TDM (Travel Demand Management) Best Practices for Southeast Pennsylvania’s US 422 Corridor

FINAL REPORT
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By Bradley J. Flamm, Ph.D. (Temple University)
Jeffrey Featherstone, Ph.D. (Temple University)
Brian Blacker (Temple University)
Ashley Nuckles (Temple University)
Robert Henry (GVF)
Kyle Guie (GVF)
RJ Griffin (GVF)
Michael Carroll, P.E. (CFA Consultants)
Christopher Ferrell, Ph.D. (CFA Consultants)
### Abstract

Thirty years of efforts to address traffic congestion in the US 422 Corridor of Southeast Pennsylvania have met with limited success. Three approaches to reducing congestion -- highway and transit capacity additions, traffic incident management and intelligent transportation systems, and transportation demand management (TDM) policies and programs -- have made some progress, but traffic congestion remains a significant challenge. To understand the barriers that have prevented TDM from being more effective and to develop a set of policy recommendations on TDM best practices adapted to the US 422 Corridor, researchers reviewed the planning history of the Corridor, the constraints preventing more effective TDM implementation, and best TDM practices in North America. The resulting analysis is presented in a Background Analysis Report and a Policy Brief. Key findings include the identification of characteristics of TDM-supportive policy environments, conditions which are only partially met in Southeast Pennsylvania. Major recommendations are presented for the short- (0 to 2.5 years), medium- (2.5 to 5 years), and long-term (5 years and beyond) and include options for incremental and transformative approaches to TDM planning and implementation. To assist stakeholders in the US 422 Corridor to identify the most appropriate steps for using TDM policies and programs to address the region's traffic congestion, the Policy Brief proposes a set of key questions to consider and an action plan for moving forward.
BACKGROUND ANALYSIS REPORT

TDM Best Practices for Southeast Pennsylvania’s US 422 Corridor

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# Table of Contents

Executive Summary ........................................................................................................................................... 3  
I. Project Overview ........................................................................................................................................ 5  
II. Study Area: The Corridor and the Expressway ...................................................................................... 9  
   The Communities of the US 422 Corridor in Southeast Pennsylvania ........................................ 9  
   The US 422 Expressway ......................................................................................................................... 10  
   Land Uses and Land Use Changes in the Corridor ........................................................................... 11  
   Population and Employment Change in the Corridor ........................................................................ 12  
   Traffic Volumes and Traffic Congestion ............................................................................................. 13  
   Air Quality in the Region and the Corridor ......................................................................................... 15  
   Public Transportation ......................................................................................................................... 16  
   Private Shuttle Service ......................................................................................................................... 17  
III. TDM in the US 422 Corridor .................................................................................................................. 19  
   Definitions of TDM ............................................................................................................................... 19  
   TDM Recommendations for the US 422 Corridor ............................................................................ 21  
   TDM Strategies Implemented in the Corridor .................................................................................... 25  
   Barriers to Successful TDM Implementation: A Local Perspective ............................................... 28  
      Defining TDM ................................................................................................................................... 28  
      Education ....................................................................................................................................... 29  
      Funding Priorities ............................................................................................................................. 30  
      User Friendly Technology Platforms ............................................................................................ 31  
      Marketing ...................................................................................................................................... 31  
      Intelligent Transportation Systems (ITS) ....................................................................................... 31  
      Land use ....................................................................................................................................... 32  
      Short term solutions ......................................................................................................................... 32  
      Long term solutions ......................................................................................................................... 33  
      Other Key Commonalities ............................................................................................................... 34  
IV. National Best Practices in TDM Implementation ............................................................................... 35  
   Integrated TDM Programs across Agencies and Jurisdictions ......................................................... 35  
   Integrating TDMs into Land Use and Transportation Planning Processes ...................................... 37  
   TDM without Land Use Controls ........................................................................................................ 39
Performance Measurement............................................................................................... 40
Decentralized Implementation of TDM Strategies.......................................................... 44
Pricing and Incentives to Influence Mode Choice and Travel Demand....................... 45
Communication Techniques and Technologies.............................................................. 47
  Public/Institutional Outreach, Education and Promotion ........................................... 47
  Multimodal Traveler Information and Coordination Systems.................................... 48
  BRT-Focused Enhancements...................................................................................... 49
  Unconventional ITS Applications............................................................................... 50
V. Concluding Remarks / Looking Ahead ..................................................................... 51
VI. Appendices
  Appendix A: Prior Studies and Plans Reviewed.......................................................... 52
  Appendix B: Statewide Policies, Incentives, Regulations........................................... 54
  Appendix C: Interviews Conducted ......................................................................... 58
  Appendix D: Annotated List of References............................................................... 60

 Figures
 Figure 1: Communities of the US 422 Corridor in Southeast Pennsylvania................. 9
 Figure 2: Commute to Work Patterns in US 422 Municipalities, the Philadelphia
 Metropolitan Area, and Philadelphia County.............................................................. 17
 Figure 3: Timeline of Planning Efforts Relevant to the US 422 Corridor....................... 22

 Tables
 Table 1: US 422 Corridor Municipalities........................................................................ 10
 Table 2: Population Change in the US 422 Corridor................................................... 12
 Table 3: Traffic Counts on US 422, 1986, 1991 and 2010............................................. 14
 Table 4: Daily Traffic Demand on US 422, 2010.......................................................... 15
 Table 5: Sample Findings on Individual TDM Initiative Effectiveness........................ 41
 Table 6: Statewide Policies, Incentives, and Regulations............................................. 54
 Table 7: Adoption Timeline of Statewide Policies, Incentives and Regulations............ 56
 Table 8: List of Interviewees....................................................................................... 58
Executive Summary

Comprising 24 municipalities, the US 422 Corridor in Montgomery, Chester, and Berks Counties in Southeast Pennsylvania has experienced three decades of strong growth in population and economic activity. Anchored by the retail, research and manufacturing employment in the King of Prussia area at the eastern end of the corridor, development in the area has been facilitated by a robust network of highways and arterials that for thirty years has suffered from regular peak hour traffic congestion.

Planners and elected and government officials at the local, regional and state levels have long struggled to address the disconnect between the supply of available highway capacity in the US 422 Corridor and the demand to use it. Their efforts have included proposals to increase roadway and transit capacity, implement Transportation System Management (TSM) strategies, and reduce traffic volumes through a variety of policies and programs known collectively as “Transportation Demand Management,” or TDM. While each of these strategies has been studied and, to some extent, implemented in the US 422 Corridor, TDM policies and programs have been the most consistently promoted, in large part because the costs of major capacity-adding highway and transit projects in the corridor have been higher than the availability of funds.

