EVALUATING THE CURRENT STATE OF THE BOSWASH MEGAPOLITAN TRANSPORTATION CORRIDOR AND INDICATORS OF RESILIENCY

By
Michelle R. Oswald, Rebekah J. Gayley, David L. Ames, and Sue McNeil
University Transportation Center
University of Delaware

Purpose

The theme of the University Transportation Center at the University of Delaware (UD-UTC) is the resiliency of transportation corridors. Resiliency is a transportation system’s ability to absorb, respond to, and recover from internal and external pressures and disturbances that influence short and long term performance of the system. Located centrally in the BOSWASH corridor, which extends from Boston, Massachusetts to Washington D.C. the UD-UTC has taken this regional transportation corridor as the organizing concept for its research. The oldest transportation corridor in the United States, the BOSWASH is multimodal and multi-generational in land transportation systems. Focusing on highway, transit, and freight corridors, the UD-UTC addresses significant transportation issues such as changing metropolitan and land use structure, congestion, safety, aging infrastructure, and competing demands of transporting individual travelers and freight while protecting the environment. The scale of the research will include problems of regional and national importance while focusing specifically on unique issues within the state of Delaware.

To execute the UD-UTC strategic plan, a research project that focuses on the resiliency of the BOSWASH transportation corridor has been developed. The main purpose of the UTC research project is to understand the characteristics of transportation corridors like the BOSWASH, including the how the history and adjacent land uses have evolved over time. As well, corridor resiliency and responsiveness to external changes is important to understand. The final goal of the project will be to build a database for future research and identify the key factors in analyzing the resiliency of transportation corridors.

As a first step in the UD-UTC research program, this paper reviews the state of scholarly understanding of BOSWASH corridor and trends in megapolitan development in the United States. It is organized in three parts beginning with (1) the current problem of transportation
planning, (2) introducing Mega-Regions: a new lens for transportation and land use planning, and (3) summary and conclusions.

**Part 1 - The current problem of transportation planning**

Corridors of highly concentrated transportation networks are not a new phenomenon. As an overview of the history of the Northeast corridor will reveal, rail lines and highways have taken decades to develop. However, as the density of these transportation networks continues to increase within the corridor, planning professionals find themselves at a loss for how to effectively manage it. The result is increased traffic congestion, environmental degradation, structural impairment, and social injustices due to limited mobility. In the past, management of complex transportation corridors has been piecemeal, relegated to scattered and shattered jurisdictions that are not always inclined to seek collaboration. The challenges to managing the Northeast’s transportation infrastructure continue to grow; a new planning model is desperately needed. The basis of this new planning model is found in the 1961 work of French geographer Jean Gottmann and is expanded upon by current-day geographers and planners. Gottmann’s ideas regarding the mega-region he referred to as “Megalopolis,” will be fully discussed in the second section of this paper. First, it is crucial to understand the how and why the transportation corridor in the Northeast became what it is today.

Societal changes in mobility have evolved over time, resulting in significant transformations to the Northeast corridor. Already by the 1830s, the corridor was highly industrialized and the development of a rail network throughout the region became possible (Von Eckardt, 1964). Individual states such as Massachusetts, Maryland, and Delaware had begun to construct their first rail lines which were initially pulled by horses (Houk, 2006), laying the foundation for a regional rail network. By the 1850s, the Massachusetts railroad system (the only state required to publicly report ridership) was well-established and reported ridership of 40 million passengers between 1838 and 1847 (Pell, 1966). When locally operated railroads consolidated with the regional system, the number of passengers grew to 200 million passengers between 1861 and 1870 in Massachusetts (Pell, 1966). As ridership increased, the rail network became one of the densest transportation systems in the nation (Von Eckardt, 1964).

With the goals of providing mobility to the public and maximizing profit in mind, rail companies strategically placed rail lines from Boston to Washington D.C. in order to connect
multiple centralized nuclei with sizable populations (Ward, 1986). The train stations were built in and around cities where the majority of people either lived or worked and typically provided service to regions of similar characteristics. The strategic planning of the rail system throughout the corridor connected pairs of cities such as Baltimore to Philadelphia or Philadelphia to New York City (Pell, 1966). This pattern developed the initial interconnected “string of cities” in the northeast, from Boston to Washington D.C., that forms the spine of Gottmann’s Megalopolis.

The corridor developed based on the strategically placed rail lines rather than as a result of the overlapping suburban areas. The transformation from the rail line network is analogous to the development of a mammal. Prior to the development of an entire skeleton, a spine must first be developed. The railroad “spine” served as a backbone for future development of the highway system leading to the overlap in suburban regions. The highway system is representative of the “skeleton” which strengthened the established transportation network and promoted interconnectivity.

