportation Ray LaHood issued a new policy statement in March 2010 that calls for "development of fully integrated active transportation networks" to include pedestrians and bicyclists in transportation projects, with transit riders and people of all ages and abilities. The US DOT policy encourages other transportation agencies to adopt Complete Streets policies to "create safe, attractive, sustainable, accessible, and convenient bicycling and walking networks."[2]

Definition of Contextually Complete Streets

A contextually complete street is both the outcome of a complete street plan and the process to get there. In order to achieve contextually complete streets, the principles of context sensitive solutions are applied. From Thinking Beyond the Pavement, Maryland State Highway Administration Workshop, 1998 in the US – "*Context sensitive design asks first about the purpose and need of the transportation project, and then equally addresses safety, mobility, and the preservation of scenic, aesthetic, historic, environmental, and other community values. Context sensitive design involves a collaborative, interdisciplinary approach in which citizens are part of a design team*."

Contextually complete streets are different from complete streets in that the context and stakeholders define what is meant by "Complete." In a contextually complete street, the stakeholders define the transportation modes and facilities, which vary from street to street based on project context. The application of context sensitive solutions to complete streets:

- Proactive stakeholder involvement
- Inter-disciplinary team
- Communication and collaboration
- Commitment

Figure 1 illustrates the process of applying context sensitive solutions to developing contextually complete streets.

CONTEXTUALLY COMPLETE STREETS PRINCIPLES

As defined above, the context and stakeholders define what is meant by a complete street and every project is unique. The principles follow:

- Comprehensive understanding of contexts
- Flexibility and creativity to shape transportation solutions
- Preserve and enhance community and natural environments
- Designing multi-modal streets for motorists, pedestrians, bicyclists, and transit users
- Safe, accessible, livable, convenient, comfortable
- Humanize the street; transform into a destination
- Proactive stakeholder involvement and interdisciplinary team
- Every project is unique; each requires a unique solution

There are several benefits to planning, designing and implementing Contextually Complete Streets. These benefits include:

- Public acceptance
- Humanizing the street
- Transforming to a destination
- Safety
- Revitalization
- Pedestrian activity
- Multi-modal transportation options
- Reducing greenhouse gas emissions

Figure 2 provides an illustration showing different streets in a sample transportation network and how each one is contextually unique. Each has its own function and form, and they work together to build a cohesive network of streets.

CONTEXTUALLY COMPLETE STREETS EXAMPLES

Examples of Contextually Complete Streets in the United States, Canada and Australia are described in this section including the process, context and unique design features for each of the streets. The examples include Stone Avenue (Tucson, Arizona), St. George Street (Toronto, Canada), McKenzie-Bend Highway (US 20) (Sisters, Oregon), Mooloolaba Esplanade (Sunshine Coast, Australia), 28th Street (Boulder, Colorado) and Franklin Corridor Bus Rapid Transit (Eugene, Oregon).

Stone Avenue, Tucson, Arizona, US

Stone Avenue is as a north/south urban corridor in Tucson, Arizona that was formerly functioning as an arterial. A four-mile stretch of this street was proposed to be widened to accommodate suburban commuters. The corridor had experienced deterioration, and businesses and residents sought to revitalize this street.

A group of 18 neighborhood associations collaborated with the City to define key issues and goals for the street which included accommodation of future travel without widening, reinvigoration of businesses and residences, and improved pedestrian safety. To improve traffic flow without widening, this corridor was modified by improving key intersections and geometrics, upgrading of traffic signals, reducing access points to minimize conflicts, and consolidating off-street parking.

The unique design features included:

- No widening of the street
- Addition of a center turn lane or landscape islands
- "Greening" of the corridor
- Integration of public art
- Improved pedestrian and bicycle crossings

- Prohibition of cross-traffic on side streets (right turns only)
- Installation of Toucan Crossings which are signals allowing pedestrians and bicyclists to cross but prohibit vehicular cross-traffic. Side street medians and raised islands were implemented with the Toucan Crossings.
- Installation of Pelican Crossings at median locations with the first signal allowing pedestrians to cross halfway to median and second signal allowing pedestrians to complete the crossing.

Figure 3 shows a side street (cross traffic) to Stone Avenue with right turns only for vehicles and improved bicycle and pedestrian crossings.

The Stone Avenue project has been successful with incremental improvements making a significant difference. The economic assistance and incentives from the City are spurring higher density mixed-use development. Speeds have been reduced and safety improved for all users.