Despite the prominence of recommendations to develop and implement TDM policies and programs in almost twenty corridor-area studies and plans completed in the 1990s, 2000s and 2010s, TDM has not had a significant impact on levels of traffic congestion on the US 422 Expressway. The reasons for this, identified in a series of stakeholder interviews conducted in the summer of 2014, include the lack of a shared definition of TDM by stakeholders in the corridor, piecemeal and partial implementation of TDM recommendations, and a policy and governance environment inappropriate for long-term TDM strategies that depend upon coordinated land use and transportation planning. Other obstacles noted by planners, elected officials, and business leaders include land use patterns that make shared and non-motorized modes of transportation inconvenient and time-consuming for area travelers, unfamiliarity with TDM policies and programs among many local decision-makers and stakeholders, the politically controversial nature of some TDM policies, and funding shortfalls.

Effective TDM practices have been developed in other regions of North America and, through a detailed analysis of the academic and professional literatures on TDM, case studies and best practices were identified that inform the future of TDM implementation in the US 422 Corridor. Approaches to TDM implementation that have been most successful include:

- consistent and coordinated application of TDM policies and programs across a region’s municipalities,
- the close integration of land use and transportation planning processes,
- the establishment of standardized performance measures,
• a decentralized approach to the implementation of TDM strategies
• the use of pricing and incentives, where appropriate, and
• reliance on communication technologies to promote TDM, educate decision-makers and the public, and provide actionable travel information.

This Background Analysis Report consists of five sections. The first, Project Overview, explains the methodology used for this project and addresses the primary questions and key findings from our analysis. The second section, Study Area: The Corridor and the Expressway, defines the geographic boundaries of the corridor and describes the notable changes that the region has undergone after completion of the US 422 Expressway in the mid-1980s. The third section, TDM in the US 422 Corridor, summarizes the history of TDM in the corridor, identifies TDM recommendations that have been made, notes those that have been put into action, and discusses the barriers that hinder further progress. The fourth section, National Best Practices in TDM Implementation, synthesizes the characteristics of successful TDM programs and policies and identifies the implications of these findings for successful future implementation of TDM in the US 422 Corridor. The report concludes with remarks summarizing the circumstances affecting TDM policies and programs in the US 422 Corridor and the major challenges to their effective implementation, and looks ahead to recommendations that will be made in a subsequent Policy Brief.
I. Project Overview

Planners and elected and government officials have grappled with traffic congestion in the US 422 Corridor of Montgomery, Chester, and Berks Counties since the 1980s. Efforts to address the disconnect between supply of available highway capacity and demand have included proposals to 1) increase roadway and transit capacity, 2) implement Transportation System Management (TSM) strategies, and 3) reduce traffic volumes through a variety of policies and programs collectively known as “Transportation Demand Management,” or TDM. While each of these approaches has been studied and, to some extent, implemented in the corridor, TDM has become the most consistently promoted because the costs of adding highway and transit capacity in the US 422 Corridor have often been higher than the availability of funds in recent decades.

In the best circumstances, coordinated and comprehensive TDM strategies can offer effective, low cost methods to address traffic congestion and the associated environmental and social impacts of motorized vehicle use. For this and other reasons, interest in TDM in Pennsylvania has been strong, not just in the US 422 Corridor but in other parts of the state as well.

Yet, despite the need to address traffic congestion, the strong interest of key US 422 Corridor stakeholders in using TDM strategies, and regular high-profile study recommendations to do so, there has been only infrequent and partial implementation of TDM policies and programs. Traffic congestion remains a significant challenge and the demand for using highway capacity has not substantially changed.

In early 2014 in order to understand why TDM strategies are so often promoted as a solution, but so infrequently or incompletely applied to reduce congestion, the Pennsylvania Department of Transportation (PennDOT) engaged Temple University’s Center for Sustainable Communities, GVFTMA (also known as the Greater Valley Forge Transportation Management Association), and CFA Consultants to address two principal questions. First is to evaluate the constraints and barriers that have prevented previous TDM recommendations from being adequately implemented in the US 422 Corridor while also scanning and assessing best current practices in TDM, including those that incorporate innovative new communications and information technologies. Second, is to present recommendations and work with key stakeholders to overcome these barriers, adapt the most successful and up-to-date TDM strategies, and promote effective implementation in the corridor.

This document—the TDM Best Practices for Southeast Pennsylvania’s US 422 Corridor Background Analysis Report—responds to the first of these goals. In this report, four key questions are addressed:

- What efforts have already been made to promote the adoption of TDM programs and policies in the US 422 Corridor?
• Why have TDM recommendations only infrequently been implemented by private, local, county and regional agencies?

• How can the work of agencies and communities that have successfully implemented comprehensive TDM programs in other contexts (geographic, economic, and political) inform efforts in southeastern Pennsylvania?

• How can advanced communications techniques and other technologies be incorporated in TDM strategies for the corridor?

This report answers these questions and, in doing so, highlights several key findings:

1. There is a two-decade history of considering TDM strategies for the US 422 Corridor as part of a comprehensive approach to addressing traffic congestion on the expressway and on other highways and arterials in the corridor. Capacity-adding highway and transit projects, as well as more efficient management of the transportation system in the corridor, have been integral parts of this comprehensive approach.

2. Those planners, elected officials and community and business leaders who have recommended TDM strategies for the US 422 Corridor have done so primarily with the goal of addressing traffic congestion and only occasionally have they promoted TDM strategies for their potential to reduce the environmental impacts of transportation in the corridor and the region. TDM has also been promoted as a means to stretch transportation dollars, allowing planners to address traffic congestion even when funding constraints prohibit capacity additions.

3. Stakeholders in the region have not been consistent in defining TDM. Some focus solely on TDM’s role in reducing the number of trips and vehicle miles traveled (VMT) in privately owned cars and light-duty trucks (reducing demand), while others have defined TDM to include capacity-adding initiatives (regional rail extensions and shoulder-running policies, for example) and transportation system management tools and strategies as ways of increasing supply.

4. Many stakeholders in the US 422 Corridor categorize TDM strategies into short-term policies and programs (primarily efforts to make shared and non-motorized alternatives to the use of cars more convenient and appealing) and long-term policies, particularly those that rely on changes to land use planning and zoning policies.

5. Several key barriers have prevented consistent and widespread TDM implementation. These include:

   a. Land use practices that have made car travel a more convenient and acceptable option for travel rather than shared and non-motorized modes;
b. Low levels of funding for the establishment and implementation of TDM programs and policies;

c. Low levels of familiarity with and support for TDM programs and policies among elected officials, business owners and employees, and the general public;

d. The political and sometimes controversial nature of some TDM policies, particularly those based on changes to land use and zoning practices;

e. Institutional mismatches and barriers to a significant number of TDM policies and programs.

6. The importance of key stakeholders, including employers, state officials, elected representatives and municipal, county and MPO planners. The comprehensive approach that permits TDM strategies to be most effective in affecting travel choices and levels of traffic congestion requires leadership at multiple levels of government and in both the public and private sectors.

7. Strong linkages between TDM and land use policies significantly enhance the effectiveness of TDM compared to TDM strategies that rely only upon voluntary compliance among large and diverse groups of stakeholders.

