Do Complete Streets Cost More than Incomplete Streets?

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Abstract

For over five years, the City of Charlotte has been applying the award-winning Urban Street Design Guidelines to plan, design, and build context-based complete streets which consider the needs of all transportation modes. This paper intends to answer the most common question the City receives about building complete streets: does building a complete street cost more than a traditional street and, if so, how much? Staff from the Charlotte Department of Transportation (CDOT) has compiled information from past projects to determine the range in cost of typical complete street projects. In addition, CDOT staff used the North Carolina Department of Transportation’s (NCDOT) database to analyze actual line item bid costs for complete streets project elements such as bike lanes and sidewalks. CDOT staff also examined fluctuations in transportation project construction costs over a five year period. The analysis shows incorporating complete streets elements such as bike lanes and sidewalks slightly increases the cost of a project. However, CDOT staff also determined overall market fluctuations in construction costs plays a more significant role in the costs of a project than do the costs for incorporating complete street elements. Costs for typical complete street elements make up a very small percentage of the overall project cost. In summary, after considering the small percentage of project budgets required to include complete street elements and the significant fluctuation in historical project construction costs, the authors of this paper make the argument for continuing to include complete streets items in project scopes and budgets.
LITERATURE REVIEW

In an effort to meet the demand of a growing population, the City of Charlotte adopted the Transportation Action Plan (TAP) (1, 2). The City is expecting approximately 225,000 new residents in the next 25 years, and related growth in economic opportunities. Along with the opportunities created by the growth, there will be increased demand on the transportation infrastructure. To address the increased demand the City has made a choice to integrate the provision of land use and transportation choices. The TAP describes a comprehensive array of transportation strategies, programs and projects to be implemented during the next 25 years in Charlotte.

As a companion to the TAP, the City also developed the Urban Street Design Guidelines (USDG) (3) to expand on the TAP’s policies and strategies. The USDG is the framework for both how projects, especially streets should be planned as well as designed. The City is committed to creating projects with the idea that providing better multi-modal facilities based on land use context is to be the best option for creating a more usable network of transportation choices for all users.

The perception of some has been that creating these projects is more expensive and can be cost prohibitive. Now that the City has built dozens of projects utilizing the Urban Street Design Guidelines, CDOT staff wanted to take a close look at how much these projects cost and understand the difference in costs between projects with more traditional scopes and complete street projects that follow the recommendations of the USDG. As a result, the City began researching project information and bid tabulation data with the goal of quantifying costs of various project types and projects features.

INTRODUCTION

The City of Charlotte’s Urban Street Design Guidelines (USDG) include a process to ensure the City’s transportation projects address the travel needs of the motorists, pedestrians, bicyclists and transit riders. The six step process is followed during the planning and design of every project to ensure the best possible project is ultimately constructed by taking into account the land use context and all modes of transportation. Charlotte has made a choice to include items such as sidewalks and bike lanes as part of all projects for streets and thoroughfares. The inclusion of these features maximizes the available travel options of our citizens. As a result of including complete streets elements in our transportation projects, City staff are often asked by citizens, as well as by others from around the country what the additional cost is for complete street features.

To answer this question the CDOT staff used historical information from our past projects as well as the NCDOT bid tab database to determine how much each component of a project costs and what percentage complete street transportation features represent in relation to the overall project costs. This information was organized by type of project such as street conversions, roadway widening, and pedestrian/streetscape projects.

As a second task CDOT staff calculated the percentage of individual complete street items such as sidewalks and bike lanes and researched historical cost for a 5 year period to determine if market conditions impacted the cost of a project more or less than the costs of complete street items (bike lanes, sidewalks, etc.).

The findings indicate that providing multi-modal transportation choices in context with land use represents a relatively minor percentage of the overall project costs. The reason for completing the analysis is to show residents and others that creating a street with elements that support the land use context, and incorporates multi-modal transportation choices does not have to be cost prohibitive.
Additionally, design choices can be made that can offset much of the potential increase in cost. Finally, the variability of the market and economy will impact a project's total cost much more than providing the community a long lasting street with the appropriate design features built to create long term sustainability and value.

**DISCUSSION OF RESULTS**

One of the most cost effective ways to retrofit a street to provide better facilities is to implement street conversions. One example of a street conversion is restriping a street from a four-lane undivided cross section to a three-lane section with bike lanes. To minimize the costs of completing a street conversion, utilizing existing curb and gutter and leveraging the work with scheduled resurfacing can make a significant difference in the expense of a project. The benefit of not changing the location of the curb and gutter is a dual benefit. The cost of removal and reinstallation of curb and gutter is saved, but more importantly the underground storm drainage can remain in place. The cost associated with storm drainage design, removal and installation will drive the overall cost of a project up substantially. The typical cost for street conversions completed in Charlotte ranges from $250,000 to $300,000 per mile. The incremental cost of the additional work to accomplish changes in markings has averaged $40,000 to $50,000 dollars per mile.

