COMPLETE STREETS IN THE UNITED STATES

AUTHORS:

John N. LaPlante, PE, PTOE
Director of Traffic Engineering
T.Y. Lin International, Inc.
200 S. Wacker Drive, Suite 1400
Chicago, IL 60606
Phone: 312.777.2887
Email: jlaplante@tylin.com

Barbara McCann
Executive Director
National Complete Streets Coalition
1707 L Street NW, Suite 1050
Washington, DC
Phone: 202.234.2745
Email: bmccann@completestreets.org

ABSTRACT

Complete Street policies help make streets safe and comfortable for all users – motorists, bicyclists and pedestrians, including children, disabled and older persons and public transportation patrons. Other benefits of Complete Streets are that they promote healthy and active lifestyles and provide alternatives to driving, thus addresses climate change and reducing dependence on foreign oil. Such policies have already been adopted by more than 175 public agencies and 39 states throughout the United States, and legislation has been introduced in the US Congress to ensure that new federally-funded road projects must also take the needs of multiple users into account. This paper discusses the growth of the Complete Streets movement and its role in road design and planning processes, particularly in relation to Context Sensitive Solutions.

We will then go on to describe how the geometric design of our urban arterials and collector streets can provide more room for nonmotorized travelers, make street crossings easier for pedestrians, and help to control traffic speeds, thus reducing pedestrian, bicycle and automobile crashes. Finally, we will show how this can be done within existing rights-of-way and within tight maintenance and construction budgets, thus making better use of taxpayer dollars. A discussion of cost considerations will conclude this paper.

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by John LaPlante, PE, PTOE and Barbara McCann

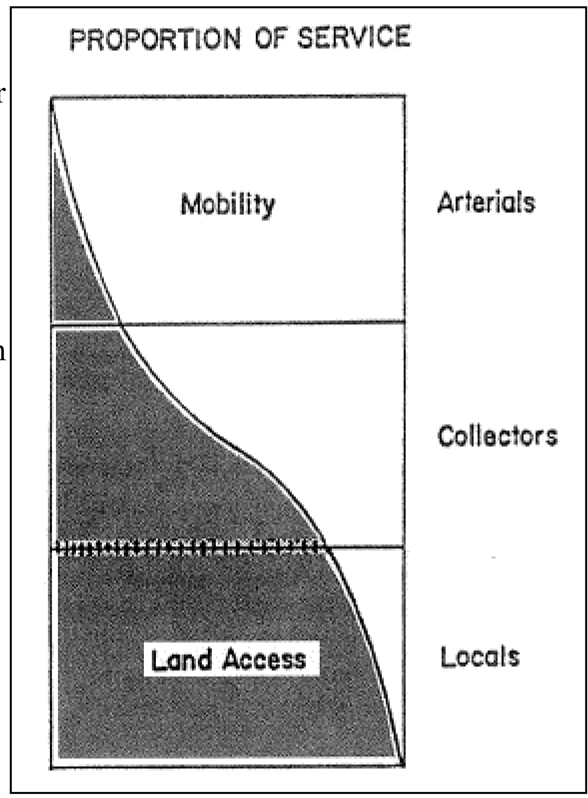
INTRODUCTION

A complete street is a road that is designed to be safe for drivers, bicyclists, transit vehicles and users, and pedestrians of all ages and abilities. However, the complete streets concept focuses not on individual roads but on changing the decision-making and design process so that all users are routinely considered during the planning, designing, building and operating of all roadways. It is about policy and institutional change.

This may seem simple enough. Over the last 30 years or so, a lot of planning and engineering energy has gone into learning to create beautiful streets that work well for everyone. In the United States, although the standards from the AASHTO *Policy on Geometric Design of Highways and Streets* ***(1)*** have been changed to reflect a multimodal approach, many transportation agencies continue to build most roads as if private motor vehicles and freight are the only users. Too many urban arterials still feature a well engineered place for cars to travel, next to a 'home-made' pedestrian facility – a 'goat track' tramped in the grass – with a bus stop that is no more than a pole in the ground uncomfortably close to high-speed traffic.