St. George Street, Toronto, Canada[3]

St. George Street, a multi-modal street in the downtown Toronto core through the urban St. George campus of the University of Toronto, was put on a road diet in the 1990s. St. George Street is classified as a minor arterial road by the City of Toronto and serves vehicles, delivery trucks, bicyclists, pedestrians and even skateboarders. A high number of pedestrians use St. George Street, and continuous sidewalks on both sides of the street are provided in the pedestrian zones. The Average Daily Traffic (ADT) along St. George Street is about 7,400 vehicles with approximately 700 vehicles per hour during the peak hour. The posted speed on St. George Street is 25 mph (40 kph).

The St. George Street road diet project was completed in 1996. The project was incrementally enhanced beginning in 1993, with the most significant construction occurring in 1996. Prior to 1993, the street operated as a four-lane road during peak hours and as a two-lane road with on-street parking permitted during non-peak hours. In 1993, the number of lanes on St. George Street was reduced to two by permitting parking during all hours. Bicycle lanes, a narrow painted median, and turn lanes were provided at key intersections as part of the lane reduction project. In 1996, the St. George Street was narrowed (pavement width reduced) and curbs reconstructed. Before the project, the pavement width was wide considering the street function and surroundings. As part of the project, the pavement width was narrowed from 46 feet (14 meters) to a varying width of 31 to 40 feet (9.5 to 12.2 meters). The sidewalk area was widened to increase the pedestrian zone.

The narrowing of the pavement and widening of the sidewalk has significantly enhanced pedestrian crossing areas. The majority of the pedestrian crossings occur at uncontrolled mid-block locations that correspond to campus pedestrian routes. Alternative roadway pavement materials were used to delineate and highlight these crossing areas.

Curb extensions at specific locations in coordination with on-street parking have reduced vehicle travel speeds. By narrowing the pedestrian crossing areas, pedestrians have been encouraged to cross at specific locations with shorter crossing distances. Landscaping has been added to provide a buffer and enhanced urban environment to the road diet project. Figure 4 provides photographs of St. George Street.

The results of the road diet project on St. George Street follow:

- Improved safety with crashes reduced by 40 percent
- Improved safety for pedestrians and bicycles
- No traffic diversion (traffic volumes relatively constant with no cut-through traffic)
- Street easier to cross
- Slower speeds
- Increase in number of pedestrians and bicyclists using the street
- Landscaping improved aesthetics and provides buffer to pedestrians
- Over 80 percent of street users surveyed recommend similar road diet projects on city streets and university campuses when appropriate.

McKenzie-Bend Highway (US 20), Sisters, Oregon, US[4]

McKenzie-Bend Highway (US 20) is a highway running through the downtown core of Sisters, Oregon. This highway experiences very high seasonal traffic and periodic congestion. Prior to the improvement project, there were a significant number of parking conflicts and poor pedestrian and bicycle conditions. In addition, the highway carries significant truck traffic along with a high number of pedestrians.

Through public support, partnership, and confidence, a series of simple solutions were developed by the project team including the City of Sisters, the Oregon Department of Transportation, and key stakeholders.

Information regarding this project was obtained through the publication titled, *Main Street… when a highway runs through it: A Handbook for Oregon Communities*.

Several solutions implemented include:

- Focus on improving local circulation and parking
- Parking bays and curb extensions
- Active, temporary signing to inform drivers of alternative routes and special road conditions
- Pedestrian crossing and access improvements
- New local street connection to provide circulation options within the downtown core

Figure 5 shows photographs of US 20 through Sisters, Oregon highlighting the pedestrian crossings, curb extensions and local parking.

Mooloolaba Esplanade, Sunshine Coast, Australia

As a recreational corridor parallel to the ocean, the Mooloolaba Esplanade was experiencing increased traffic congestion and creating a barrier to shops and restaurants and access the ocean. Poor pedestrian and bicycle connections further limited access and connectivity. In addition, traffic on Mooloolaba Esplanade was creating significant traffic noise to the restaurants and shops.

The solution for Mooloolaba Esplanade was to apply a road diet to reduce the number of lanes. The street was converted from a two-way street to a one-way street with short term parking, landscaping, street lighting, islands, and bulb-outs at intersections. Figure 6 shows photographs of Mooloolaba Esplanade with the improvements.