8. TDM practices that emphasize high-level coordination but decentralized implementation among municipalities can maximize effectiveness and accountability while still respecting the variety of goals and interests that different actors and jurisdictions bring to issues of development and congestion management.

This report provides our assessment of past TDM efforts in the US 422 Corridor, barriers to implementation, best practices initiated in other parts of the US, and the application of new technologies to managing transportation demand. Our work has been based upon three main efforts. First, is a detailed analysis of prior studies and plans. In just the past five years, two major studies in the US 422 Corridor — the 2009 US 422 Corridor Master Plan prepared by the Delaware Valley Regional Planning Commission (DVRPC) and the 2011 US 422 Corridor Plus study commissioned by DVRPC and implemented by the Michael Baker Corporation—have addressed worsening traffic congestion by, among other recommendations, proposing the implementation of TDM strategies. Prior to 2009 over a dozen other studies and plans have directly or indirectly promoted TDM strategies for the corridor.

Second, and to support this review of past efforts, we engaged in a series of interviews with key US 422 Corridor stakeholders, including those analysts, planners, and elected officials who have been involved with prior studies and initiatives and professional and elected officials who are responsible for transportation planning and decision-making in the corridor today.
Third, the team reviewed professional and academic reports and studies of best TDM practices in North America. We examined the professional literature for lessons learned and model practices and summarized academic studies documenting the effectiveness of TDM congestion relief strategies. This literature review was also supplemented by interviews with national experts on TDM and local practitioners from other regions.
II. **Study Area: The Corridor and the Expressway**

Instances of rapid development in suburban development corridors are common in metropolitan regions around the nation, but the US 422 Corridor in the northwest quadrant of the Philadelphia metropolitan region is a classic example because of the sequence of highway construction, economic, demographic and land use changes that have occurred over the past three decades. Beginning in the 1980s with the completion of the US 422 Expressway, the communities in the corridor have benefited from the economic development that accompanied the increase in mobility driven by highway construction. But they have also suffered the costs—particularly in terms of vehicular traffic congestion—that have come along with success. This section of the Background Analysis Report sets the stage for the report by describing the communities through which the US 422 Expressway runs, the expressway itself, and the growth in economic activity, housing, and traffic congestion. Regular peak hour traffic congestion has created an ongoing challenge for planners and elected officials in Montgomery, Chester and Berks Counties and has been the incentive to consider capacity-adding, system management, and transportation demand management responses.

**The Communities of the US 422 Corridor in Southeast Pennsylvania**

The US 422 Corridor study area in southeast Pennsylvania begins in King of Prussia located in Upper Merion Township, about 20 miles west of center city Philadelphia. The

*Figure 1: Communities of the US 422 Corridor in Southeast Pennsylvania*
The corridor stretches twenty five miles to the northwest to Amity Township, Berks County, following the path of the Schuylkill River along the boundary between Montgomery County and Chester County (see Figure 1).

The corridor region comprises 24 municipalities located in three Pennsylvania counties (see Table 1). They include a mix of older boroughs established in the 1700s, such as Phoenixville and Pottstown; suburban growth communities like Limerick Township and Lower Providence Township which until the 1970s were largely rural in character; and the large regional commercial and employment center of King of Prussia in Upper Merion Township.

Table 1: US 422 Corridor Municipalities

<table>
<thead>
<tr>
<th>County</th>
<th>Municipality</th>
<th>County</th>
<th>Municipality</th>
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<tbody>
<tr>
<td>Berks</td>
<td>Amity Township</td>
<td>Montgomery</td>
<td>Bridgeport Borough</td>
</tr>
<tr>
<td></td>
<td>Douglass Township</td>
<td></td>
<td>Collegeville Borough</td>
</tr>
<tr>
<td></td>
<td>Union Township</td>
<td></td>
<td>Limerick Township</td>
</tr>
<tr>
<td>Chester</td>
<td>East Coventry Township</td>
<td>Lower Pottsgrove Township</td>
<td></td>
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<tr>
<td></td>
<td>East Pikeland Township</td>
<td>Lower Providence Township</td>
<td></td>
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<tr>
<td></td>
<td>East Vincent Township</td>
<td>Norristown Borough</td>
<td></td>
</tr>
<tr>
<td></td>
<td>North Coventry Township</td>
<td>Pottstown Borough</td>
<td></td>
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<tr>
<td></td>
<td>Phoenixville Borough</td>
<td>Royersford Borough</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Schuylkill Township</td>
<td>Trappe Borough</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spring City Borough</td>
<td>Upper Merion Township</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tredyffrin Township</td>
<td>Upper Providence Township</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>West Norriton Township</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>West Pottsgrove Township</td>
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</tr>
</tbody>
</table>

The corridor is defined by the US 422 Expressway, which serves as an important link between suburban communities in the western half of the corridor and major job sites in and near King of Prussia and further east in the City of Philadelphia. At the eastern end of the corridor, US 422 connects with other regionally significant roadways including US 202, I-76 and I-276.

The US 422 Expressway

Construction of the 18-mile long eastern section of the US 422 Expressway was completed in April 1985 (a western section of US 422 exists in Ohio and western Pennsylvania, but is not the subject of this study). The project cost approximately $110 million and took about 30 years of planning, design, and construction in several phases to
complete. When finished, the new expressway provided access to large areas of undeveloped land in the communities which it runs through, attracting the attention of land developers and leading to profound changes in the character and economy of the corridor.

**Land Uses and Land Use Changes in the Corridor**

While the past thirty years have been witness to rapid and important changes in population, employment and development in the US 422 Corridor, there remain today a variety of land use patterns within the area. In general, the eastern end of the corridor, closest to the major metropolitan center of Philadelphia, is more fully developed than the municipalities in the western half of the corridor. Historic boroughs dot the corridor including Bridgeport, Phoenixville, Pottstown, Royersford, Collegeville, Norristown and Spring City. These exhibit more concentrated development and a greater diversity of development than most of the surrounding townships. Average population density for the eight boroughs in the corridor is a little over 5,000 people per square mile while average density for the 16 townships is approximately 1,200 people per square mile with some as low as 150 people per square mile.

King of Prussia—famously designated by Joel Garreau as one of the Philadelphia region’s few “edge cities”—is home to one of the largest commercial shopping malls in the country. But located in the same township, adjacent to this major commercial center, are the 3,500 acres of mostly open, preserved spaces in the Valley Forge National Historic Park.

Within the diversity of uses, some common characteristics have emerged. Concentrations of commercial use are located at the 13 major interchanges of the expressway. Between interchanges, large areas of single family residential housing has been developed adjacent to the expressway right of way. These areas extend throughout the townships in many cases, particularly in the eastern half of the corridor. Some multifamily residential housing has been constructed, generally near land zoned for commercial uses. Dispersed wooded and agricultural lands are intermingled with single family residential uses in the western half of the corridor. Some land zoned and used for industrial uses is still found along the banks of the Schuylkill River in older boroughs like Pottstown, Royersford and Norristown.