This stems in large part from entrenched planning and design practices. Transportation projects typically have begun with an automobile-oriented problem – increasing average daily traffic (ADT) or a deteriorating Level of Service (LOS). The performance of the right-of-way for bicyclists, pedestrians, and transit riders or vehicles often has not been measured. Roadway classification has similarly been oriented toward auto-mobility.

FIGURE 1: Proportion of Service *(1)*



Thus, city streets are being designated as arterials, collectors or locals depending on their place in that area's functional classification system. Those streets designated as arterials are by definition intended to primarily provide mobility, with emphasis placed on operating speed and traffic carrying capacity (see Figure 1). This has led to other design requirements that stress access management, wider lane widths, increased turning radii, and minimum interference with traffic movements.

However, these mobility standards seldom include references to pedestrian or bicycle accommodations, transit routes, or other community impacts. This has often led to highways dividing neighborhoods and destroying local businesses in older established communities, and creating sterile, inhospitable wastelands in developing suburbs.

CONTEXT SENSITIVE SOLUTIONS

As a reaction to this unhealthy trend, Context Sensitive

Solutions and the Complete Streets movement have sprung up, and many professional organizations are working to create and adopt a new arterial street design paradigm for our urban areas. Along these lines, the Institute of Transportation Engineers (ITE), in conjunction with the Congress for New Urbanism and FHWA, has developed a new Recommended Practice entitled *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach*.***(2)***

How do Complete Streets initiatives relate to CSS? Context Sensitive Solutions is a process that began within the transportation profession, and was initially project-oriented and location-specific, aimed at making sure a road project fit into its external context, both environmental and societal. Early projects tended to be large roadway improvements and featured extensive public meetings and stakeholder outreach and plenty of extra work. More recently, CSS practitioners recognize that this process can be streamlined so it can be applied to every project, and early public involvement does not necessarily lead to expensive and time consuming outreach efforts.

Complete Streets expands this concept to focus on the roadway's internal context – the road users, and is about making multi-modal accommodation routine so multi-modal roads do not require extra retrofit funds or extra time to achieve. The intent is to change the everyday practice of transportation agencies so that every mode should be part of every stage of the design process in just about every road project – whether it is a minor traffic signal rehabilitation or a major road widening. The ultimate aim is to create a complete and safe transportation network for all modes.

Complete Streets policies often involve elected officials and other community leaders, as city councils or state legislatures adopt Complete Streets policies to affirm the community's commitment to creating a multi-modal transportation network. This affirmation can be important in assuring engineers that designing for all users now takes priority over a singular focus on automobile LOS, and is essential if disputes arise over projects using the new paradigm. Engineers empowered by this clear direction from their leadership often tackle the new problem of multi-modal accommodation with gusto, using problem-solving skills and trying innovative treatments.

Complete Streets policy development exercises have also helped bring planners and engineers together with community stakeholders from AARP volunteers to bicycle advocates to public health officials. In fact, the Centers for Disease Control and other public health organizations have begun recommending Complete Streets policy adoption as an important element in the fight against the obesity epidemic.

Thus CSS, which began within agencies and focuses on context, and Complete Streets, which often begins with community leaders and focuses on road users, can be seen as complementary, not competitive movements.

NATIONAL COMPLETE STREETS COALITION

The National Complete Streets Coalition has been working for five years to promote policy and procedural changes at the federal, state, and local level. The Coalition includes both practitioners, such as ITE and the American Planning Association, user groups such as the American Public Transportation Association, AARP, and America Bikes, and groups interested in public health and other benefits of Complete Streets. The Coalition's work has also been supported by groups representing elected officials, such as the US Conference of Mayors and the National League of Cities.

The Coalition has succeeded in gaining national media attention and policy adoption across the country. Over 125 jurisdictions, from states down to small towns, have adopted some type of complete streets policy, most over the last few years. In 2009, state legislatures passed policies in Hawaii and Connecticut, the governor signed an Executive Order in Delaware, and the Transportation Commission in North Carolina adopted a resolution directing the agency to begin using Complete Streets principles in all projects. Most of the policies have been adopted by cities, from the small town of Albert Lea, Minnesota, to the Sunbelt metropolis of Scottsdale, Arizona, or Cook County in the heart of Chicagoland. Forty-two policies were adopted in 2009, following adoption of 25 policies enacted the previous year. This rapid acceleration demonstrates the thirst for complete, livable streets in communities across the United States. They are following in the steps of 'early adopters' of the Complete Streets approach, including the states of Oregon and Florida, and the cities of Arlington, Virginia, and Boulder, Colorado. Thirty-eight states are now home to at least one Complete Streets policy.

