Enhancing Streets and Lives; North Carolina's Move to Complete Streets, A Review

By

Carson K. Dellinger

Submitted to the Graduate Faculty of North Carolina State University in partial fulfillment of the requirements for the Degree of Master of Environmental Assessment

Raleigh, North Carolina

2017

Approved by advisory committee:

Dr. Gary Blank, Chair
Ms. Linda R. Taylor

December 14, 2017
ABSTRACT

Complete Streets are a concept of roadway design that includes elements and features that provide for the safe and convenient passage of all people and modes of transportation. It is well documented that Complete Streets reduce traffic accidents, contribute to community health and safety, increase real estate values, and increase bicycle and pedestrian use of roadways. For these reasons, many cities and states in the USA have adopted Complete Streets policies, including the State of North Carolina (NC). This study aims to understand the impact of NC’s adoption of the Complete Streets policy on roadways across the state by reviewing active State roadway projects since the adoption of the policy. A sample of NC Department of Transportation (NC DOT) project plans of a specific type were reviewed for the inclusion of Complete Street design elements. Over 30 percent of the reviewed NC DOT projects included design elements of Complete Streets, with sidewalks being the most common of the design elements. Local government participation may be the impetus for the inclusion of Complete Streets design elements in roadway projects.

ACKNOWLEDGEMENTS
My appreciation goes out to Dr. Gary Blank of NCSU for his advice and patience over the course of this project, and to Jason Moore, PE of the NC DOT for his assistance and advice in accessing and reviewing the data.
Appendix A: Terms for Submission of non-thesis masters papers to the NCSU Digital Repository:

- You are the copyright holder of the submission and/or you have the authority to grant the rights contained in this license. You also represent that your submission does not, to the best of your knowledge, infringe upon anyone's copyright.
- You grant to the NCSU Libraries a non-exclusive, perpetual license to deposit the work (your submission) in the NCSU Digital Repository, a non-commercial, openly available collection of institutional scholarly research.
- Furthermore, you grant to the NCSU Libraries the right, without changing the content, to migrate one or more copies of the submission to any medium or format for backup and preservation purposes.
Enhancing Streets and Lives: North Carolina’s Move to Complete Streets, A Review

By Carson Dellinger

Abstract

Complete Streets are a concept of roadway design that includes elements and features which provide for the safe and convenient passage of all people and modes of transportation. It is well documented that Complete Streets reduce traffic accidents, contribute to community health and safety, increase real estate values, and increase bicycle and pedestrian use of roadways. For these reasons, many cities and states in the USA have adopted Complete Streets policies, including the State of North Carolina (NC). This study aims to understand the impact of NC’s adoption of the Complete Streets policy on roadways across the state by reviewing active State roadway projects since the adoption of the policy. A sample of NC Department of Transportation (NC DOT) project plans of a specific type were reviewed for the inclusion of Complete Street design elements. Over 30 percent of the reviewed NC DOT projects included design elements of Complete Streets, with sidewalks being the most common of the design elements. Local government participation may be the impetus for the inclusion of Complete Streets design elements in roadway projects.

Introduction

In 2009, the North Carolina Board of Transportation adopted the Complete Streets policy, meaning that the NC Department of Transportation (NC DOT) would “consider and incorporate all modes of transportation when building new projects or making improvements to existing infrastructure” (NCDOT, 2012). Eight years later, we ask what effect adopting this policy has had on transit infrastructure. Considering good reasons for such a policy but practical matters to address during implementation, we might anticipate mixed results. This paper explains the concept and examines the policy impact in North Carolina.
In 2015, over 1,000 people in the USA died in bicycle traffic accidents; there were over 450,000 additional accidents reported. The same year, over 5,000 pedestrians were killed in traffic accidents, and over 120,000 were treated by medical professionals (CDC, Motor Vehicle Safety). Accidents such as these make the Center for Disease Control and Prevention’s (CDC) top ten leading causes of death in the USA.

