Street Systems and Classifications to Support Smart Growth

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ABSTRACT

This paper presents concepts on street systems to support Smart Growth that are being developed through a joint project of the Institute of Transportation Engineers and the Congress for the New Urbanism. The intent of the joint project is to encourage the practice of context sensitive street and network design to create and strengthen multi-modal places, to emphasize walkability, and to support compact, mixed use environments. Within the current practice of street design, network density and functional class are used as inputs to the design process to control the basic size, speed, and accessibility of the roadway being designed. In that context, the network aspects focus on minimizing travel time and congested operations, rather than on defining their contribution to community character. Similarly, while the functional class system establishes the hierarchy for street networks, it remains silent on the size, scale, and modal accommodation of the various roadways in each classification by leaving that activity to a capacity-based needs calculation. The joint project work establishes a dimensional framework that pairs a street typology (modes accommodated, purpose) and design criteria (maximum number of lanes and design speed) with urban design (levels of activity, location of access, relation to street) to create coherent networks that serves the diverse economic, social, and environmental needs of metropolitan communities.

INTRODUCTION

The Congress for the New Urbanism (CNU) and the Institute of Transportation Engineers (ITE) have initiated a joint project to develop new design guidance for streets that incorporate and implement the principles of Smart Growth and New Urbanism. ITE’s interest in this effort has grown out of the work of the ITE Smart Growth Task Force, particularly the preparation of a draft Proposed Recommended Practice for Smart Growth Transportation Guidelines (1) that link the broader objectives of smart growth to transportation policy and practice. CNU brings to the project an on-going Transportation Task Force activity to produce a New Urbanist Street Design Manual that embodies the principles of New Urbanism. The 27 principles contained within the Charter of the New Urbanism (2) extend and enhance smart growth approaches with added focus on urban design and regional structure as well as a commitment to neighborhoods that are compact, walkable, and mixed-use.

The Project

The project will result in creation and dissemination to state and local agencies, standard-setting organizations and design professionals of new guidance for context sensitive design of major streets. This new resource will synthesize existing and new design guidance for implementing the principles of context sensitivity, smart growth, and new urbanism. The new guidance will address:

- Established urbanized areas as well as new developments;
- The street hierarchy from connector streets through major arterials (excluding limited access highways); and
- The design process as well as the specific design criteria needed to achieve desired outcomes.
The conceptual framework for the project contrasts with many other efforts to formulate design guidance by taking a broader view of the street design challenge. In addition to addressing design criteria, the project will develop and present three elements that need to be addressed in creating street design for great streets:

1. Circulation networks: layout and characteristics of multimodal systems, impact of roadway network characteristics on ability to support context sensitive design.
2. Place types: A system to describe place types (composed at least of land use, intensity, and urban design features) in a way that helps to direct the street design process and its outcomes.
3. Functional Classification System: Modifications or revisions to the conventional functional street classification system that recognize the complexity of urban environments and the many functions served by urban streets in addition to the functions of land access and mobility that are emphasized in the AASHTO “Green Book”. (3)

The resulting design criteria for each street type will vary according to place type, with particular attention to identifying those elements which will be treated differently in the context sensitive design manual than under conventional approaches.

Project Deliverables

The project’s first phase will result in interim guidance for context sensitive design of major urban streets. It will present the new design framework developed in this effort and detail a design process to implement that framework based on current AASHTO, FHWA, ITE, and other design standards, criteria, and practices. This task will incorporate optimal existing guidelines into a new planning framework for, not only the travelway, but also the pedestrian realm, intersections, bicycle facilities, transit accommodation, access management, and on-street parking. During this task, topics for which existing design criteria are considered inadequate for achieving the project’s objectives will be identified. New guidance on these topics will be developed in Phase 2 of the project and incorporated into the final product.

THE NEED FOR NEW RESOURCES

Smart growth and new urbanist principles advocate the creation and sustenance of compact, walkable neighborhoods and urban centers as the building blocks of successful regions. Transportation systems that support such places require multi-modal and context sensitive planning and design of transportation facilities. Current network and roadway standards are limited in their ability to provide adequate guidance for the design of transportation networks and facilities intended to support smart growth objectives, enhance quality of life and protect environmental quality.

At the arterial level, there is a lack of guidance about form and function that inhibits street designs that integrate with smart growth principles. The multi-function nature of arterials, particularly those that carry multiple modes and mix local and regional trips, complicates the design process in urbanized (and urbanizing) areas. The relationship between transportation and land use is also more complex along arterials, particularly as these streets have become corridors of commerce, as well as of movement.
Portland Metro’s work on regional streets (4) addresses some of this complexity by incorporating mode and adjacent land use character into their arterial street design requirements. Within the highway design field, work in context sensitive design (CSD) represents very substantial progress in reconciling the traditional goals of highway development with a broader set of societal goals that include:

- Making transportation facilities a more broadly supportive part of communities
- Environmental preservation
- Enhancement of historic, scenic and natural resource values.