Interconnectivity between metropolitan regions became stronger with the development of alternative modes of transportation including automobile and air travel. These alternative modes began to increase by the 1920s causing rail ridership to slowly decline (Gottmann, 1961). Modal competition between air and rail, as well as automobile and rail had a significant impact on the corridor. No longer did residents have to rely on fixed rail lines for mobility to and from the major cities of the corridor. The automobile was preferred for short intercity commutes while air travel began to dominate long distance travel, leading to a decrease in rail ridership. In terms of convenience, travel time, and accessibility, the rail system could not compete with the alternate modes.

Within the next two decades almost every household across America owned an automobile (Gottmann, 1961). In 1940, there were approximately 27.4 million passenger cars registered in the United States and by 1957 there were approximately 55 million privately owned automobiles (Gottmann, 1961). This increase in motor transportation led to a demand for a nationwide highway network (Gottmann, 1961). The National Interstate and Defense Highway Act of 1956 prioritized federal subsidy of highway construction across the country. As a result, the highway system grew and the expansion created an additional increase in automobile ownership. Federal spending on interstate highway systems within the Megalopolis served to strengthen the spine of multi-modal interconnection between cities.
However, the transition from rail to automobile was not without consequences in the Northeast corridor. With increased mobility through the highway network, residents were willing to live further away from the inner cities. Suburban home construction, bolstered by federal subsidy through the Federal Housing Act of 1947, grew more appealing to city residents tired of overcrowded housing and crime. Highways that led into cities were also highways that led out of cities and created suburban areas where people could avoid the disadvantages of city life. The Megalopolis corridor arose from well-developed transportation networks and rapid suburbanization. Today, the northeast corridor is a mega-region that consists of continuous urban sprawl, long commutes, and a lowered quality of life (Todorovich and Vallabhajosyula, 2007). Figure 1 displays the commutersheds that had developed by 1975 due to suburbanization and the desire to live outside of the city, away from rail lines.
As shown in light gray, many people in 1975 were living in the suburbs and relying on their personal vehicles to access workplaces located in the centralized city (shown in dark grey) (Miller, 1975). These commutersheds created the overlapping urbanized regions that connect the major cities of the Northeast into one continuous corridor (Miller, 1975). Figure 2 illustrates how continuous decentralization in Megalopolis has generated gradually increasing commute times from 1990 to 2000. The challenge to engineers and planners alike is that decentralization in the corridor, which manifests as longer commute times, results in greater dependence on personal automobiles for trips of all purpose. In turn, this results in increased traffic congestion and demand on infrastructure systems that affects quality of life, response to emergencies, public expenditure on infrastructure, and the environment.

Figure 1- Commutersheds of Megalopolis in 1975 (Miller, 1975)
Evaluating the BOSWASH Megalopolis Corridor

The resulting impact of geographical shifts from urban to suburban development to the environment in the corridor is immense. As was stated, longer commute times increase demand on highways and caused severe congestion (Von Eckardt, 1964). Congestion however, is more than a traffic problem; it is a land use and environmental issue as well. The environmental cost of cars caught in severe highway congestion is an increase in fuel emissions that negatively impacts air quality. Environmental and political costs related to the reliance on fossil fuels in the US are also problems. Poor air quality emissions, coupled with the land use impacts of highway construction, have created significant environmental degradation throughout the Megalopolis corridor (Regional Plan Association, 2007).

Urban decentralization has resulted not only in congestion – and its related problems of traffic and environmental degradation – but also social and economic restructuring of the corridor. Once the automobile was established as the new form of mobility, those that could afford a vehicle were able to live outside the city. However, those that could not afford to buy a car were forced to remain within a close distance of their workplace, typically in urban districts where passenger train was heavily relied upon for mobility between cities (Vicino et al., 2006). This relationship is still apparent today where the suffering passenger rail system provides service (mass transit) to riders that simply cannot afford personal vehicles (Todorovich and

![Figure 2- Commute Duration for 1990-2000 (Regional Plan Association, 2007)](image_url)
Vallabhajosyula, 2007). Limited mobility traps poverty within certain areas in the Megalopolis corridor. Figures 3 and 4, shown below, display the current arrangement of urban clusters overlaid with income information, throughout the Megalopolis corridor.