The City also participates in funding pedestrian/streetscape projects. A pedestrian/streetscape project might include intermittent islands, curb bulb-outs, new or improved sidewalks, improved curb and gutter, milling and resurfacing. The average cost of these types of projects for the City ranged between $1.5 million and $2 million per mile. As with street conversions, the most cost effective way to implement streetscape projects is to utilize as much of the existing curb and gutter as possible, along with coordinating with planned resurfacing projects. The cost savings of utilizing both items incoordination is estimated to be approximately $500,000 per mile of project.

The key purpose of the analysis was to calculate the line item costs of adding sidewalks and bike lanes to a project. NCDOT keeps a detailed database of all bids for road construction projects. The database for 2010 (4) was used to analyze 135 projects throughout the state of North Carolina. The state average cost as well as the division average cost for each line item was calculated from the bid information. CDOT staff then compared three projects of similar size and scope to evaluate detailed quantities and costs.

For the purposes of this study, the CDOT staff calculated the costs of three different, typical urban street cross-sections; a two-lane street, a three-lane street, and a four-lane median divided street. For evaluation purposes we assumed each project was constructed in an open field condition without impacts to adjacent properties, buildings or existing land uses. Due to the variable cost of real estate based on location and land uses associated each parcel could vary significantly. With the focus of the research being on specific line items costs associated with complete street features we did not include real estate costs in our calculations. Also, during the planning phase of each project it is possible to mitigate for the amount of right-of-way necessary to construct a project by potentially reducing lane widths from the standard twelve feet to eleven feet or by reducing median widths where practical. It is important to note the cost shown per mile below in *Tables 1 thru 3* include line item costs for the project as well as the costs for planning, design grading, mobilization, erosion control, traffic control and a project contingency. Due to the topography in Charlotte the costs also include an assumption of major storm water impact per mile. The storm water impact refers to either a major culvert crossing or a bridge project per mile requiring FEMA permitting.
TABLE 1 - 2 Lane Streets with Curb and Gutter
(Cost increases or decreases as percentage differences from the baseline project)

<table>
<thead>
<tr>
<th>Street Options</th>
<th>Construction Costs Per Mile (Million)</th>
<th>Sidewalk (%)</th>
<th>Bike Lanes (%)</th>
<th>Lane Width (%)</th>
<th>Difference (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12’ Lanes (28’ F-F) (baseline project)</td>
<td>3.80</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12’ Lanes + 5’ Sidewalk (28’ F-F)</td>
<td>4.00</td>
<td>+3.8</td>
<td>-</td>
<td>-</td>
<td>+4.0</td>
</tr>
<tr>
<td>11’ Lanes (26’ F-F)</td>
<td>3.75</td>
<td>-</td>
<td>-</td>
<td>-1.3</td>
<td>-1.5</td>
</tr>
<tr>
<td>11’ Lanes + 5’ Sidewalk (26’ F-F)</td>
<td>3.95</td>
<td>+3.8</td>
<td>-</td>
<td>-1.3</td>
<td>+2.5</td>
</tr>
</tbody>
</table>

Table 1 shows the average cost for a two-lane street to be approximately 3.8 million dollars. The addition of sidewalks increases the overall project cost approximately 3.8 percent. The table also shows that it is possible to mitigate for the addition of a sidewalk into a project by reducing the proposed lane width. By reducing the lane width from 12 feet to 11 feet the reduction in asphalt costs is approximately 1.3 percent. The two lane street does not include provision for additional costs associated with the inclusion of a bike lane due to the type of street. A local street typically has low volumes and low speeds allowing bicyclists to ride in the flow of traffic, without the need for dedicated bike lanes.

TABLE 2 - 3 Lane Streets with Curb and Gutter
(Cost increases or decreases as percentage differences from the baseline project)

<table>
<thead>
<tr>
<th>Street Options</th>
<th>Construction Costs Per Mile (Million)</th>
<th>Sidewalk (%)</th>
<th>Bike Lanes (%)</th>
<th>Lane Width (%)</th>
<th>Difference (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12’ Lanes (40’ F-F) (baseline project)</td>
<td>4.80</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12’ Lanes + Bike Lanes (50’ F-F)</td>
<td>5.10</td>
<td>-</td>
<td>+5.4</td>
<td>-</td>
<td>+5.5</td>
</tr>
<tr>
<td>12’ Lanes + Bike Lanes + 5’ Sidewalk (50’ F-F)</td>
<td>5.35</td>
<td>+3.4</td>
<td>+5.1</td>
<td>-</td>
<td>+8.5</td>
</tr>
<tr>
<td>11’ Lanes (36’ F-F)</td>
<td>4.70</td>
<td>-</td>
<td>-</td>
<td>-2.1</td>
<td>-2.0</td>
</tr>
<tr>
<td>11’ Lanes + Bike Lanes (46’ F-F)</td>
<td>5.00</td>
<td>-</td>
<td>+5.5</td>
<td>-2.1</td>
<td>+3.5</td>
</tr>
<tr>
<td>11’ Lanes + Bike Lanes + 6’ Sidewalk (46’ F-F)</td>
<td>5.25</td>
<td>+3.4</td>
<td>+5.2</td>
<td>-2.1</td>
<td>+6.5</td>
</tr>
</tbody>
</table>

Table 2 illustrates the average cost for a three-lane street to be approximately 4.8 million dollars. The addition of a sidewalk increases the cost of a three-lane street by approximately 3.4 percent. The additional pavement needed for the bike lanes is also a slight increase to the overall project cost of a little more than 5 percent. By taking account the land use context and reducing the overall lane with it is
possible to recoup approximately 2 percent of the additional costs when including complete street features. The overall increase in costs of the complete street features can be reduced to as little as 6.5 percent of the overall budget for a typical three-lane street.