The results of the project to Mooloolaba Esplanade follow: [5]

- Designed to fit the context and shaped by the community
- Attractive and vibrant street
- Safe and comfortable for all users
- Interaction and gathering place for pedestrians
- Retail and restaurants with outdoor seating line the street with ocean on other side

Franklin Corridor – Bus Rapid Transit, Eugene, Oregon, US[6]

The Franklin Corridor is 4 miles (6.4 kilometers) of the bus rapid transit (BRT) system in Eugene, Oregon with eight stations including major regional facilities (University of Oregon and the Sacred Heart medical center). The system which opened in January 2007 as one of ten FTA demonstration projects for BRT with first year ridership growth over the fixed route service has risen approximately 80% which exceeded the 20-year daily ridership goal. Twenty-five percent are new transit users.

Key components of the Franklin EmX corridor include signal priority, queue jumping, dedicated transit-ways, median stations, public art, and sustainable features in combination provide a state-of-the-art BRT system. The solutions focused on reducing the overall footprint of the BRT transit way. Additionally trees older than 50-years, classified as heritage trees by the City of Eugene, needed to be protected. By City ordinance, these trees could not be damaged or removed without a public vote.

Development of the design included investigation of the true functional minimums of lane widths on both tangent and curved transit ways, vehicle approach and departure angles from stations to assure adequate docking for near level boarding, and reversing curve radii at various speeds to allow for lane shifts across intersections and to thread the transit way through restrictive portions of the corridor. These minimums were tested through a combination of computer modeling, customized with BRT vehicles and field testing of the designed configuration to validate the model results.

The designed transit ways incorporated key innovations which include:

- Bi-Directional Lanes (shown in Figure 7) - Implementation was critical to the success of the project using a block control concept and detection system of loops and onboard transponders.

- Tree Protection – Use of reinforced grade beams for vehicle support to distribute live loads and minimize the compaction of the subsurface soils around the deeper tree root system.

- Integrated Water Quality - For portions of the corridor with separated right-of-way, the design integrated water quality strips between track like ribbons of concrete. The concept of the water quality strip provided water quality treatment before stormwater flow is concentrated. The filter was designed using a sand filter design concept.

The Franklin corridor included a range of operational concepts in addition to the bi-directional transit-ways that ranged from on-street transit lanes to mixed traffic operations.

CONTEXTUALLY COMPLETE STREETS TOOLS

Tools that can be used in achieving a Contextually Complete Street include road diets, traffic calming, intersection design, designing for pedestrians and bicyclists, transit design features, lane restrictions, and green street options. Designing for a context sensitive multi-modal transportation system results in reduced greenhouse gas emissions and less vehicle miles traveled.

Road Diets

A road diet entails removing travel lanes from a roadway and utilizing the space for other uses and travel modes such as bike lanes, on-street parking, transit, wider sidewalks, and landscaping. The technique is commonly used to convert four-lane undivided roadways into streets with two travel lanes and a center turn lane or raised median. Improvements have generated benefits to users of all modes of transportation, including transit riders, bicyclists, pedestrians and motorists. The resulting benefits include reduced vehicle speeds; improved mobility and access; reduced collisions and injuries; and improved livability and quality of life.

The Road Diet Handbook: Setting Trends for Livable Streets authored by Jennifer Rosales, Parsons Brinckerhoff is a comprehensive guide for practitioners on the decision-making of the applicability of road diets. The *Road Diet Handbook* takes a practitioner through planning, analysis, design, and implementation of road diet projects. It includes guidelines for identifying and evaluating potential road diet sites, design concepts such as typical cross-sections, and lessons learned from experiences. The handbook assesses livability benefits for case studies around the world including improved mobility for all modes of transportation and enhanced street character, and provides overall guidelines for the implementation of road diets.

For cost-effectiveness and natural resource conservation, road diet projects can be designed and constructed by simply re-striping the roadway and re-using the existing pavement width and curbs. It is important to recognize that every project is unique. Design solutions for road diet project alternatives need to:

- Provide a safe and efficient transportation corridor for vehicles, buses, bicycles and pedestrians.
- Balance the needs of the transportation system with the interests of the surrounding community and the environment
- Create a transportation facility that is an asset to the community

The road diet design concept of the conversion of a four-lane undivided roadway to a two-lane roadway is shown in Figure 8. A center turn lane is recommended when driveways are present, and a landscaped center median in areas where driveways are uncommon or absent. The remaining roadway width can be converted to bike lanes, on-street parking, landscaping, sidewalks, and/or revert to the adjacent property owners.