![Urban Clusters in Southern Megalopolis](image)

*Figure 3- Urban Clusters in Southern Megalopolis (Vicino et al., 2006)*
Based on these maps, it is apparent that there is a trend relegating poverty stricken regions to centralized cities, such as Baltimore, Wilmington, and Camden. This socioeconomic issue will be a challenge for the future of the corridor, along with the related problems of congestion and sprawl.

**Part 2 – Introducing Mega-Regions: a new lens for transportation and land use planning**

The Northeast corridor in the United States is an area of political, economic, and social supremacy due to its composition of continuous urbanized areas. One solution to managing this intricate web of continuous urbanized areas lies in the research of a French geographer, writing over forty years ago – well before the problems associated with transportation and infrastructure were deemed a “crisis.” In 1961, French geographer Jean Gottmann saw the pattern of cities strung along the Eastern Seaboard, including Boston, Providence, New York, Philadelphia, Baltimore, and Washington, D.C., recognized this pattern as important, and termed this unique
area “Megalopolis.” (Gottmann, 1961). According to Gottmann, characteristics such as high density, increased infrastructure, population growth, technological advancements, and intricate transportation systems had enabled the Megalopolis corridor to become a significant geographical region (Gottmann, 1961). Figure 5 displays “Megalopolis” as defined by Jean Gottmann.

Megalopolis, meaning “large city,” describes the four hundred and fifty five mile region that stretches from northern Boston to southern Washington D.C. and crosses the boundaries of ten states (Miller, 1975). Gottmann believed that rather than viewing each city in Megalopolis as its own entity, the region as a whole ought to be viewed as a new form of city. The corridor was created when the expanding suburbanized areas around each of the cities caused traditional commutershe boundaries to blur (DeCerreno, 2007).

Since 1961, metropolitan growth within this corridor has been extreme. Suburbanization and urban sprawl have both increased in occurrence since 1961, which, in turn, has led to
increased population density within and around the major Megalopolis cities. Geographer Richard Morrill (2006) updated Gottmann’s map based on population growth in the corridor from 1950 to 2000, proving the continual relevancy of the corridor. Figure 6 shows growth in twenty year increments from 1950-1990 of the expanding Megalopolis region. Population growth for the year 2000 is also included in Morrill’s map (Morrill, 2006). Population densities that were once limited to the eastern-most sections of states like Maryland, Pennsylvania, and Massachusetts, have crept westward and cities such as Harrisburg, PA, and Springfield, MA, are now part of Megalopolis.

Though Gottmann’s theories held potential to reorganize the scale at which decisions were made in the Northeast corridor, planning professionals – transportation and/or land use – have failed to incorporate the idea of the mega-region or mega-corridor into planning and decision making. Despite demonstrable economic dependencies between cities and/or counties in the Megalopolis corridor, planning at that scale has yet to be organized. For this reason, among others, Gottmann’s Megalopolis concept failed to take hold among the general public. Recently, however, as the I-95 corridor becomes increasingly congested and state DOT’s find themselves overwhelmed with the costs of maintenance and new construction, some geographers...
and urban planners are returning to Gottmann’s transportation corridor concept, with the intention of adapting it to respond to today’s areas of concern and a growing infrastructure crisis.

In 2005, geographer Robert Lang and Dawn Dhavale (2005) expanded Gottmann’s definition of Megalopolis and wrote that the idea of a transportation/metropolitan corridor was not unique to Megalopolis in the northeastern United States; rather, megapolitan corridors – a 2005 take on Gottmann’s 1961 Megalopolis - are present in ten different locations within the United States. Lang and Dhavale wrote that the Megalopolis characteristics of interconnectivity, population density, distinct regional identity, and long historical background deign “megapolitan” status to the following regions: Northeast, Midwest, Piedmont, Gulf Coast, Pennisula, I-35 Corridor, Valley of the Sun, Norcal, Southland, and Cascadia (Lang and Dhavale, 2005). These ten megapolitan regions cover thirty-five states throughout the United States and are predominantly located along the east and west coasts. In terms of population density, the megapolitan corridors either currently posses or have the potential to possess ten million residents by 2040 (Lang and Dhavale, 2005). Figure 7 displays the ten megapolitan corridors in their respective locations throughout the country.

Figure 7- Map of Megapolitan Corridors (Lang, 2005)
Lang and Dhavale predict that as the current megapolitan corridors continue to grow in population, the total number of megapolitan corridors will also grow – doubling from ten to twenty by 2040 (Lang and Dhavale, 2005). Approximately thirty-three trillion dollars towards these regions will be spent on Megapolitan growth (Lang and Dhavale, 2005). Table 1 provides a comparison between megapolitan and national growth from 2005 to 2040.