Among the other common causes of mortality is illness related to obesity. The CDC calls obesity a national epidemic, with more than 72 million adults suffering with the condition. In most places of the USA, more than 20 percent of the population are obese. In the South, including North Carolina, 30-35 percent of the population is obese. Medical care for obesity related illness in the USA in 2009, was almost $150 billion (CDC, 2010). In addition to a balanced diet, the obvious treatment for obesity is adequate physical activity. However, currently less than half of Americans get enough physical activity to improve their health (CDC, 2012). Though the reasons for the lack of physical activity vary per individual, those without access to places like sidewalks and walk paths are less likely to be as physical as their peers and more likely to be overweight (Veugelers, et al., 2008; and Grow, et al. 2008) In fact, communities with access to parks, sidewalks, community centers, and walk paths are more likely to be physically active and to rate themselves as having a higher quality of life (Centers for Disease Control and Prevention, 2011; Dodson, et al. 2014; Lee and Sener, 2016). Physically active youth are also inclined make other healthy lifestyle choices (CDC, 1997). In 2012, only 30-49 percent of youths in NC reportedly had access to parks, playgrounds, sidewalks, or walking paths in their neighborhoods (CDC, 2012), leaving many kids without convenient and safe outlets for activity.

Beyond making streets safer for users (Elvik, 2009), it is suggested that pedestrian and bicycle-friendly design elements promote economic growth in communities (Anderson, et al., 2015; Riggs and Gilderbloom, 2015; Shay, et al. 2016). Often negatively affected by automobile-focused roadways are those in lower-income situations. The American Automobile Association (AAA) estimates that owning a vehicle in the US and driving 15,000 miles costs an average of approximately $9,000 per year (AAA Carolinas, 2016). Low-income communities with residents less likely to have access to personal vehicles are
often found in areas serviced by high-speed roadways with limited safe routes for active travel. That limited travel can substantially impede mobility, thus affecting lower-income population’s access to healthcare and employment (Shay, et al. 2016). Besides providing opportunities for mobility, multi-modal roadways improve the value of neighborhoods. One study of remodeled street in Louisville, Kentucky found that converting two multi-lane one-way streets to single-lane two-way streets with bike lanes reduced the number of accidents, improved area property values, and aided in reducing the volume of crime on the streets (Riggs and Gilderbloom, 2015). Cost saving, when considered for safety aspects, found that $18.1 million in collision costs were averted on Complete Streets in one year; savings from injuries prevented from avoided accidents weighed heavily in the analysis (Anderson, et al., 2015). Costs include the initial cost for the project design and execution, but also include long-range costs or cost-savings to the community. A cost analysis of design implementation in Charlotte, NC found that there was a slight increase in costs compared to that of “incomplete street” design, but also attributed the increase to market fluctuations in construction (Shapard and Cole, 2013).

Bicycling and walking in lieu of using motorized transportation also has environmental benefits (CDC, 2011; McCann, 2011). Reducing motorized traffic effectively improves human air quality, reduces greenhouse gases, and reduces noise pollution (World Health Organization).

The need for safe means of pedestrian and bicycle transportation and recreation has prompted the US Government to launch the “Safer People, Safer Streets: Pedestrian and Bicycle Safety Initiative” which, among other aims, promotes the expansion and improvement of bicycle and pedestrian infrastructure. One policy that specifically supports pedestrian and bicycle safety is “Complete Streets.” Complete Streets is a policy which lends a new look at the way streets are designed: in addition to accommodating motor vehicles, roadway design also includes accommodations for pedestrians, bicyclists, transit users, and green spaces in a multi-modal design approach (McCann, 2011). The design elements associated with Complete Streets include sidewalks, bicycle lanes, transit stops, appropriate lane widths, appropriate speed limits, and integration with surrounding land-uses (Complete Streets NC, 2016). The Complete Streets design elements (CSDE) concept
originated largely in response to the danger from motorists to pedestrians and bicyclists on roadways.

Research shows that the CSDE improve the safety of roadways. Bicycle and pedestrian traffic accidents occur more often in urban areas or in non-intersection locations (National Highway Traffic Safety Administration. Traffic Safety 2015). By increasing the visibility of cyclists and pedestrians, drivers can be reminded of their presence. Additionally, the “safety in numbers” rule comes into play: more pedestrians and cyclists in an area tend to make walking and cycling safer for all (Elvik, 2009; Rajiv and Wier, 2010). One effective example of the applied elements increasing safety is that of a roadway in Moines, IA, USA which converted a 4-lane commuter route to 2-lanes with a center turn-lane and bike lanes in both directions by restriping the road accordingly. Traffic increased by 6 percent while collisions decreased by more than 50 percent (Anderson, et al., 2015). An example of the CSDE improving commerce is in West Jefferson, NC, where ten new businesses were opened on a downtown street after the implementation of CSDE made the area more pedestrian-friendly (Anderson, et al., 2015).