Traffic Calming

The ITE *Traffic Calming State of the Practice*[7] provides traffic calming options that can be considered. Traffic calming measures include:

- Narrow streets
- Pavement texturing/coloring
- Curb extensions
- Medians
- Landscaping
- Street trees
- On-street parking
- Chicanes
- Chokers
- Raised crosswalks
- Raised intersections
- Diagonal diverters
- Selective enforcement

In addition to the above traffic calming examples, roundabouts can be used for intersection traffic control to both slow traffic speeds and keep traffic moving. The FHWA *Roundabouts: An Information Guide*[8] is an important resource to use when considering the implementation of a roundabout.

Designing for Pedestrians[9]

Streets have multiple uses and appropriate solutions should be selected to improve pedestrian safety and access. In addition, walkable streets promote healthy communities and safe neighborhoods. Sidewalks are important elements of street design.

Key attributes of good sidewalk corridors are:[10]

- Accessibility
- Adequate travel width
- Safety
- Continuity
- Landscaping
- Social space for people to interact
- Quality of place to strengthen the character of neighborhoods and business districts

When designing for pedestrians, the following are key issues/actions to be addressed and/or undertaken:

- Identification of pedestrian crossing locations and exposure to potential hazards
- Identification of missing sidewalks or pathways
- Identification of transit zones and stop locations and provision of adequate pedestrian access.
- Both pedestrian and bicycle facilities need to be designed to be compatible with and facilitate transit use.
- Design and maintenance of landscaping to provide good visibility between pedestrians and approaching vehicles.
- Provision of adequate lighting for pedestrian safety at night.
- Comfortable sidewalks for pedestrians, with a minimum width of 5 feet, and maintained routinely.

Other sources for effective design of pedestrian facilities include: ITE's *Alternative Treatments for At-Grade Pedestrian Crossings*[11], *Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations* published by FHWA[12], ITE's *Design and Safety of Pedestrian Facilities*[13], and AASHTO's *Guide for Planning, Design and Operation of Pedestrian Facilities*[14]. Pedestrian facilities need to be accessible to all users, and in the U.S. meet the requirements of the Americans with Disabilities Act (ADA), and an additional resource is the United States Access Board's *Draft Guidelines for Accessible Public Rights-of-Way*[15].

To reduce the effective street crossing distance for pedestrians, the following design options can be considered:

- Narrow the street width,
- Provide curb extensions (Figure 9), and/or
- Add raised pedestrian refuge islands at intersections.

Pedestrian refuge islands as raised medians can be added at intersections between center left turn lanes, if designed appropriately.

Designing for Bicyclists[16]

Bicycle travel is an important element of multimodal, livable streets. Bike lanes not only improve the bicycling environment, but also provide a buffer to pedestrians. In addition, bike lanes allow space for vehicles to temporarily stop while emergency vehicles pass, add to turning radii, and improve sight lines. Important sources for bicycle facility design and treatments are the *AASHTO Guide for the Development of Bicycle Facilities*[17], *ITE Innovative Bicycle Treatments*[18], and the *MUTCD*[19].

Bicycle facilities include:

- Bicycle lanes (Figure 10)
- Multi-use paths
- Shared facilities such as wider curb travel lanes
- Bicycle Racks

General considerations for bicycle facilities are:

- Smooth surfaces are needed for safety and comfort of bicyclists.
- Regular maintenance and street sweeping are required and pavement should be free of large cracks and potholes.
- Curb inlets for drainage or bicycle-safe inlet grates should be provided.
- Provide bicycle storage racks.

Designing for Transit

Transit-friendly streets need to address all of the functions of a street, including adequate space for pedestrians. Every street is unique, and thus requires a different solution. The right balance is required, since some transit modes may have the tendency to overwhelm other street activities. The integration of various modes at intersections is important, particularly at busy downtown intersections with substantial pedestrian traffic. In the photo shown in Figure 11, a Denver Regional Transportation District (RTD) light rail line intersects with the 16th Street Mall Shuttle in the center of downtown Denver. Safety and visibility are key factors to maintaining separation of modes and efficient travel movements.