Lang and Dhavale’s definition of megapolitan areas has gained credibility because it uses data and geography collected by the US Census Bureau to create standards for designation. The researchers use census-designated statistical areas to identify and label the megapolitan areas, with the county as the most basic unit of analysis. Counties, as units of analysis, then combine to form metropolitan statistical areas (MetroSAs), micropolitan statistical areas (MicroSAs), or Non-core Based Areas – all recognized by the US Census Bureau. Megapolitans must consist of at least two – but sometimes as many one or two dozen – metropolitan statistical areas (MetroSAs), as defined by the US Census Bureau. Census-designated “micropolitans”\(^2\) are also incorporated into megapolitans so long as they are contiguous to the metropolitan area and share a pre-determined level of linked economic activity. Other criteria determined by Lang and Dhavale for identifying Megapolitan areas are as follows:

- Constitutes an “organic” cultural region with a distinct history and identity.
- Occupies a roughly similar physical environment.

\(^1\) Metropolitans Statistical Areas: An “urbanized area” or “principal city” with at least 50,000 people plus surrounding counties with a 25% “Employment Interchange Measure” (EIM) in 2000.

\(^2\) Micropolitan Statistical Areas: Meaningful core-based areas with populations between 10,000 and 50,000 but whose central cities are too small to qualify as MetroSAs. MicroSAs are recognized as self-contained settlements outside of MetroSAs whose boundaries are determined by commuting patterns.
• Links large centers through major transportation infrastructure.
• Forms a functional urban network via goods and service flows.
• Creates a usable geography that is suitable for large-scale regional planning.
• Lies within the United States.

Figure 8 displays a diagram of interconnected metropolitan areas and the designated areas that form as a result of transportation connections. As shown, urban realms develop around the central cities while micropolitan areas exist outside the urban realm, or metropolitan area.

The true promise for Lang and Dhavale’s megapolitan identification lies within the fifth bullet point listed above. Many benefits will arise from large-scale regional planning at the megapolitan level, once locations with megapolitan areas recognize their economic, cultural, and geographic dependency. This conclusion is not so far from what Gottmann originally proposed in Megalopolis. Lang and Dhavale have attempted in “Beyond Megalopolis” to harness the ideas of Gottmann’s Megalopolis and package it in a practical way that will be useful to researchers, policy makers, geographers, and residents. Since 2005, Lang has worked to further refine the definition of megopolitans in an attempt to make America’s new urban form relevant to those making decisions about the regions. In Beyond the Metroplex: Examining Commuter Patterns at the “Megapolitan” Scale (2007), Lang and Nelson more narrowly define megapolitan areas than did Lang and Dhavale (2005). For Lang and Nelson, megapolitan areas are “big, but not enormous and can easily be traversed by car in a day, round-trip… [megapolitan areas have] economic linkages as demonstrated by commuter patterns. The ‘anchor urban cores’ of megopolitans lie at least 50 miles, but no more than 180 miles, apart.” Beyond the Metroplex is a
further attempt to resolve what people often intuitively sense about a place – “metros that were once distinct places now merging into urban complexes” – with how these places are classified by governments, policy makers, and researchers. Lang and Nelson use the Dallas/Ft. Worth Metroplex as an starting point for how other megapolitan areas might grow and develop in the future; however, they emphasis that the Dallas/Ft. Worth Metroplex is just a starting point for research as today’s megapolitan areas cast a shadow over the original metroplex in their enormity. Megapolitans, as defined by either Lang and Dhavale (2005) or Lang and Nelson (2007), will continue to grow in terms of population and physical space for the coming decades and the US must formally recognize this dominant urban geography.

**Table 2- Population Change and Distribution in Megalopolis (Vicino et al., 2007)**

<table>
<thead>
<tr>
<th></th>
<th>1950</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>31,924,488</td>
<td>48,720,108</td>
</tr>
<tr>
<td>As % of US population</td>
<td>20.9</td>
<td>17.3</td>
</tr>
<tr>
<td>Metro population</td>
<td>22,270,346</td>
<td>47,681,719</td>
</tr>
<tr>
<td>As % of Megalopolis</td>
<td>69.7</td>
<td>97.8</td>
</tr>
<tr>
<td>Population density (square miles)</td>
<td>610.2</td>
<td>931.3</td>
</tr>
<tr>
<td>As % of US population density</td>
<td>42.6</td>
<td>80.5</td>
</tr>
<tr>
<td>Population of metro centers</td>
<td>16,435,953</td>
<td>16,453,217</td>
</tr>
<tr>
<td>As % of Megalopolis population</td>
<td>51.4</td>
<td>33.7</td>
</tr>
<tr>
<td>Population of suburban counties</td>
<td>6,284,393</td>
<td>31,228,502</td>
</tr>
<tr>
<td>As % of Megalopolis population</td>
<td>19.6</td>
<td>64.0</td>
</tr>
</tbody>
</table>