Other examples of bicycle and pedestrian infrastructure include:

- Bicycle lanes (Figure 1-A)
- Signalized pedestrian crossings and mid-block crossings (Figure 1-A)
- Pedestrian and bicyclist-scale lighting (Figure 1-A)
- Separation/buffers between roadways and bike lanes or sidewalks (Figure 1-A)
- High-visibility signage (Figure 1-A)
- Paved shoulders on roadways (Figure 1-B)
- Bicycle parking and storage facilities
- Curb extensions
- Intersection treatments for bicycles – bicycle boxes, stop bars, lead signal indicators
- Landscaping
- Shared-lane pavement markings and signage
- Trails, greenways, and shared-use paths
- Reduced Speeds
The Complete Streets policy NC DOT adopted further commits to pursuing the implementation of the design elements in the growth of towns and cities and in select rural settings, with the following exceptions: where exceptional circumstances prohibit adherence to the policy, in facilities prohibit use by law, in areas where the population or employment densities or the level of transit service does not justify the incorporation of CSDE, and on interstates (NC DOT, 2012). The US Department of Transportation (US DOT) has developed “indicators” to measure the transportation environment and effects of transportation infrastructure in individual states and metropolitan areas of the USA. One indicator is a state’s implementation of the Complete Streets policy, which is given a score of 0 (no policy) or 100 (policy in place) (USDOT, 2016). North Carolina received a score
of 100 for its adoption of the policy. However, to better understand how the policy has been incorporated into communities in the state, a review of projects completed by the NC DOT will be conducted.

**Methods**

Projects for review were sourced from NC DOT’s Highway Lettings webpage. All state transportation projects sent for approval by the NC DOT are listed on the page by year, including years 2004 to 2017, then by date entered into the database which is approximately once per month. All projects have a project number; those under the State Transportation Improvement Program (STIP) are also identified by a letter followed by a four-digit number. The letter identifies the project type; Bridges (B), Urban areas (U), or Rural areas (R), Interstates (I), Rest Areas (K), or Safety (W).

Complete data sets, those from 2010 to 2016, were included in the review. Because Complete Streets policy was adopted in July of 2009, the year was excluded from the review. Likewise, because the current year, 2017, is incomplete, it was excluded from the review. Following the advice of NCDOT’s Roadway Design Unit Project Engineer, only project types B, U, and R were included in the review.

All records from January of 2010 to December of 2016 were reviewed; those with B, U, or R followed by a four-digit number were recorded in a database using Microsoft Excel. The database program allows for hyperlinks, which is what was recorded for each project. Additional project records included the date that the project was submitted, the County where it occurred, the type of project, and the Division under which it occurred. Projects were then sorted into Divisions 1-14 based on County. Within each Division, projects were sorted into project type (Urban, Rural, or Bridge), then by date from oldest to most recent.

A sample set of the projects was then selected for review. In order that all three types of projects were included, approximately 10 percent of each project type were selected for review from each Division. If 10 percent of the number of projects per type was less than 1, then 1 project was reviewed. If 10 percent of the number of projects was not equal to a whole number but was greater than 1, then the review number was rounded to the nearest
Projects within Project Type were selected by date, starting with the median project, then including the last, first, and randomly chosen, as is common practice in political science reviews (Horiuchi, et al., 2007).

Within the projects, documents differed, but mostly included plans and proposals for work. Plans often include structure, pavement markings, signals, signs, traffic, and title plans, which included most of the plans. When available, title plans were reviewed. When not available, structure and pavement markings were reviewed. Design elements that contribute to the accommodation of pedestrians, bicyclists, or public shared-transportation were noted. Those which included such design elements were noted as being “Complete Streets Compliant.” Examples of NC DOT plans that include design elements of Complete Streets are included as Figures 2 and 3.

Figure 2. Pavement marking plans of a NC DOT project that include high visibility crosswalk markings. Crosswalk markings are indicated with a red outline.
Figure 3. Section from a set of NC DOT Title Plans which include an extended paved shoulder for a future multi-use path, circled in red.