Other techniques, such as access management, are developing to address some of the transportation-land use interface. However, despite these advances, the complexities embodied in designing major streets to be compatible with smart growth patterns show that new resources are needed. Foremost are techniques and design guidance that are based on a sophisticated understanding of contemporary regions and urban, town, and natural environments. This concept suggests that elements of transportation planning also need to be included when arterial streets are being designed, effectively requiring an integrated approach to two levels of design.

**TWO LEVELS OF DESIGN**

Urban major street system design consists of two parts:

- **Network design** – layout and spacing of major streets, including number of lanes, and pedestrianway, bicycle, and transit components. A network would be provided for each mode, whether or not they are to coexist in the same rights-of-way. This part of design also includes consideration of the context in which the street is to be located and how it should relate in general to the area with which it will be integrated.
- **Street design** – geometric design of street and associated features. This includes provisions for all modes, linkages with and accommodations for adjacent land uses as well as any non-transportation activities to be provided for within the right-of-way (e.g., sidewalk dining).

The urban street design concept is intended to support certain objectives for the transportation system. These are listed in Table 1.

<table>
<thead>
<tr>
<th>Table 1. Smart Growth Objectives For Urban Transportation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Connectivity (all modes and intermodal)</td>
</tr>
<tr>
<td>• Walkability</td>
</tr>
<tr>
<td>• Travel choices</td>
</tr>
<tr>
<td>• Context sensitive design</td>
</tr>
<tr>
<td>• Quality of life</td>
</tr>
<tr>
<td>• Less (neighborhood) traffic</td>
</tr>
<tr>
<td>• Safety</td>
</tr>
<tr>
<td>• Efficient use of resources</td>
</tr>
</tbody>
</table>

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NETWORK DESIGN

The network design component includes both a network context and layout along with functional classifications of the network components. Most urban street system designers are familiar with the conventional functional classifications:

- Grade separated
  - Freeway, tollway
  - Expressway
- Major streets
  - Arterial
  - Collector
- Local streets

The use of access and mobility as the primary elements that distinguish between the classes of major streets disregards the functions of streets in shaping blocks and building lots, in providing public spaces, and in accommodating non-motorized modes. Further, the S-curve of access vs. mobility shown in Exhibit 1-5 of the AASHTO Green Book includes no recognition of walkability as a desirable feature of any part of the network. (3)

The system is too rudimentary to reflect the complexity of urban environments and the need for many different street designs. The palette of four street types in urban areas is inadequate to reflect streets of varying contexts, the variety of modes that use urban streets, and areas with different character. The designs that emerge are not sufficiently differentiated to respond to and strengthen different urban environments.

While the functional class system establishes the hierarchy for street networks, it remains silent on the size and scale of the various roadways in each classification by leaving that activity to a capacity-based needs calculation, which results in making big roads bigger over time. The lack of a dimensional framework that pairs roadway design criteria (maximum number of lanes and design speed) with urban design (levels of activity, location of access, relation to street) in the functional class system is highly problematic with respect to creating a coherent network that serves the diverse economic, social, and environmental needs of metropolitan communities.

The joint project work is developing just such a dimensional framework that responds to the two levels of design described above. A pairing of street typology with urban place types is being developed to address the elements of network design and modal accommodation. Within each of the paired street types and place types, specific street design criteria are provided.

Street and Place Types

Table 2 lists the street typology currently being discussed and relates it to existing functional classifications. The major street design guide discussed in this paper will cover only streets that serve roles similar to the major streets. As with all items discussed in this paper, no final decisions have been made on contents, so these could change, possibly significantly.
Table 2. Possible Street Typology.

<table>
<thead>
<tr>
<th>CSD/Smart Growth</th>
<th>Conventional Equivalent</th>
<th>Functions under CSD/Smart Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeway</td>
<td>Freeway</td>
<td>Through, longer distance traffic</td>
</tr>
<tr>
<td>Expressway</td>
<td>Expressway</td>
<td>Through traffic, high volumes</td>
</tr>
<tr>
<td>Throughway</td>
<td>Major arterial</td>
<td>Through traffic, high volumes</td>
</tr>
<tr>
<td>Boulevard</td>
<td>Minor arterial</td>
<td>Inter-neighborhood traffic and local circulation</td>
</tr>
<tr>
<td>Avenue</td>
<td>Collector</td>
<td>No collector function; connects to town, village centers</td>
</tr>
<tr>
<td>Connector</td>
<td>Collector</td>
<td></td>
</tr>
<tr>
<td>Local (some subcategories)</td>
<td>Local</td>
<td>Local property access</td>
</tr>
</tbody>
</table>

The principal differences being considered are that (1) the boulevards and avenues would accommodate local circulation to a greater extent than conventional minor arterials, and (2) collectors that connect local streets to arterials would no longer be used; instead connectors would link neighborhoods to their village and town centers.