Although corridors as a whole are increasing in population, a pressing question remains where within the corridors are people residing? Largely, growth within megapolitan corridors is suburban. According to Vicino, Hanlon, and Short (*Megalopolis 50 years on: the Transformation of a City Region*, 2007), the overall growth of the BOSWASH/Megalopolis corridor masks the decline of major cities such as Baltimore, Boston, Philadelphia, and Washington D.C. Urban decentralization was the original impetus for the rise of megapolitan corridors, but it has come at the cost of population loss in the central cities within metropolitan regions (Vicino et al., 2007). Because the birth rate in the United States has remained relatively constant for the past several decades, growth in one area generally requires decline in another. In the megapolitan corridors defined by Lang et al, growth of the megapolitan as a whole has created decline in central cities. The exception to this trend is New York City which continues to
retain its population and remain a centralized force (Vicino et al., 2007). Table 2 displays the suburban versus urban trends within the Megalopolis corridor over a span of fifty years.

Though the Megalopolis corridor remains densely populated at 931 people per square mile, population dispersion away from central cities has occurred. However, the nature of that dispersion is unique because of Megalopolis’ overall growth rate: “[In 1950] more than one in five of the total population lived in the central cores of the five large cities of Baltimore, Boston, New York, Philadelphia, and Washington. Fifty years on, less than one in 10 lived in these same areas. In 1950, less than one in five lived in the suburbs. By 2000, two out of three lived in the suburbs. The urban cores had virtually no population increase during the 50-year period while the suburbs grew by almost 400%” (Vicino, et al., 2007).

The population redistribution trend within Megalopolis has led many geographers such as Vicino et al. (2007) and Morrill (2006) to revisit Gottmann’s original description of the Megalopolis corridor and expand its area of influence. For example, population changes illustrated in Richard Morrill’s (2006) “Megalopolis Revisited” map shown previously in Figure 2 illustrates the growing physical expanse of the Megalopolis corridor. Though population decentralization has caused parts of Megalopolis to decline, it is the very force that has given rise to Megalopolis-like megapolitan areas across the US.

**Part 3 – Summary and Conclusion**

The challenges facing all highly developed megapolitan corridors must be recognized and addressed. The problems of congestion, environmental degradation, structural deterioration, and social inequities resulting from the current form of urban development in the US have not been adequately resolved through past approaches of delegating authority of sections of the corridor to state DOT’s or local MPO’s. The problems facing the megapolitan corridors that increasingly come to shape the landscape of the future know no boundaries such as state lines, watersheds, or city limits. Therefore, responses must encompass regional action. The theories of Gottmann, revisited by Lang, Dhavale, Morrill, Pell, Todorovich et al, Van Eckardt, Vicino et al, and others, hold potential for addressing today’s transportation and infrastructure needs, as well as tomorrow’s.

Visually, the development that spans continuously from New Hampshire to Northern Virginia is remarkable. The physical development of the Northeast corridor combines with the
corridor’s political, economic, and social supremacy to enable the region to attain a worldly importance. “No other section of the United States has such a large concentration of population, with such a high average density, spread over such a large area. And no other section has a comparable role within the nation or a comparable importance in the world” (Gottmann, 1961). Though Gottmann wrote this in 1961, the same largely remains true today for the corridor. Politically, it is a center of government for both the nation and world including facilities such as the White House, the Pentagon, and the United Nations Headquarters (Pell, 1966).

Economically, the corridor has the greatest concentration of financial power and its residents receive the nation’s highest average income (Pell, 1966). Socially, the corridor leads the country in higher learning institutions as well as book publishing, radio, and TV broadcasting (Pell, 1966). These factors, true in 1961 and 2007, are just some of the reasons that Gottmann (1961) claimed Megalopolis as one of the most influential corridors in the world. For these reasons, the region continues to be a subject of much research today. Though the region is proving unmanageable and unsustainable, the value of the resources found in Northeast corridor are too great to be given up on. Rather, continued research in how best to manage this complex corridor is vitally needed.
References