Figures were created using ArcGIS Desktop. Data layers included NC County Boundaries, Municipality Boundaries, NC Roadways, NC Bicycle Routes, NC DOT Division Boundaries, and NC Hydrology. Most data layers were obtained through NC DOT Connect’s GIS webpage; the NC Hydrology data layer was obtained from NC One Map Geospatial Portal. Three of the data layers were altered to reflect the necessary information. The NC Roadways layer was split into two different layers based on the roadway’s owner: State owned or not State owned. NC municipalities were narrowed down by selection to only what census data defined as “cities,” in order to simplify the map data. Data defined by the review process was added to the NC DOT Division Boundaries layer in order to display the percent of CSDE inclusion per Division. Road lengths were determined using the “statistics, sum” option in the data layer’s “attribute table.” Road lengths were rounded to the closest mile increment.
Results

A total of 550 STIP projects were active from 2010 to 2016--type B, U, or R. Of those, 345 were type B, 127 were type R, and 78 were type U. Following the selection method described above, 64 projects were chosen for review, approximately 12 percent of total. Distinguished by project type, 36 were type B, 13 were type U, and 15 were type R. Of the 64 projects reviewed, 21 projects were Complete Streets Compliant. Average statewide inclusion of CSDE in the projects reviewed was 33 percent. Urban projects had the greatest CSDE inclusion rates, at 69 percent. Bridge projects ranked second with 27 percent, and only 13 percent of Rural projects included CSDE (Figure 4).

![NC DOT Project Review Results](image)

Figure 4. Graph depicting the number of projects reviewed and number of projects found Complete Streets compliant by project type.

Among the NC DOT State Divisions, half had 50 percent project compliance, four had greater than 50-percent compliance, and 3 contained no compliant projects in the sample group (Figure 5).
Figure 5. Complete Streets compliance by NC DOT Division across the State. The percent of projects reviewed and found to include CSDE is indicated by color.