At the federal level, bills have been introduced in both the House and Senate to require states and Metropolitan Planning Organizations to adopt Complete Streets policies, and to require Complete Streets planning for federal road investments.

A new complete streets policy adopted by a legislature or city council may make some engineers nervous. But if well written, the impact should be gradual and reasonable. These policies are not prescriptive; Complete streets will look different in different places. They must be appropriate to their context and to the modes expected on that corridor. Often the initial policy sets a broad vision and agency staff are directed to create more specific implementation documents.

A bustling street in an urban area may include features for buses, bicycles, and pedestrians as well as private cars, while in a more rural area with some walkers a paved shoulder may suffice, and low-traffic streets need few treatments. Places with existing complete streets policies are successfully building all types of roads that meet the varied needs of children, commuters, and other users while creating an overall network that serves all the modes.

IMPLEMENTATION CHALLENGES

In order for Complete Streets to be truly effective, the following four implementation measures should be considered:

- Rewrite and/or refocus agency policies and procedures to serve all modes
- Rewrite and/or adapt design guidelines
- Train and develop staff skills in serving all modes and in policy implementation

- Collect base data on all users and modes for more meaningful before-and-after performance measurements

The policy change should result in an institutionalization of the complete streets approach in all aspects of the transportation agency and beyond, and often that means a restructuring of everyday procedures, beginning with scoping. Most communities with Complete Streets policies have found that significant cost savings can be achieved through early scoping. For example, in Charlotte, North Carolina, transportation planners use a six-step complete streets early planning process that systematically evaluates the needs of all modes ***(3)*** for each project. Other communities have established new project checklists, instituted cross-departmental scoping meetings, or created new selection criteria and exceptions procedures. Effective implementation also reaches beyond the transportation agency to include closer coordination with the local transit agency, as well as changes to zoning codes and development review standards, so that private developers are also creating Complete Streets. The American Planning Association has just published a Complete Streets Best Practices Manual, and the National Complete Streets Coalition offers a Local Implementation Assistance Program to help jurisdictions with this task.

An effective policy often leads to the re-writing of design manuals. One of the best examples of this in the country is in Massachusetts. A complete streets policy statement became one of three guiding principles for their award-winning Project Development and Design Guide – context-sensitivity is another. The new manual has no chapters for bicycling, walking, transit, or disabled users – every mode is integrated into every chapter, with new tools to help engineers make decisions about balancing the modes. ***(4)*** Other communities with notable new design manuals are Louisville, Kentucky and New York City.

The third of the four implementation steps is the need for additional training for planners and engineers. Balancing the needs of all users is a challenge, and doing so with every project requires new tools and skills. Many of those tools are less about meeting specific design challenges and more about how to make decisions prioritizing different modes. Some jurisdictions, such as Columbus, Ohio, have launched training programs that are aimed at helping planners and engineers use new checklists, scoping procedures, and other tools for making appropriate multi-modal decisions.

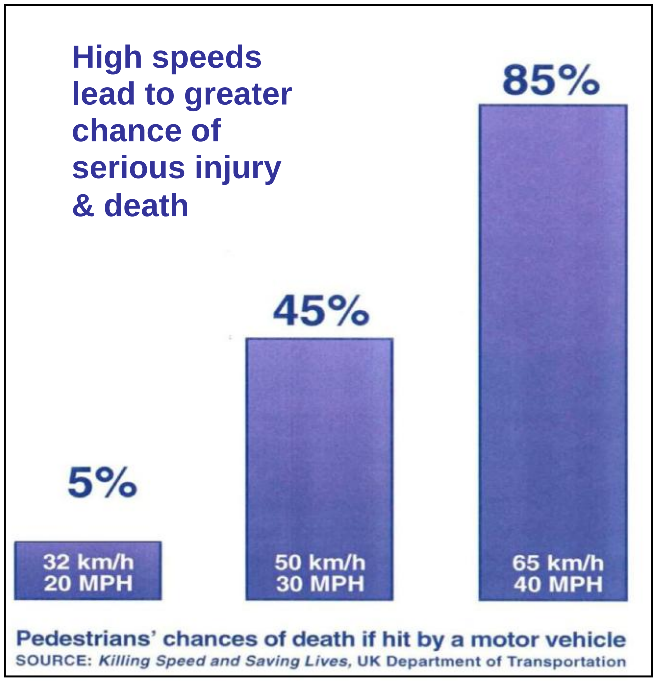
Complete streets policies should also result in new ways to measure the success of the road network in serving all users. New performance measures can make a big difference in project selection; if selection criteria have not been broadened beyond automobile LOS, implementation will often stall. The state of Florida, Ft. Collins, Colorado and other jurisdictions have adopted multi-modal Level of Service standards; other places have created a variety of qualitative and quantitative measures to do just that. New performance measures can also help build public support for innovations, as in Redmond Washington, where an annual Mobility Report Card is aimed at the general public.