The borough municipalities in the corridor are communities of relatively high population densities, zoned for mixed land uses in street networks with high levels of interconnectedness. The township communities in the corridor have seen most of the area’s new development and population growth. Because much of their growth has occurred under very different conditions than boroughs experienced prior to the second half of the 20th century, townships in the corridor reflect lower population densities, stricter single-use zoning patterns, and street networks with less connectivity. These conditions hinder travel by non-motorized and shared modes of transportation and foster a higher dependence on motorized transportation.
Between 1995 and 2005, residential land use in the Montgomery and Chester County areas of the corridor increased by 18%, with the majority of new residences being low density single family housing. Commercial and community services land uses increased by 11% and 15%, respectively, during the same period. Agricultural land use, on the other hand, declined by 29% and woodlands declined by 14% between 1995 and 2005.

The increased accessibility of municipalities in the corridor made properties located there more desirable, increasing demand for them, and thus the prices for purchasing them. A 1992 study completed by DVRPC examined the first five years of these changes and their impact on land values in the corridor. Analysts found that the real estate value of properties in eight municipalities in the 422 Corridor increased from $2.4 billion to $3.9 billion just five years after the expressway opened.

These rapid land use changes have contributed to a dramatic transformation of the rural countryside in the corridor and led to significant costs in terms of increasing amounts of time spent in travel due to peak hours traffic congestion.

### Population and Employment Change in the Corridor

Between 1990 and 2000, the population in the US 422 Corridor increased by approximately 30,000 residents, representing an increase of 12%. While the population declined in many of the historic boroughs (including Norristown and Phoenixville), large population increases in the townships more than compensated for this. Limerick Township saw its population double and Lower Pottsgrove and Upper Providence experienced significant population growth too.

#### Table 2: Population Change in the US 422 Corridor

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern</td>
<td>12</td>
<td>161,074</td>
<td>166,682</td>
<td>183,808</td>
<td>199,556</td>
</tr>
<tr>
<td>Middle</td>
<td>9</td>
<td>63,234</td>
<td>65,167</td>
<td>75,412</td>
<td>85,782</td>
</tr>
<tr>
<td>Western</td>
<td>3</td>
<td>11,826</td>
<td>13,444</td>
<td>15,647</td>
<td>19,392</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>236,134</td>
<td>245,293</td>
<td>274,867</td>
<td>304,730</td>
</tr>
</tbody>
</table>

Data Source: US Census Bureau

*Notes: Eastern section incorporates East Pikeland, Upper Providence and points further east; Middle section incorporates from East Vincent and Limerick west to the Berks County line; the Western section incorporates the three Berks County municipalities.*
This trend of a growing population continued from 2000 to 2010 when, according to census data, the population grew by 30,000 to over 304,000 residents. East Coventry Township experienced the largest jump between 2000 and 2010 with a population increase of approximately 45%. The population of Amity Township in Berks County increased by 41% and Upper Providence and Limerick Township again saw significant growth with increases of 38% and 35%, respectively. Many of the older boroughs that saw population decline in the previous decade turned the corner between 2000 and 2010; Phoenixville and Norristown Boroughs both saw increases of about 10%. DVRPC forecasts project that the US 422 Corridor will add 30,000 new residents by 2030 representing a corridor-wide increase of about 10%.

The growth in population has been accompanied by large increases in employment, as businesses have taken advantage of relatively inexpensive land to build large corporate campuses and commercial and retail properties. Between 1990 and 2000, the corridor added over 20,000 new jobs with most of these in new businesses located in close proximity to US 422 interchanges. Some of the major employers in the corridor include large pharmaceutical companies like GlaxoSmithKline, Pfizer and Quest Diagnostics which employ approximately 13,000 employees. Between 2010 and 2030, DVRPC forecasts project that the corridor will add another 28,000 jobs.

Traffic Volumes and Traffic Congestion

Traffic congestion following the 1985 completion of the US 422 Expressway gradually increased as new residential, commercial, and office development occurred. Table 3 below captures annual average daily traffic (AADT) volumes for the first full year of operation followed by traffic volumes five years later in 1991 and twenty-four years later in 2010. Several segments have seen almost a tripling in annual average daily traffic compared to the first few years of operation. Interestingly, whereas the population growth along the corridor sections ranged from around 15 percent to 30 percent between 1991 and 2010, the traffic growth ranged from 50 percent to 135 percent.

Today, some sections of the highway regularly accommodate close to 100,000 vehicles a day and reflect high volume to capacity ratios (findings from a 2010 analysis of daily traffic demand performed by Michael Baker, Inc. is displayed in Table 4 below). The expressway is the most heavily traveled in the vicinity of the bridge that connects the rest of the corridor to the major commercial and office locations in King of Prussia and to major regional expressways leading to Philadelphia and other destinations.

The Delaware Valley Regional Planning Commission (DVRPC) Congestion Management Process has identified the US 422 corridor as a priority corridor for traffic congestion relief. The southeast section of the corridor spanning roughly from Phoenixville to King of Prussia and Norristown is in the top 20% of Pennsylvania sub-corridors for high current volume to capacity ratios.
### Table 3: Traffic Counts on US 422 in 1986, 1991 and 2010

<table>
<thead>
<tr>
<th>Expressway Segment</th>
<th>Municipality</th>
<th>1986 AADT</th>
<th>1991 AADT</th>
<th>2010 AADT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berks County Line to PA 100</td>
<td>North Coventry/ West Pottsgrove</td>
<td>18,500</td>
<td>23,500</td>
<td>54,959</td>
</tr>
<tr>
<td>PA 100 to Hanover St</td>
<td>North Coventry</td>
<td>25,700</td>
<td>30,500</td>
<td>62,716</td>
</tr>
<tr>
<td>Armand Hammer Boulevard to Evergreen Rd</td>
<td>Lower Pottsgrove/ Limerick</td>
<td>23,600</td>
<td>37,100</td>
<td>52,219</td>
</tr>
<tr>
<td>Lewis Rd to Township Line Rd</td>
<td>Limerick</td>
<td>21,500</td>
<td>36,700</td>
<td>57,298</td>
</tr>
<tr>
<td>Walnut St to PA 29</td>
<td>Upper Providence/ Limerick</td>
<td>29,100</td>
<td>42,700</td>
<td>66,408</td>
</tr>
<tr>
<td>PA 29 to Egypt Rd</td>
<td>Upper Providence</td>
<td>29,700</td>
<td>44,500</td>
<td>68,824</td>
</tr>
<tr>
<td>Egypt Rd to PA 363</td>
<td>Lower Providence</td>
<td>29,100</td>
<td>46,200</td>
<td>68,810</td>
</tr>
</tbody>
</table>

Data Sources: 1986 and 1991 data available from DVRPC Publication 92-006; 2010 data available from 422 Corridor Plus report

While congestion can occur at any time of day, in general, the US 422 Corridor experiences recurring peak hours traffic congestion in which high volumes to capacities are sometimes exacerbated by collisions, vehicle breakdowns and other non-recurring traffic incidents. DVRPC has provided travel time-based performance measures for the corridor which utilize anonymously collected GPS data from vehicles to calculate average speeds at particular periods throughout the day. The travel time-based performance measures are captured in two indices, the Travel Time Index (TTI) and Planning Time Index (PTI).