The most common CSDE was sidewalks; the second most common was crosswalks with pavement markings. None of the projects included completed bike lanes, though 4 projects did include widened shoulders, 2 of which were designated as future bike or multi-path lanes. Table 1 shows the breakdown of CSDE included in the projects.
<table>
<thead>
<tr>
<th>Date</th>
<th>STIP ID</th>
<th>Type</th>
<th>Division</th>
<th>County</th>
<th>Description</th>
<th>Design Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/17/2011</td>
<td>Pasquotank, Camden U-4438 C202599</td>
<td>Urban 1</td>
<td>Pasquotank</td>
<td>Elizabeth City</td>
<td>US 17 Business.</td>
<td>Shared lanes with bicycle markings, pedestrian crossings</td>
</tr>
<tr>
<td>5/20/2014</td>
<td>New Hanover-Pender B-4591 C203395 E-Project</td>
<td>Bridge 3</td>
<td>New Hanover</td>
<td>Bridge #4 Over Island Creek, SR 1002 (Holly Shelter Rd), Bridge repair</td>
<td>4' shoulder extention for bicycle route</td>
<td></td>
</tr>
<tr>
<td>1/17/2012</td>
<td>Onslow U-5168 C202576</td>
<td>Urban 3</td>
<td>Onslow</td>
<td>Jacksonville</td>
<td>Computerized signal system includes pedestrian signals.</td>
<td></td>
</tr>
<tr>
<td>2/21/2012</td>
<td>Johnston B-3864 C202783</td>
<td>Bridge 4</td>
<td>Johnston</td>
<td>Bridge #40 over Neuse River on US 70 Business. Grading, paving, structure, signals.</td>
<td>Includes extra width shoulder for furture multi-use path, sidewalk, and high visibility pedestrian crosswalk markings.</td>
<td></td>
</tr>
<tr>
<td>1/19/2010</td>
<td>Wake B-3919 C202232</td>
<td>Bridge 5</td>
<td>Wake</td>
<td>Bridge #48 over Austin Creek. Bridge #140 over Smiths Creek.</td>
<td>14' Lane for future bicycle accommodation, sidewalks, wheelchair accessible ramps.</td>
<td></td>
</tr>
<tr>
<td>9/21/2010</td>
<td>Durham R-5164D C202610</td>
<td>Rural 5</td>
<td>Durham</td>
<td>NC 147 Diamond Grading and Shoulder Replacement</td>
<td>Sidewalks and crosswalks</td>
<td></td>
</tr>
<tr>
<td>11/20/2012</td>
<td>Durham,Wake U-4716A-U4716B-U4716C C203128</td>
<td>Urban 5</td>
<td>Durham</td>
<td>Clegg passing siding and Hopson Rd grade separation with Church St. extention from Kit Creek Rd to Keystone Parks Dr. and from Park Knoll Dr. to Hopson Rd including the closing of at-grade railroad crossing. Grading, Drainage, Structure, Paving</td>
<td>Sidewalks on part of the project, but no signage.</td>
<td></td>
</tr>
<tr>
<td>9/20/2016</td>
<td>Cumberland B4490 C203659</td>
<td>Bridge 6</td>
<td>Cumberland</td>
<td>Bridge #16 over CSX Railroad, NS Railroad, and Hillsboro St on NC 24-210. Grading, paving, drainage, structure, signals, retaining walls.</td>
<td>Crosswalk markings at main intersection</td>
<td></td>
</tr>
<tr>
<td>9/18/2012</td>
<td>Cumberland U-20998 C202885</td>
<td>Urban 6</td>
<td>Cumberland</td>
<td>SR 1132 (Legion Rd) from SR 1363 (Jelk Rd) to SR 1007 (Owen Dr) in Fayetteville.</td>
<td>Crosswalk markings at main intersection</td>
<td></td>
</tr>
<tr>
<td>2/21/2012</td>
<td>Guilford,Rockingham R-2309AB-R-2413C C200800</td>
<td>Rural 7</td>
<td>Guilford</td>
<td>US 220 from SR 2182 (Horsepens Crk Rd) to intersection of existing NC 68. Gradinf, Paving, Signing, Signals, culverts, walls, structures</td>
<td>Part AB only: Sidewalks on each side of road, signals, crosswalk markings</td>
<td></td>
</tr>
<tr>
<td>10/16/2012</td>
<td>Orange U-0624 C203175</td>
<td>Urban 7</td>
<td>Orange</td>
<td>NC 86 (S. Columbia St) from Purefoy Rd to Manning Dr. in Chapel Hill. Grading, drainage, paving, widening, signals.</td>
<td>Sidewalks on each side of road, signals, markings</td>
<td></td>
</tr>
<tr>
<td>10/18/2016</td>
<td>Moore U-3324 C201886</td>
<td>Urban 8</td>
<td>Moore</td>
<td>Aberdeen- Southern Pines intersection of SR 1309 (Morganton Rd) and US (Sandhills Blvd). Resurfacing, grading, drainage, retaining walls, structure, guardrails, signing and signals, gutters, curb</td>
<td>Sidewalks on one side of roadway and crosswalk markings on pavement</td>
<td></td>
</tr>
<tr>
<td>10/20/2015</td>
<td>Davidson B-3159 C203587</td>
<td>Bridge 9</td>
<td>Davidson</td>
<td>Bridge #27 over US 29-64-70/I-85 Bus Loop on NC 6/US 52</td>
<td>Sidewalks and crosswalk markings,</td>
<td></td>
</tr>
<tr>
<td>1/17/2012</td>
<td>Forsyth U-4909 C202745</td>
<td>Urban 9</td>
<td>Forsyth</td>
<td>Winston-Salem Union Cross Rd from Wallburg Rd to Sedge Garden Rd. Grading, paving, drainage, structures, signals</td>
<td>Partial sidewalk</td>
<td></td>
</tr>
<tr>
<td>6/18/2013</td>
<td>Stanly B-4643 C203156</td>
<td>Bridge 10</td>
<td>Stanly</td>
<td>Bridge #24 and approaches on NC 49 over Curl Tail Creek. Grading, drainage, paving, structures</td>
<td>Extended shoulders, no signals/markings (11 ft with guardrails)</td>
<td></td>
</tr>
<tr>
<td>4/49/16</td>
<td>Cabarrus B5123 C203722</td>
<td>Bridge 10</td>
<td>Cabarrus</td>
<td>Bridges #14 and #19 over Rocky River and access road on US 29. Grading, drainage, structure, paving</td>
<td>Paved multiuse path on both sides of road</td>
<td></td>
</tr>
<tr>
<td>2/19/2013</td>
<td>Mecklenburg U-02098 C202824</td>
<td>Urban 10</td>
<td>Mecklenburg</td>
<td>Charlotte- US 74 (Independence Blvd) from Albemarle Rd to east of Wallace Lane.</td>
<td>Sidewalks with handrails, crosswalks and sidewalks with curbed island</td>
<td></td>
</tr>
<tr>
<td>12/18/2012</td>
<td>Graham B-4122 C202429</td>
<td>Bridge 14</td>
<td>Graham</td>
<td>Bridge #81 over Long Creek on SR17 in Robbinsville. Grading, drainage, culvert, paving</td>
<td>Sidewalk</td>
<td></td>
</tr>
<tr>
<td>10/18/2016</td>
<td>Macon B-5125 C203667</td>
<td>Bridge 14</td>
<td>Macon</td>
<td>Franklin. US 441 Business from Palmer and Main Streets to US 23-441 Bypass</td>
<td>Sidewalks, crosswalks with signals, and crosswalk indication signs.</td>
<td></td>
</tr>
<tr>
<td>10/20/2015</td>
<td>Transylvania U-5104 C203318</td>
<td>Urban 14</td>
<td>Transylvania</td>
<td>Calwell St from US 64 to Probart Street.</td>
<td>Sidewalks and crosswalks.</td>
<td></td>
</tr>
</tbody>
</table>
Roadways owned and maintained by the State of NC total 84,112 miles. Roads not maintained by the State, but rather by a county, city, a private entity, the National Park Service, or by the National Forest Service, total 55,114 miles. Though individual roads are not distinguishable, the color display of the roadway types provide some insight as to proportional ownership of roads. Within municipal boundaries, it appears that most roadways are under the jurisdiction of the city or other entity (Figure 6).