There are many examples of the successful integration of transit with streets. The Melbourne Tram system, the most extensive of its kind in the world, runs in a loop through downtown in the center of the street. Pedestrians access the Tram stations via crosswalks that link them to stations in the center. The streets with bidirectional traffic flow maintain wide sidewalks for pedestrians. Figure 11 shows streets designed for transit and transit users.

On-Street Parking[20]

On-street parking provides a buffer to pedestrians from traffic and is found to decrease traffic speeds. In addition, on-street parking meets the needs of adjacent land uses and stimulates street activity. On-street parking should be implemented based on project context, traffic volume and speed, adjacent land uses, and local parking management plans and policies.

General considerations for on-street parking are:[21]

- Parallel parking should be considered on urban arterials and collectors.
- Angled parking may be considered on low-speed and low-volume commercial collectors and main streets.
- On-street parking should not be considered on major streets with speeds greater than 35 miles per hour due to potential maneuvering conflicts.
- Consider the use of a curb lane for on-street parking during off-peak hours when traffic capacity needs to be balanced with on-street parking needs.

Lane Restrictions

Lane restrictions are one tool available to improve the function of different modes together along one corridor. Lane restrictions may isolate modes, such as bus lanes, from free flowing traffic to improve the operational capacity and efficiency of travel.

The intent of implementing lane restrictions is to improve the operations of each travel mode while maintaining a safe environment for all street users. Bicyclists may be separated from vehicular traffic through colored bicycle lanes, or trucks may be restricted to certain lanes. Lane restrictions should be implemented in the context of the street, based on existing and future traffic volumes, bicycle and pedestrian traffic and transit mode share. Enforcement and signage are important elements to lane restrictions.

Examples of implementing lane restrictions include:

- Trucks right lane
- Left lane 10' wide
- Transit only lanes (shown in Figure 12)
- Paint lane lines narrower than actual width
- Wide lane lines encroaching on the lane
- Colored bicycle lanes

Green Streets

A green street meets the transportation need and applies environmental stewardship to improve the natural, built and social environments. As identified in Metro's (regional government agency for Portland Metro, Oregon, U.S.) *Green Streets Handbook*[22], the appropriate green streets design solutions and/or combination of solutions depends on the desired functions (e.g., runoff reduction, detention, retention, conveyance and water quality mitigation) and site/watershed conditions.

CONTEXTUALLY COMPLETE STREETS RESOURCES

- www.completestreets.org
- *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities*, An ITE Proposed Recommended Practice

- *Road Diet Handbook: Setting Trends for Livable Streets*, Jennifer Rosales
- *NCHRP 480: "A Guide to Best Practices for Achieving Context Sensitive Solutions*," Transportation Research Board
- Innovative Bicycle Treatments: An Information Report, Institute of Transportation Engineers.
- *Alternative Treatments for At-Grade Pedestrian Crossings, Informational Report*, Institute of Transportation Engineers
- *Traffic Calming State of the Practice*, Institute of Transportation Engineers
- *Creating Livable Streets, Street Design Guidelines for 2040*, METRO, Oregon
- *Roundabouts: An Informational Guide*, Federal Highway Administration
- *Livable Streets*, Donald Appleyard
- *Great Streets*, Allan B. Jacobs

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[22] *Green Streets, Innovative Solutions for Stormwater and Stream Crossings*, METRO, June 2002.

LIST OF FIGURES

FIGURE 1 Proactive Stakeholder Involvement and Interdisciplinary Team to Develop Contextually Complete Streets