**TABLE 3 - 4 Lane Divided Street with Curb and Gutter**
(Cost increases or decreases as percentage differences from the baseline project)

<table>
<thead>
<tr>
<th>Street Options</th>
<th>Construction Costs Per Mile (Million)</th>
<th>Sidewalk (%)</th>
<th>Bike Lanes (%)</th>
<th>Lane Width (%)</th>
<th>Difference (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12’ Lanes (75’ F-F) (baseline project)</td>
<td>5.20</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12’ Lanes + Bike Lanes (85’ F-F)</td>
<td>5.60</td>
<td>-</td>
<td>+4.9</td>
<td>-</td>
<td>+5.0</td>
</tr>
<tr>
<td>12’ Lanes + Bike Lanes + 5’ Sidewalk (85’ F-F)</td>
<td>5.80</td>
<td>+3.1</td>
<td>+4.7</td>
<td>-</td>
<td>+8.0</td>
</tr>
<tr>
<td>11’ Lanes (71’ F-F)</td>
<td>5.05</td>
<td>-</td>
<td>-</td>
<td>-2.8</td>
<td>-3.0</td>
</tr>
<tr>
<td>11’ Lanes + Bike Lanes (81’ F-F)</td>
<td>5.40</td>
<td>-</td>
<td>+5.1</td>
<td>-2.8</td>
<td>+2.5</td>
</tr>
<tr>
<td>11’ Lanes + Bike Lanes + 6’ Sidewalk (81’ F-F)</td>
<td>5.60</td>
<td>+3.2</td>
<td>+4.9</td>
<td>-2.8</td>
<td>+5.0</td>
</tr>
</tbody>
</table>

Table 3 describes the baseline project cost for a four-lane divided street to be approximately 5.2 million dollars. The table illustrates that adding complete street features when balanced by reducing lane widths can accomplished for be as little as 5 percent of the overall project budget.
Figure 1 below summarizes the average cost per mile of bike lanes and sidewalks. In addition, Figure 1 shows graphically the cost savings per mile created when reducing the travel lane width from the standard twelve feet to eleven feet.

**FIGURE 1 – Percentage of Costs for Sidewalks and Bike Lanes per Mile**
(With Potential Cost Savings by Reducing Lane Width)

The line item cost analysis shows adding typical complete street elements to a project is a very small percentage of the overall project budget. Sidewalks add on average a little more than 3 percent to the overall budget of a project. Bike lanes can add a little more than 5 percent to the overall project budget. However, by designing the street with the context of the street in mind possible changes in to the standards transportation project can help mitigate the additional costs. The reduction of lane width from 12 foot lanes to 11 foot lanes can result in a cost savings of approximately 2 percent; therefore, keeping the additional costs of a project to approximately 6 percent of the overall project budget.
CDOT staff also reviewed information on historical project costs. Information provided by Doug Lane with NCDOT (unpublished data), Graph 2 was organized to depict overall construction costs for the five year period from 2005 to 2010 with the base year being 2010.

**FIGURE 2 - Construction Costs (Year to Year)**

Figure 2 shows that construction cost can vary significantly from year to year based on economic factors and market conditions. Construction costs were approximately 17 percent more in 2005 than in 2010 and approximately 12 percent less in 2008 than in 2010. The volatility of the overall economy and the construction market impacts project cost more substantially than adding features to a street to better serve the public and create transportation choices for users of the system.

**CONCLUSION**

The research and information provided shows creating complete streets can potentially add additional costs to a project; however, the cost added to a project can be mitigated with proper planning and design. In addition, the broader economy can impact the project costs more substantially than will complete street features. The vitality and sustainability of the streets built do not have a dollar value associated with them that can be easily calculated, but they do have an effect on quality of life. For the City of Charlotte, the minor amount of change in the overall percentage of costs does not preclude us from building complete streets. The Transportation Action Plan for the City of Charlotte states, “The City intends for all transportation projects to improve safety and neighborhood livability, foster economic development, promote transportation choices and active living…” Factors such as increased walkability, bikeability, neighborhood livability, congestion relief, and tree canopy all add value the city and its residents. The enhanced value residents receive by living in neighborhoods which combine all of these aspects is something very difficult to calculate in dollars and cents. For these reasons the City believes creating streets in coordination with land use context is ultimately the long term sustainable choice for Charlotte’s residents.
REFERENCES