The TTI analysis shows that during morning peak hours (6:00 am to 8:30 am), eastbound trips can take more than twice as long compared to free-flow conditions specifically in the southeast sections of the corridor approaching King of Prussia. The same pattern is observed for afternoon peak westbound trips from King of Prussia through to Egypt Road in Lower Providence Township.

PTI analysis shows that on the worst traffic days, eastbound morning trips can take three to four times as long compared to free-flow conditions. The extent of the eastbound congestion is also greater, reaching further westward in the corridor to Lewis Road on the western edge of Upper Providence Township.
### Table 4: Daily Traffic Demand on US 422, 2010

<table>
<thead>
<tr>
<th>Location</th>
<th>Lanes</th>
<th>Daily Capacity</th>
<th>2010 Volume</th>
<th>2010 Capacity Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Grosstown Rd. and PA 100</td>
<td>4</td>
<td>88,280</td>
<td>54,960</td>
<td>62%</td>
</tr>
<tr>
<td>Between Sanatoga and Limerick/Linfield</td>
<td>4</td>
<td>85,800</td>
<td>53,090</td>
<td>62%</td>
</tr>
<tr>
<td>Between PA 29 and Oaks</td>
<td>4</td>
<td>85,800</td>
<td>66,410</td>
<td>77%</td>
</tr>
<tr>
<td>Schuylkill River Bridge</td>
<td>5</td>
<td>113,110</td>
<td>99,095</td>
<td>88%</td>
</tr>
</tbody>
</table>

Data Source: 422 Corridor Plus, Appendix A

In addition, the PTI shows that congestion on these days can exceed typical peak hours and span from approximately 5:30 am to 9:00 am. Again, the pattern is mirrored for westbound trips on US 422 in the afternoon peak period. Overall, the severity of traffic congestion is more pronounced for eastbound morning peak travel relative to westbound afternoon peak travel.

### Air Quality in the Region and the Corridor

Air quality in the US 422 Corridor study area reflects that in the southeast Pennsylvania region as a whole, Berks, Chester and Montgomery counties are all considered nonattainment areas under the federal Clean Air Act for the 2008 8-hour Ozone Standard (0.075 parts per million, or ppm), with ozone levels exceeding national concentration standards and threatening adverse effects on human health. Chester and Montgomery counties are also designated as nonattainment areas for the 2006 Particulate Matter Standard. The corridor area meets federal standards for all of the remaining criteria pollutants.

While motorized vehicle travel is not the only source of Volatile Organic Compounds (VOCs), which contribute to ground-level ozone formation, and particulate matter, these mobile sources are significant contributors to pollutant emissions in the corridor. High vehicular traffic volumes and the resulting traffic congestion remain major contributors to the problem. Finding strategies for reducing traffic volumes and congestion has long been a challenge that the region’s planners and elected officials have grappled with. Providing high quality shared modes of transportation—mass fixed-route transit and private shuttle services—are two strategies that resources have been invested in.
Public Transportation

Public transportation service in the corridor is limited in extent and frequency. SEPTA passenger rail service (the Norristown High Speed Rail and the Manayunk / Norristown Regional Rail lines) terminates at the far eastern edge of the US 422 Corridor. There is also a regional rail in Tredyffrin Township, the Paoli Thorndale line.

SEPTA fixed-route bus service is available within the corridor, but is limited.

- Route 93 connects Norristown Transportation Center to Pottstown via Collegeville, Trappe and Limerick Township (the entire route within Montgomery County), but operates no more frequently than every 35-40 minutes in peak hours and every hour during day-time off-peak hours.

- Route 99 connects Phoenixville Borough to Norristown Transportation Center via Oaks, Valley Forge and King of Prussia.

- Route 139 connects Limerick Township to King of Prussia via Royersford, Phoenixville and Valley Forge, but has lengthy headways of an hour even during peak periods.

- Two other bus lines operate within the study area, routes 91 and 131, however they have very limited coverage areas and limited service frequencies.

In addition to SEPTA service, Pottstown Area Rapid Transit (PART) offers bus service that connects downtown Pottstown Borough to areas of Lower Pottsgrove, Upper Pottsgrove, West Pottsgrove and North Coventry Townships. The five bus lines operate hourly service loops, but the number of service lines is cut down to three for evening service.

The infrequency and limited extent of public transportation in the communities of the US 422 Corridor are reflected in the low ridership and modal share. In the 2012 5-year ACS data set, only 3.6% (+/- 1.3%) of workers aged 16 and older (5,554 +/- 1,948 out of a total of 154,540) commuted by public transportation. Of those, almost two-thirds were residents of Upper Merion and Tredyffrin Townships and Norristown Borough, the easternmost communities of the corridor where commuters are likely traveling away from the corridor to jobs in Philadelphia.

Figure 2 below reflects the commute to work patterns for the municipalities in the US 422 Corridor compared to that of the Philadelphia metropolitan region and Philadelphia County. The corridor municipalities have nearly an equal percentage of commuters traveling via carpool and working from home compared to the metro area and Philadelphia County. However, there are higher shares of workers driving alone and lower shares of workers taking public transportation in the corridor compared to the region and county.
**Private Shuttle Service**

Several privately operated transportation shuttles serve businesses in the corridor. Greater Valley Forge Transportation Management Association (GVFTMA), the regional TMA in the study area, manages several of these. The Upper Merion Rambler offers shuttle service from 9:00 am to 4:00 pm throughout Upper Merion Township and services the King of Prussia Mall and other office and commercial centers nearby. There is also a commuter shuttle bus called theconnector which links employees in the King of Prussia business park with regional passenger rail stations in Norristown and Wayne. Theconnector is a 14 passenger bus that operates during AM and PM rush hours and offers free Wi-Fi and bicycle racks.

Montgomery County Community College offers a shuttle bus connecting their Blue Bell campus, located northeast of Norristown, to their Pottstown campus. The shuttle serves staff, faculty and students and the ride lasts on average 50 minutes. Periodically, GVFTMA also operates specialty shuttles such as a holiday shopper shuttle around the King of Prussia mall and until recently GVFTMA ran a complimentary shuttle for Valley Forge National Historic Park visitors.
These shuttles serve the most heavily congested southeast sections of the 422 Corridor, but are not designed to serve significant numbers of commuters traveling from the western suburbs of the corridor to the major economic centers on the eastern end.