Table 3 shows proposed characteristics of CSD/smart growth major streets. A limit on the number of traffic lanes is being contemplated. Where more capacity is needed to serve high intensity areas, spacing of major streets would be reduced instead of adding more lanes. That would keep the scale of streets compatible with the walkable neighborhood concept of smart growth.

Table 3. CSD/Smart Growth Street Characteristics.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Maximum Lanes</th>
<th>Maximum Speed</th>
<th>Curb Parking</th>
<th>Adjacent Sidewalk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeway/Expressway</td>
<td>6</td>
<td>55</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Throughway</td>
<td>6</td>
<td>45</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Boulevard</td>
<td>6</td>
<td>35</td>
<td>Yes</td>
<td>Both sides</td>
</tr>
<tr>
<td>Avenue</td>
<td>4</td>
<td>30</td>
<td>Yes</td>
<td>Both sides</td>
</tr>
<tr>
<td>Connector</td>
<td>2</td>
<td>25</td>
<td>Yes</td>
<td>Both sides</td>
</tr>
<tr>
<td>Local (some subcategories)</td>
<td>2</td>
<td>25</td>
<td>Yes</td>
<td>Both sides</td>
</tr>
</tbody>
</table>

Parking is desired on all streets to serve abutting land uses and to shield and separate pedestrians from passing traffic. This is felt to be desirable for walkable environments. Similarly, walking convenience demands that sidewalks be placed on both sides of all major and local streets.

There is also a land use compatibility requirement that needs to be met. Table 4 shows a possible compatibility chart. Again, as with other concepts described in this paper, this table is an initial idea only and will be discussed and refined before being recommended for use in practice. The key to Table 4 is to realize that there are different land use types and some road types are not compatible with specific land uses.
Table 4. Urban Street Compatibility With Adjacent Land Uses.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Land Use Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Suburban</td>
</tr>
<tr>
<td>Freeway/Expressway</td>
<td>OK</td>
</tr>
<tr>
<td>Throughway</td>
<td>OK</td>
</tr>
<tr>
<td>Boulevard</td>
<td>OK</td>
</tr>
<tr>
<td>Avenue</td>
<td>OK</td>
</tr>
<tr>
<td>Couplet</td>
<td>OK</td>
</tr>
<tr>
<td>Connector</td>
<td>OK</td>
</tr>
<tr>
<td>Local (some subcategories)</td>
<td>OK</td>
</tr>
</tbody>
</table>

A means of quantifying place types to address the degree of urbanization of a place with regard to the intensity of activity is in development. A taxonomy of place types is being explored that includes consideration of the Transect zones in use in the Smart Code (5), the Urban Land Institute’s definitions of retail centers, the American Planning Association’s land use classifications and other systems like the American Society of Landscape Architect’s context analysis and Portland Metro’s Urban Index.

The place types also address the function of a particular place within the region, both from the standpoint of regional attractiveness, but also from a transportation standpoint. Definitions of land use will be integrated with definitions of urban places and intensity of activity. Questions being used to form the definitions of place include:

- Is a mixed use place a jobs center or a retail center or a residential village
- Who is traveling there?
- How pedestrian intensive is the place meant to be?

As mentioned above, the traditional one-mile arterial grid may or may not be sufficient in all cases. Where a higher intensity of activity is expected, major streets would be spaced more closely so they would not have to be wider. Connectivity and networking would be required, although not necessary limited to rectangular layouts. The principle is to permit convenient connections within neighborhoods instead of requiring longer trips via higher classification streets. Figure 1 shows an example of the differences.
STREET DESIGN

Design aspects that will be considered for the new guidelines include:

- Narrower lanes – standard may be less than 12 feet
- Bike lanes on all major streets
- More curb parking in village and town centers
- Shorter pedestrian crossings and more generous pedestrian signal phases
- Design speeds with both minimums and maximums
- More roundabouts to both control speeds and reduce intersection delays (at intersections that would otherwise be signalized)
- Higher priority for transit on streets and sidewalk areas
- Improved pedestrian accommodations
- Intersections more compatible with transit, bicycle, and pedestrian needs
- Access management
- Drainage pattern and inlet locations
- Landscape and street furniture
- Transitions

CONCLUSIONS

The integration of the above elements into a cohesive dimensional framework is expected to be an essential part of the new design resource that is evolving through the joint CNU - ITE project.

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REFERENCES