SPEED MATTERS

Complete Streets is about more than simple allocation of street space. One of the major components of this new design paradigm is selecting a design speed that is appropriate to the actual street typology and location, and one that allows safe movement by all road users, including more vulnerable pedestrians and bicyclists. From a safety and community livability standpoint, speed does matter.

Everyone should be familiar by now with the chart that shows that a pedestrian being hit by a car traveling at 32 kilometers per hour (km/hr) (20 miles per hour [mph]) has a 95% survivability rate, whereas that same collision with a car going twice as fast, 65 km/hr (40 mph), will lower the survivability likelihood to only 15%. (See Figure 2.)

FIGURE 2: Vehicle Speed versus Injury and Death *(5)*



This disparity in survivability rate becomes even more important when combined with actual vehicle stopping characteristics. For example, a child darting out 45 meters (150 feet) in front of a car traveling 40 km/hr (25 mph) gives the motorist 2.5 seconds to react and apply the brakes, during which time the vehicle will travel 30 meters (100 feet), leaving 15 meters (50 feet) in which to stop. Even under wet pavement conditions, a car can stop in 12 meters (40 feet) at 40 km/hr (25 mph), and the child is scared but unhurt. In this same scenario, if the car is traveling 60 km/hr (38 mph), the 2.5 second perception-reaction time will take up 42 meters (140 feet), leaving only 3 meters (10 feet) of stopping distance and a resulting vehicle-pedestrian collision speed of 58 km/hr (36 mph) and less than a 20% chance that the child will survive the crash.

In the United States, current practice is to use a design speed based on a somewhat arbitrary functional classification that does not relate to the community through which it passes, and then post a speed limit based on the 85^{th} percentile of speeds engendered by this artificial street designation. This practice is based on the conventional wisdom that in order to maintain mobility to and through our communities, some arterial streets have to be designated as major traffic carriers, or else the entire regional economy will grind to a halt. And travel speed has always been equated as a necessary component of this mobility.

DEFINING MOBILITY

However, given the stopping distance and injury severity data described previously, it appears that speeds over 50 km/hr (30 mph) in urban areas are incompatible with pedestrians (including transit patrons) and bicyclists. Does this mean that our only choice is to sacrifice mobility to achieve safe and livable communities? The answer to this question depends on how we define mobility. The most important aspect of mobility is overall travel speed, or more accurately, total travel time.

For an 8 km (5-mile) trip along an arterial corridor with a 70 km/hr (45 mph) travel speed, the added travel time for a reduced speed of 50 km/hr (30 mph) would be 3.3 minutes. In the overall scheme of things, how important is this potential delay compared to the proven safety benefits and the city livability advantages that come with the slower traffic speeds? Some will quote the standard benefit-cost travel time delay litany that is broadly publicized in the United States, which allocates an hourly wage to this delay. This means these 3.3 minutes of delay are multiplied by an Average Daily Traffic (ADT) of 30,000 vehicles times 365 days per year times $20/hour in time costs equaling over $12 million in lost wages to the economy. However, in reality the loss is still slightly over 3 minutes per individual for this one trip, for which they are probably not being paid, and which is less than the time they will willingly spend in line getting their morning coffee.