![Roadway Ownership throughout North Carolina](image)

Figure 6. Roadway ownership across the State; NC owned and maintained roads are indicated in black, roadways owned and maintained by other entities are indicated in chartreuse.

Bicycle routes designated by the NC DOT Division of Bicycle and Pedestrian Transportation total 6,999 miles. Bike routes on roadways maintained by the State total 5,946 miles. The image of bike routes across the State (Figure 7) shows four dense clusters of routes in Divisions 3, 5, 10, and 13, and are located in and around the cities of
Wilmington, Durham, Charlotte, and Asheville. The four cities with notable NC DOT designated bike routes have taken measures to incorporate pedestrian and bicycle paths into their master city plans.

Figure 7. Bicycle routes across the State pictured in red. Dense clusters of bike routes are circled in yellow.

Discussion

No explanations as to what led to the inclusion or exclusion of CSDE into projects were noted in the project data. Sidewalks were the most common CSDE, with more than 90 percent of the sidewalks occurring in urban areas (including Bridge projects in urban areas). It was also not always clear--where sidewalks were included--whether the sidewalks were being repaired, moved, or added to the site. Often, sidewalks are a component of the building code required by a city or town. Whether the sidewalks were
included as a component of the NC DOT design or if they were a requirement of the municipality in which they occur cannot be determined.

When asked for the NC DOT Project data to review the inclusion of CSDE, the Roadway Design Unit Project Engineer, happy to oblige, stated: “Bear in mind, not all projects will have involvement nor are supposed to, and as I said, it is an enormous amount of data. Unfortunately, we do not maintain a list of which projects contain Complete Street modifications to point you in any direction. They are simply accounted for in the development of the individual projects, and not logged into any database. (It’s sorta like if you asked me, how many times I had Mexican food the last 8 years … where I went, what did I eat, and how much did it cost? There’s plenty of instances, I just don’t track it with that level of detail.)” That statement proved to be true. Though more than 10 percent of projects that were the type most likely to contain CSDE were reviewed, nearly 500 projects of the same types were not reviewed. The NC DOT Project Lettings database provides no way to search for features or for project types. Projects are simply listed within the date range that they were entered into the database. I predict, at the current rate of review, that it would take at least a solid month (30 days) of project review to assess the remaining STIP types B, U, and R. However, it is clear that further assessment could lead to a different statistical outcome.

The NC DOT’s Complete Streets Planning and Design Guidelines state “Under the new policy, NC DOT will collaborate with cities, towns, and communities during the planning and design phases of new streets or improvement projects. Together, they will decide how to provide the transportation options needed to serve the community.” It can be reasoned, then, that urban municipalities’ planning departments work to incorporate design elements like sidewalks into street designs. The four cities in NC with the most noticeable volume of bike routes each have city-led campaigns to incorporate bicycle-friendly features into their streets.