Public transit and privately operated shuttle services are valuable to those who use them, whether they do so out of necessity or by choice. But these services cannot, as currently operated, make large reductions in the volume of privately operated cars and trucks on the US 422 Expressway and other highways and arterials in the corridor. For that to happen, a comprehensive approach to managing the demand for travel in the area is needed, an approach typically called TDM, or Transportation Demand Management.
III. TDM in the US 422 Corridor

Population and employment growth in the US 422 Corridor since the 1980s have led to calls to address traffic congestion by adding highway and transit capacity, by managing transportation systems more efficiently, and by implementing TDM policies and programs. This section describes the history of TDM in the corridor and the barriers that have prevented a more consistent and thorough implementation of TDM strategies.

Definitions of TDM

Traffic congestion in the US 422 Corridor has largely been understood as a problem of high demand by motorists and insufficient capacity or supply on the expressway. Generally speaking, congestion can be reduced in the corridor by increasing supply, managing existing supply more efficiently, reducing demand, or doing two or all of these at the same time.

Support for new highway projects—expanding supply—is more politically palatable than is encouraging motorists to reduce demand by driving less. But increasing roadway supply is expensive and competition statewide for transportation investment dollars is always high. One approach to this challenge is to use techniques such as traveler information systems (using roadside signs, transit system message boards, and online websites and smart phone applications), incident management programs, and ramp-metering to manage travel on area roadways more efficiently. Collectively these and other strategies are referred to as Transportation System Management (TSM), and many of them are already being implemented in the corridor and the region through the work of PennDOT District 6’s Traffic Management Center in King of Prussia.

Nevertheless, planners and elected officials have long recognized that, even if some capacity-adding projects can be funded, managing demand must be part of a comprehensive approach to alleviating traffic congestion. This can be done by reducing the numbers of trips travelers take or by shifting travel demand to other travel modes or times of day.

The approach, called TDM by transportation professionals, is widely embraced and promoted by planners, engineers, and public officials, but has no single authoritative definition. Three well-known national experts in the field demonstrate the difference in approaches to defining the term.

Todd Litman, the author of an online encyclopedia of Transportation Demand Management, uses a simple, very broad definition: “Transportation Demand Management (TDM, also called Mobility Management) is a general term for strategies that result in more efficient use of transportation resources.”
The Center for Urban Transportation Research at the University of South Florida, a nationally recognized resource for information on TDM, uses a slightly more detailed definition:

“Transportation demand management (TDM) focuses on helping people change their travel behavior—to meet their travel needs by using different modes, traveling at different times, making fewer trips or shorter trips, or taking different routes.”

And Michael Meyer, the author of an article chronicling the history of Transportation Demand Management, wrote that:

“In its broadest sense, transportation demand management (TDM) is any action or set of actions aimed at influencing people’s travel behavior in such a way that alternative mobility options are presented and/or congestion is reduced. Three broad categories of such actions include, (a) offering travelers one or more alternative transportation modes or services that result in higher per vehicle occupancy, (b) providing incentives/disincentives to reduce travel or to push trips to off-peak hours, and/or (c) accomplishing the trip purpose through non-transportation means (such as substituting the use of telecommunications for work or shopping trips).”

Local planners who have addressed the topic also use a variety of definitions. The authors of the *Pottstown Metro Regional Comprehensive Plan* defined TDM as a “strategy that seeks to reduce the number of motor vehicles on a road, particularly at peak travel hours.”

Transportation planners for Montgomery County conceive of TDM differently, and wrote in the 2005 *Montgomery County Comprehensive Plan* that TDM

“involves developing and implementing policies and physical road changes in an effort to reduce congestion without then promoting an increase in the amount of traffic on roadways because they are easier to travel” and that “at the most basic level, TDM tries to minimize single-driver automobile use as the first choice for personal transportation, especially during peak times.”

And the authors of the *US 422 Corridor Development Potential and Growth Management Strategies* wrote that TDM

“strategies seek to reduce the demand on the system by changing people’s behavior. Demand management strategies typically include a set of incentives intended to induce people, particularly commuters, out of their cars and into an alternative transportation mode or service.”

Some of these definitions are vague enough that almost any policy or investment that changes some aspect of supply or demand can be considered TDM. Others explicitly state that TDM policies should encourage motorists to drive less by making fewer trips or shifting the hours or modes of some of their trips. Both incentives (making public transit
more appealing, for example) and disincentives (making private car use more expensive or less convenient) can be used. The former, not surprisingly, are usually more acceptable than are the latter to the public, their elected representatives and, thus, municipal, county and regional planners.

TDM Recommendations for the US 422 Corridor

Proponents have been successful in initiating TDM policies and programs in urban areas across the United States and Canada, including in the Philadelphia metropolitan region. While advocates for TDM have often argued that such policies should be implemented at the state or regional levels, the intensity of traffic congestion in the US 422 Corridor has led to proposals specific to this sub-region. Figure 2 on the following page provides a timeline of planning efforts relevant to TDM in the US 422 Corridor; this is further supplemented by a summary in Appendix A. While there were early planning efforts undertaken in 1992, shortly following the completion of the expressway, subsequent efforts were not pursued until a decade later.

The scope and extent to which TDM recommendations have been incorporated in prior plans and studies for the US 422 Corridor have been inconsistent. Though many acknowledged TDM as an approach with potential to successfully address traffic congestion, none of the plans offered a comprehensive TDM program for the corridor. More often, the case was that TDM strategies were suggested as supplementary recommendations to major infrastructure investments like highway and rail capacity expansion and interchange redesign.

Some of the plans simply provided an overview of typical TDM strategies and made a general recommendation that any and all TDM strategies could be implemented where appropriate without identifying those stakeholders who would be responsible for doing so, the resources needed, a timeline to be targeted, or measures of accountability and evaluation.

The most extensive set of TDM recommendations for the corridor was found in the Phoenixville Area Intermodal Transportation Study of 2003 and the Montgomery County Transportation Plan of 2005. These plans covered a wide range of TDM strategies including improved transportation options, incentives to using alternative transportation, employer-based solutions as well as integration with land use policy.

To deepen our analysis of TDM recommendations made in the US 422 Corridor, we referred to the four categories of TDM strategies proposed by Todd Litman of the Victoria Transport Policy Institute (VTPI):

- improved transport options,
- incentives to use alternative modes and reduce driving,
FIGURE 3: TIMELINE OF PLANNING EFFORTS RELEVANT TO THE US 422 CORRIDOR

1992

- Route 422 Corridor Development Potential and Growth Management Strategies

2003

- Phoenixville Area Intermodal Transportation Study

2005

- PennDOT District 6-0 Regional Operations Plan

2007

- Montgomery County Transportation Plan
- Pattstown Metro Regional Comprehensive Plan
- Keystone Principles and Criteria...

2008

- US 422 Corridor Master Plan
- R6 Norristown Line Service Extension Study

2009

- PennDOT Smart Transportation Guidebook

2010

- Phoenixville Borough Congestion and Crash Site Analysis Program
- State Land Use and Growth Management Report

2011

- Connections 2040: Plan for Greater Philadelphia

2013

- 422 Corridor Plus Report

- 422 Corridor Plus Report
Background Analysis Report

- land use and parking management, and
- policy and institutional reforms.

