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Dawn Haynie
Georgia State University, Shaynie@gsu.edu

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Examining the Measures of Street Connectivity in the American City and their Interdependencies as applied in Practice

S. Dawn Haynie
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Street patterns, and their measures of connectivity, are significant factors in urban planning and design, as illustrated by the APA's Planning and Urban Design Standards (Handy, Paterson, & Butler, 2003). Studies have looked at the measures of dense urban areas, sparse suburban areas, and in most cases, contrasted the two to characterize differences in planning history, patterns of growth, and associated impacts. Strong correlations have been demonstrated between the measures of street connectivity, and yet despite these trends, further examination demonstrates that not all measures capture the same level of connectivity. The importance of these measures, particularly as they are introduced into regulatory frameworks, indicates a need for an extensive study of their interdependencies. This research illustrates clearly the inconsistencies between the measures of street connectivity, examines how the measures covary for networks with distinct morphologies, and presents an argument for using a measure of connectivity that more effectively discriminates between street networks, arguing for a measure capturing both scale and configuration.

To characterize existing street networks and capture typological variations within MSAs, eight local areas, measuring 2 miles square, are extracted from each of the 12 largest MSAs. Selected areas include those significant historically and identified within the planning literature. Measures of street connectivity are calculated for these 96 areas and reported. When possible, each area was categorized by the morphology of its urban form. Three categories were established – grid, curvilinear, and cul-de-sac. Grids were characterized by straight-street elements that ran parallel to each other, curvilinear networks were characterized by meandering street elements that discouraged continuous vistas, and cul-de-sacs were characterized by the discontinuity of dead-end streets. Correlations between the measures were tested, and the scatterplots consistently showed significant correlations, with limited overlap and high polarization between the various categories.

Given these established correlations, in practice, we operate under the assumption that the measures of street connectivity will be correlated, particularly those measures of road length and block area. As a result, we adopt policies restricting length, and presume then by association that block size will also be restricted, resulting in higher densities yielding increased connectivity. However, a closer examination of the measures illustrates interesting exceptions to these established interdependencies.

When correlations are analyzed for each type, the strength in the statistical regressions deteriorates. Measures of street connectivity are strongly correlated for only those street networks with roads and blocks configured in a more traditional, grid form. For the cul-de-sac areas characterized by road segments that penetrate blocks with a tree-like network, i.e. those street networks with many dead-end or internal streets, the correlations weaken substantially given the dispersion in the measures. Correlations between measures of street connectivity are not of mathematical necessity. They do no prevail for all possible networks; only for a specific class of street networks, or configurations of roads and blocks, such as those considered typologically as grids.

These findings suggest that if we wish to increase street connectivity, if we wish to "connect spatial separated spaces and to enable movement from one place to another" as charged by Handy, Paterson, and Butler (2003), then we must first focus on a measure of connectivity that inherently measures configuration. And, if we wish to "increase the number of connections and the directness of routes," then we must second consider a measure that captures the circuitousness of a network relative to the potential distance available for encounter. Of the measures used to define street connectivity, metric reach and directional distance do both, more consistently, and arguably, they may be a more accurate and more appropriate descriptor of street connectivity, as intended by policy makers.

Tracks: Urban Design
Alt Tracks: Land Use Policy and Governance
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