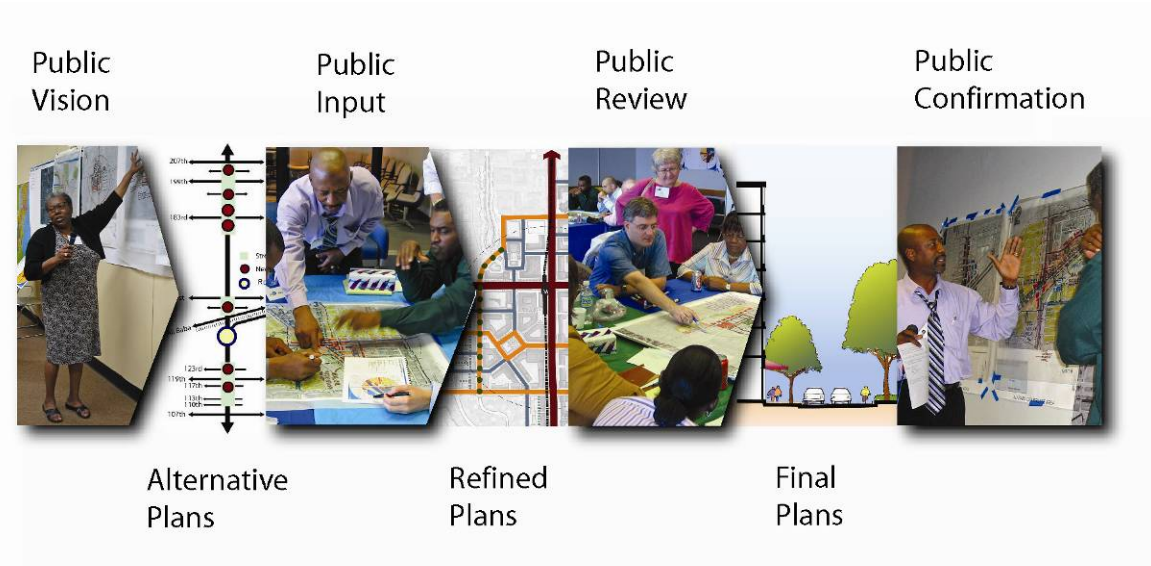

FIGURE 2 Context and Stakeholders Define "Complete"

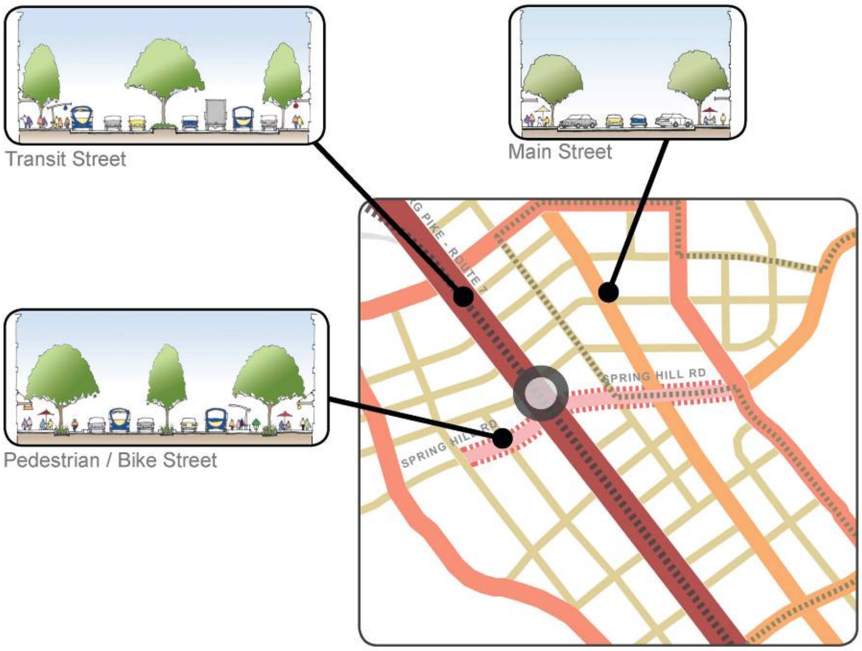

FIGURE 3 Side Street Approach to Stone Avenue, Arizona, US

FIGURE 4 St. George Street, Toronto, Canada

Photos courtesy of Jennifer Rosales

FIGURE 5 US 20 through Sisters, Oregon, US

Photos courtesy of Matthew Sucher, PB

FIGURE 6 Mooloolaba Esplanade, Sunshine Coast, Australia

Photos courtesy of Steven Burgess, PB

FIGURE 7: Bi-Directional Transit Lane

FIGURE 8 Road Diet Illustration (Before and After)

BEFORE **AFTER**

Photos courtesy of Todd Boulanger, City of Vancouver, Washington

FIGURE 9: Curb Extension

Photo courtesy of Jennifer Rosales

FIGURE 10 Bicycle Lane in Portland, Oregon, US

Photo courtesy of Jim Hencke, PB

FIGURE 11 Transit Streets in Melbourne, Australia and Denver, Colorado, US

Photos courtesy of Jennifer Rosales and Lindsey Sousa, PB respectively

FIGURE 12: Transit Only Lanes with Shared Bicycles

FIGURE 13 Green Street with Bio-Filtering Stormwater Planter/Bio-Swale and Unit Pavers

Photos courtesy of Jennifer Rosales, PB