Take this scenario one step further, to the all-too common suburban arterial traffic experience of driving 70 km/hr (45 mph), stopping for up to 2 minutes at a traffic signal, accelerating back up to 70 km/hr (45 mph), only to stop and wait again 0.8 km (one half mile) down the road. This uncoordinated signal system wastes time and fuel and the many stops increase crash rates. If we can coordinate these signals to permit two-way (or at least peak direction) progression at a constant speed of 40 or 50 km/hr (25 or 30 mph), the total travel time ends up being roughly the same.

The other part of the mobility equation is capacity, with the number of lanes acting as the primary surrogate measurement. It should be recognized by now that a D Level of Service (LOS) is a reasonable peak period LOS in an urban area, provided the above-mentioned signal progression can be maintained. However, there some state Departments of Transportation or regional planning organizations recommend a C (or even B) LOS in an urban setting whenever possible.

Not only is this a waste of tax dollars constructing unneeded pavement, it also increases pedestrian crossing distances (and thus pedestrian crossing times, which impact negatively on signal timing for vehicular traffic), and encourages faster vehicular speeds during the other 22 hours of the day in each direction.

ARTERIAL TRAFFIC TAMING MEASURES

Following are some specific design measures that may be used to retrofit urban and suburban arterials into Complete Streets. These roads present one of the biggest challenges to engineers in that they tend to be the most hostile to bicyclists, pedestrians and transit riders – but all of these modes are usually present on and crossing these roads in significant numbers.

Instead of the concept of "traffic calming" that is used in discussing the design of residential streets, it is suggested that the term "traffic taming" be used to describe the concept of making our arterial streets more pedestrian, bicycle and community friendly. This compilation of suggestions for retrofitting arterial streets into Complete Streets is not meant to be all-inclusive. Many more solutions are available to us once we take seriously the task of designing our arterial roadways for community livability, while retaining a reasonable level of mobility along our most important travel corridors.

Arterial traffic taming must first deal with controlling vehicular speeds. In addition to timing the traffic signals for a 40 or 50 km/hr (25 or 30 mph) operating speed, other possible speed control measures include:

- Narrower travel lanes – Based on the results of a recent NCHRP study, 3.3 m (11-foot) or even 3.0 m (10-foot) lanes in urban areas are just as safe as 3.6 m (12-foot) lanes for posted speeds of 70 km/hr (45 mph) or less. *(6)*
- Road diets – A 4-lane to 3-lane road diet can work for ADTs as much as 20,000. This makes the more prudent driver the "pace" car for that roadway and greatly improves left turning safety.
- Tightening corner curb radii – Selecting the appropriate design vehicle and using the minimum needed to provide the "effective" turning radius from the closest approach lane into any lane in the departure roadway will slow down turning vehicle speeds.
- Elimination of any free-flow right turn lanes – This specifically includes freeway entry and exit ramp connections. Encouraging freeway speeds on to or off of arterial streets is particularly dangerous for both pedestrians and bicyclists.
- Raised medians – Raised medians visually narrow the roadway and provide a median refuge for midblock crossings.
- Median and parkway landscaping – Appropriate low maintenance landscaping further visually narrows the roadway and provides a calming effect.
- Curb parking – Retaining curb parking provides for business viability and direct community access, while creating a significant traffic calming effect.
- Curb bulb-outs – Where on-street parking exists, curb bulb-outs shorten pedestrian crossing distances, improve sight lines and help control parking.

PEDESTRIAN CROSSINGS

The other important element in creating a pedestrian-friendly arterial street is making the pedestrian crossing locations safe, comfortable and more frequent. On any road where there is transit service, there will be a pedestrian crossing wherever there is a transit stop, whether we provide for it or not. All bus riders need to cross the street either coming or going, assuming they intend to go back home at some point during their travels.

In a dense downtown case with signals spaced every 90 to 180 m (300 to 600 feet), crossing at a traffic signal is a reasonable expectation. However, along most urban and suburban arterials these signals are usually spaced no closer than every 0.4 km (one quarter mile). Requiring pedestrians to travel just 360 m (1,200 feet) or more out of their way to cross a street will add 5 minutes to the travel time of a pedestrian walking at the average 1.2 m/sec (4.0 feet/second) walking speed. If we were to suggest a 5-minute detour for all automobile traffic, this would be the equivalent of adding a distance of 4 km (2.5 miles) for a car traveling at 50 km/hr (30 mph), and the outrage would be loud and instantaneous.