An analysis of TDM recommendations in prior plans and studies directly relevant to the US 422 Corridor shows that the overwhelming majority of these can be tallied in the “improved transport options” category. The most frequent proposal to enhance mobility in the corridor is the establishment of passenger rail service. While this is not strictly a Transportation Demand Management strategy, it is perceived by stakeholders as critical for offering viable and appealing alternatives to the use of single-occupancy vehicles for commuting. This was evident in the proposal for the construction of the Schuylkill Valley MetroRail, a new rail service along the route of US 422. After the MetroRail proposal was shelved by the Federal Transit Authority (FTA) in 2003 due to cost, restoring rail service to the corridor resurfaced in the form of proposals to extend SEPTA Regional Rail from Norristown westward towards Berks County via an existing freight rail line.

The primary funding mechanism for this latter incarnation of new rail service in the corridor was a proposal to toll the US 422 Expressway and efforts proceeded under the expectation that this was feasible for several years. The idea, however, was abandoned in 2011 following strong public opposition that emerged when presented as part of public presentations of the US 422 Master Plan. This has left prospects for new passenger rail service in the corridor uncertain, though the passage of Act 89 in November, 2013 has renewed hopes for an extension of rail service to King of Prussia from Norristown.

Other TDM strategies recommended that fall into this category of improved transport options include the construction of park and ride facilities, pedestrian and bicycle facilities improvements, the operation of vanpooling services and employee shuttles as well as the introduction of bus rapid transit (BRT) service in the corridor. While passenger rail service has been the most common transit improvement recommendation for the 422 Corridor, BRT (or express bus service, similar in some respects) has been a prominent recommendation in several prior plans and studies. The most explicit call for BRT was in the US 422 Corridor Master Plan, which identified the dedication of a portion of the US 422 right-of-way to BRT as an important opportunity for improved transportation in the corridor. The master plan further argues that BRT could be introduced in stages and that its effectiveness could be maximized by incorporating BRT with mixed-use and transit-oriented development, as well as in existing and future park-and-ride lots. The Pottstown Metropolitan Regional Comprehensive Plan and the Montgomery County Transportation Plan also include BRT recommendations. Both of these plans cite the ability of Intelligent Transportation Systems (ITS) improvements, such as traffic signal priority for buses and on-board GPS (needed for real-time arrival information systems), to complement BRT service.

The second most prevalent type of TDM recommendations in past studies and plans in the corridor fall under the category of land use and parking management. Initiatives such as the US 422 Corridor Master Plan place significant emphasis on smart growth planning practices: encouraging development at higher population densities; revising
zoning codes to permit a greater diversity of mixed land uses; and revitalizing existing
town centers in the corridor to promote walkability and the use of alternative
transportation modes. Another common recommendation is one found in the Montgomery
County Transportation Plan which calls for the adoption of development site design
standards that incorporate transportation needs including pedestrian and bicycle use.
Other plans go further by proposing specific recommendations like transit oriented
development (TOD) and trip reduction ordinances or requiring that TDM be a part of
development approval processes.

State and regional policies that promote TDM generally make recommendations
that can be classified in this same category of land use and parking management. The
regional DVRPC Connections 2040: Plan for Greater Philadelphia emphasizes infill
development practices, traditional neighborhood design (TND) and concentrating future
development around existing urbanized areas and town centers that promote transit
oriented development. Similar recommendations are echoed in the Pennsylvania
Department of Community and Economic Development (DCED) State Land Use and Growth

The DCED report encourages future “green” and walkable development, typical of
smart growth policies, and speaks to a larger overall statewide policy initiative to
encourage state agencies to implement plans that promote “sound land use.” This
statewide initiative stems from the 1999 Land Use Planning Executive Order (1999-1)
which initiated an Interagency Land Use Team.

The principles of sound land use planning were further developed by the 2005
Keystone Principles and Criteria for Growth, Investment and Resource Conservation. These
principles and criteria are intended to guide state agency investment towards projects that
achieve economic development and conservation of valuable natural resources. PennDOT
embraced this state-level effort by developing a series of internal procedures, guidance for
local municipalities and funding streams that promoted the integration of transportation
and land use. PennDOT publications include the PennDOT Sound Land Use Implementation
Plan (2000), Transportation Impact Fee Handbook for municipalities (2007), and the Smart
Transportation Guidebook (2008) which called for context sensitive design in PennDOT
projects.

In addition to land use recommendations, regional and state plans also outlined
strategies that go beyond the VTPI TDM strategy categories by recommending that
Intelligent Transportation Systems (ITS) or Transportation Systems Management
(TSM) be integrated into comprehensive TDM programs. Some of the most common such
recommendations included incident management and response on major expressways as
well as travel advisory information to be supplied to commuters via variable message signs
along roadways. These recommendations were a key component of both PennDOT District
6-0’s Regional Operations Plan and DVRPC’s Connections 2040 regional transportation plan.
TDM Strategies Implemented in the Corridor

In any planning effort, strategies for addressing a particular problem are always easier to recommend than they are to implement. And the degree to which particular recommendations are challenging to implement can vary widely. The next two sections of this report address some of the specific barriers to implementation of TDMs in the US 422 Corridor, but first identifies those TDM strategies recommended in previous plans and studies that have already been translated into action.

The information for this section of the report was obtained from Greater Valley Forge TMA (the regional TMA serving most of the corridor and a partner organization in the creation of this report), municipal smart growth planning data obtained from a 2013 survey conducted by the DVRPC Office of Smart Growth, and the review of prior plans and studies and state-level policies which are listed in appendix A and B, respectively.

Three general types of TDM recommendations have seen the highest levels of implementation in the US 422 Corridor during the past two decades: improvements to bicycling and pedestrian infrastructure, the provision of ITS incident management and traveler information services, and the establishment of stakeholder groups and regional planning processes.

- Investments to improve transportation opportunities for bicycle and pedestrian users are most evident in the bike sharing programs that have been initiated in both Pottstown and Phoenixville as well as significant investment in the Schuylkill River Trail throughout the US 422 Corridor. A section of the trail from Spring City west to Pottstown is currently under construction along with Sullivan’s Bridge, which will connect the trail to the King of Prussia area. Municipalities are also pursuing grants to better connect the trail to schools and commercial areas throughout the corridor. Tredyffrin Township’s recent work to complete the Chester Valley Trail merits attention as does the planning efforts to connect the Schuylkill River Trail to the Chester Valley Trail which will create a very extensive network for bike travel.