The City of Charlotte’s efforts towards multi-modal user-friendly street planning and design won the city the Environmental Protection Agency’s (EPA) National Award for Smart Growth Achievement in Policies and Regulations in 2009. Charlotte’s DOT uses
six-step process, created in their Urban Street Design Guidelines, to examine potentials for CSDE in every project (Seskin, 2009).

The City of Asheville adopted a Complete Streets Policy in June of 2012, which applies to all new and retrofit or reconstruction projects, with some exceptions, and involves city planners and engineers to routinely include multi-modal design elements. City transportation planning also enlists community input by working with several local non-profit organizations and not-for-profit clubs to assess the demand for active transportation corridors (City of Asheville). Each September, for example, pedestrian and bicycle user counts are conducted with help from the NC Center for Health and Wellness, volunteers from the Asheville Bicycle and Pedestrian Task Force, UNC Asheville, the Blue Ridge Bicycle Club, Asheville on Bikes, and other interested members of the community. The donation supported non-profit organization, Asheville on Bikes (AOB), exists solely for the purpose of representing active transportation interests and safety in Asheville and the surrounding area (AOB, About). Specifically, AOB participates in City Council meetings and tackles active-transport issues by notifying the public and organizing letters and contacts for public response. They actively review design options and review NCDOT and City of Asheville roadway projects, providing comments and recommendations to support bicycle transportation.

In 2006 the City of Durham adopted pedestrian and bicycle plans. More recently, the plans were updated and in May of 2017, the Durham Bike + Walk Implementation Plan was adopted by City Council to create “a better, safer future for walkers and bikers” (City of Durham). While the original bike and pedestrian plans strived to affirm the merit of Complete Street design plans, the newer plan understands the benefits of active transportation to the City and thus determines to expedite delivery of pedestrian and bicycle facilities. In addition to the City’s planning department, several parties were involved in formulating the plan, including: a Steering Committee with individuals from area Universities, Bicycle and Pedestrian Advisory Commission, Downtown Durham Inc, the Mayor’s office, the Durham Police Department, and the DOT, among others; three firms were hired for consulting and design.
The city of Wilmington, too, adopted a Complete Street policy in 2010. In addition to the Complete Streets policy, the Wilmington Comprehensive Plan (2017) lists “Making walking and biking a real mobility option” as one of their top ten goals.

County departments, too, include planning groups or transportation departments, but have larger areas to govern and may not be as focused on the bicycle and pedestrian commuting capabilities of roadways.

**Conclusion**

North Carolina’s adoption of a Complete Streets policy is a progressive step toward addressing the long-term health and success of its people. The bulk of NC DOT projects do not include Complete Streets design elements, though Urban projects do have a greater tendency to be inclusive of some of the design elements. Projects with a greater chance of having a multi-modal design are in areas that have local advocacy for the design elements.

This analysis found that 33 percent (n= 64) of projects reviewed state-wide included Complete Street Design Elements. Urban projects had the highest percentage and rural projects the lowest.

Sidewalks seem to be the most prevalent addition to project design but the impetus for sidewalk inclusion seems to depend upon local building codes.

As of yet, only a small percentage (7 percent) of state-maintained miles of streets and roads in North Carolina are designated bicycle routes.

Four North Carolina municipalities are leaders in adoption of the concept and incorporating design elements, especially those for bikes and pedestrians, in their street projects.
Literature Cited


Anderson, Geoff; Searfoss, Laura; Cox, Alex; Schilling, Elizabeth; Seskin, Stephanie; Zimmerman, Chris. 2015, Safer Streets, Stronger Economies: Complete Streets Project Outcomes from Across the United States. Institute of Transportation Engineers. ITE Journal, June 2015; 85, 6; page 29


City of Asheville. Resolution No. 12-154. A resolution providing for a Complete Streets Policy and directing staff to develop performance measures and implementation strategies to enable safe and convenient access to our transportation system for all users of all ages and abilities, including pedestrians, bicyclists, people with disabilities, transit riders, and motor vehicle drivers. Retrieved from http://www.ashevillenc.gov/civicax/filebank/blobdload.aspx?BlobID=22838


https://smartgrowthamerica.org/charlottes-complete-streets-policy-wins-national-award/

Shapard, James and Cole, Mark. 2013. Do Complete Streets cost more than Incomplete Streets? Transportation Research Record, ISSN 0361-1981