In urbanized areas, there should be some provision for pedestrians to cross the street at almost every unsignalized intersection. At the very least, on streets with a bus route there should be some provision for pedestrians to cross the street wherever there is a bus stop.

Many of the suggested pedestrian crossing improvements flow directly out of the traffic speed control measures noted above. They include:

- Narrower travel lanes – Shorten the pedestrian crossing distance and roadway exposure time.
- Road diets – Reduce the number of lanes to be crossed.
- Tighter corner curb radii – Shorten pedestrian crossing distances and provide space for perpendicular curb ramps.
- Adding corner “pork chop” islands where design vehicle turning radii do not permit a small corner radius – Also shortens pedestrian crossing distances.
- Raised medians – Provide pedestrian refuge and allow pedestrians to cross half the street at a time.
- Curb bulb-outs – Shorten pedestrian crossing distances, improve sight lines and provide space for curb ramps.
- Continental-style crosswalks and pedestrian crossing warning signs – Effective for lightly traveled arterials posted for urban speed limits.
- Pedestrian-actuated crosswalk warning signs – For more heavy traffic flows.
- Pedestrian-actuated HAWK-style signals – Now in the new *Manual of Uniform Traffic Control Devices (MUTCD)*.
- Full signalization – All pedestrian signals should now be timed using the new MUTCD pedestrian walking speed of 1.05 m/sec (3.5 feet/second) to set the Flashing Don’t Walk pedestrian clearance time and 0.9 m/sec (3.0 feet/second) to determine the total Walk/Flashing Don’t Walk time.
- Countdown clocks – The new MUTCD not only requires countdown clocks at all new pedestrian signal installations, but there will be a 10-year compliance date for retrofitting all existing ped signal locations, finally correcting the long standing confusion surrounding the traditional but counter-intuitive Flashing Don’t Walk.

COSTS

A common fear about instituting Complete Streets policies is that a need for new facilities will raise costs beyond acceptable levels. However, a Complete Streets approach can keep costs down in a number of ways. Many agency officials interviewed for the Complete Streets Best Practices Manual said early consideration of all modes has saved them time and money; this has been a particular goal in Massachusetts, where failure to consider all modes had resulted in project delays in the past.

A hallmark of the Complete Streets process is its incremental and opportunistic approach: planners and engineers begin to search for opportunities to improve the travel environment for all users in the course of regular road rehabilitation or other projects, rather than planning a few (expensive) signature projects. Incorporating small changes during the course of regular road work, such as moving a paint stripe or realigning a crosswalk, can be a cost-effective way of making improvements that lead to a complete network. For example, Seattle and Colorado Springs, Colorado, have used planned road resurfacing to systematically institute road diets, when road conditions allow it. Some standard infrastructure projects, such as conversion from open to closed drainage, can be enhanced with Complete Streets facilities (i.e. sidewalks) for negligible additional cost. Changing signal timing at an intersection to a 1.05 m/sec (3.5 ft/sec) walking speed adds nothing to the cost of a signal, and adding countdown clocks can be done for as little as $2,000 per intersection. Adding curb bulbs where on-street parking occurs reduces the time for pedestrians to cross the street, allowing more time for automobile movement; this can be a relatively low cost way to improve both pedestrian and automobile access.

Many communities have found that improvements to the bicycle, pedestrian or public transportation environment make up a small part of overall project costs. On a project-by-project basis, any additional money spent is actually a long-term investment in the financial and physical health of the community. And when improvements are far beyond the scope of the originally planned project, elements needed to 'complete' the street can be added to a list for future projects.

CONCLUSION

In the United States, Complete Streets is both evolutionary and revolutionary. A growing awareness of other transportation modes has led to a trend toward accommodating a wider variety of users, and Complete Streets is simply the latest evolutionary step in this process. At the same time, stepping beyond how design is typically done today by greatly increasing travel options, flexibility, usability, we can create a revolutionary new network of travel for all modes.

Largely through the work of the transportation industry, the United States has succeeded brilliantly over the last century in building better roads for farmers, for national security, and for economic growth. It is now time to achieve the same success in the challenge of completing United States streets for everyone.

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