- Past regional plans that include strategies to promote bicycling as a TDM option include DVRPC’s Connections (2035) Plan and Connections (2040) Plan. These plans identify a 1,700 mile regional trail network and a smaller 750-mile multiuse trail network called the Circuit. Presently, 250 miles of trail exist with additions underway. The plans also include capital for bike lanes, sidewalks, streetscapes and other bike/ped infrastructure. DVRPC estimated that the trail network will be completed by 2040 with ample funding, but with only minimal funding about 80% of the Circuit is estimated to be completed by 2040. The hub of the regional trail network, Philadelphia, experienced a bicycle commuting rate increase of 260% between 2005 and 2013. This ranks Philadelphia first in mode share for bicycle commuting among the ten biggest U.S. cities. As the Circuit is completed and expands outward into the suburbs bike infrastructure should improve in a larger geographic area. A report published by the Bicycle Coalition
of Philadelphia states that “buffered bicycle lanes carry 131% more bicyclists than streets with no bike lanes within the Philadelphia region”. While investments in bicycle share programs and bicycle trails and lanes have not yet significantly affected traffic congestion levels in the US 422 Corridor, this research suggests that a similar rise in bicycle commuting could occur in suburban communities in the US 422 Corridor as bicycle infrastructure improvements are made.

- **ITS/TSM improvements in the corridor initiated and managed by the PennDOT District 6-0 Regional Traffic Management Center (TMC) in King of Prussia have been largely successful.** There are currently ten closed circuit television cameras monitoring traffic in the corridor, two permanent variable message signs, an incident management task force was established in 2010 managed by GVFTMA and there are two roving response trucks in the corridor daily to respond to accidents and disabled vehicles. PennDOT District 6-0 is also installing a high speed Fiber Optic communications network in the corridor to obtain automated real time traffic information. GVFTMA has contributed to these efforts by hosting websites which provide traffic information and alerts directly to commuters such as PhillyTraffic.com and 422improvements.com.

- **The establishment of stakeholder groups and regional planning processes to address congestion on US 422: The 422 Corridor Coalition is a group of private and public stakeholders who meet to discuss congestion and potential solutions for the corridor. GVFTMA continues to expand its network of partnerships with public and private organizations to promote transportation alternatives. And the corridor has pursued a number of corridor-wide planning efforts including the US 422 Master Plan, initiated by DVRPC.**

For many of the recommended TDM strategies in the corridor, there are signs of progress with regards to implementation but also clear limitations to fully realizing success. Many of the employer-based TDMs have been only partially implemented with some companies offering more comprehensive solutions than others. GlaxoSmithKline (GSK) and Vanguard, two major employers in the region, offer flexible and alternative work schedules, promote RideEco the regional pre-tax transit commuter benefit, and offer some type of employee shuttle service. The Connector shuttle service has been a major improvement in the King of Prussia office park area. However, many of these shuttles connect employees to regional rail lines which are only located at the eastern end of the corridor, so full coverage of these services throughout the corridor has not yet happened.

Three Park-and-Ride lots have been created at interchanges along the corridor, but a 2013 study conducted by GVFTMA showed that they are underutilized. GVFTMA is involved in many efforts to promote alternative transportation modes including Dump the Pump and Car Free Day, the annual Bike to Work Challenge and an awards system for recognizing companies that promote sustainable transportation. These efforts are integral to the education of commuters about transportation alternatives and existing programs,
but have not been sufficiently effective to convince significant numbers of commuters to reduce their use of private cars.

The list of TDM recommendations which have been implemented inconsistently in the corridor also includes basic smart growth planning practices and policy and institutional reforms. Smart growth planning principles are evident in plans for the corridor including the Montgomery County Transportation Plan and the Pottstown Metropolitan Regional Comprehensive Plan. Further, some municipalities have enacted TND ordinances and transportation impact fees on development. However, these policies appear to be concentrated in existing communities like Pottstown and Phoenixville, which already reflect traditional urban design principles of mixed uses and high and efficient population densities. These policies are less evident in the suburban growth townships. While a level of joint-municipality comprehensive planning in the corridor is evident in the Pottstown and Phoenixville regional planning committees, translating this into a set of coordinated, enforceable regulations is not. The regional comprehensive plans have very little legal muscle, and the corridor does not possess a regional zoning ordinance or some of the stricter land use ordinances like trip reduction ordinances which further integrate transportation into the land development process.

Recommended TDM strategies which have very low levels of implementation in the corridor include steps to expand or enhance existing transit systems in the form of an express bus service or increasing service frequency. An express bus service was available in the corridor at one time but was abandoned due to lack of funding. While bus rapid transit (BRT) has been recommended for the corridor in several prior plans and studies, no comprehensive efforts to analyze the feasibility of a BRT system in the US 422 Corridor have been undertaken. Throughout the corridor's history, BRT has been overshadowed by a preference for passenger rail service. To date, an alternatives analysis to examine a range of potential alternative modes (including both rail and BRT) to address the corridor's transit needs has not happened.

Additionally, a viable and extensive car sharing or vanpooling program has not been implemented in the corridor or region. There are some employer shuttles operating in the area and one limited township shuttle service in Upper Merion Township, but extensive and easy-to-use tools to promote car sharing like a commute matching database are not available to area commuters. DVPRC does manage a Mobility Alternatives Program that allows commuters to connect with other commuters, but the technology is not as advanced and robust as that available in other regions of the country. In addition, more advanced land use policies and ordinances to promote smart growth and the integration of transportation and land use have not been implemented very much at all. Only two municipalities in the corridor have passed TOD ordinances, in part due to the lack of viable transit in the corridor. Few municipalities appear to incorporate site design standards that account for transportation needs including bicycle and pedestrian travelers beyond loose sidewalk provisions.

Some TDM recommendations in prior studies and plans have not been implemented to any extent. These include TDM policies that would only work given significant capital
investment or recommendations which are politically unpopular. The development of passenger rail service in the corridor, for example, has not yet been implemented nor can it be in the foreseeable future given cost, planning and engineering, and other challenges. Major incentives or disincentives to using alternative transportation modes have not been implemented either. HOV lanes have not been established anywhere in the corridor and user fees (tolls) were abandoned following strong public opposition to such proposals for the US 422 Corridor and several years before that for Interstate 80. Additionally, strict ordinances which incorporate TDMs into the development approval process, commonly referred to as trip reduction ordinances, have never been adopted in the corridor.

Some of the reasons for lack of implementation of recommended TDMs can be surmised from the summary provided above. Several significant hurdles are the lack of an extensive, viable mass transit alternative to personal automobile use; political barriers to the adoption of strict land use ordinances; and insufficient resources to fund capital improvements. There are, in addition, other less evident obstacles to TDM implementation in the corridor. Overall, there is a lack of a comprehensive, coordinated effort among agency levels to clearly define TDM, to identify appropriate TDMs for the corridor and to establish a course of action accompanied with performance measures to translate these recommendations into implementable policies and programs. The approach to TDM in the corridor to date has been piecemeal and a more comprehensive and collaborative TDM program would have to be implemented for significant progress in managing travel demand. The next section of this report goes into more detail regarding the challenges that exist in the corridor to implementing TDM recommendations.

Barriers to Successful TDM Implementation: A Local Perspective

After interviewing and receiving feedback from 20 stakeholders from 14 organizations along the US 422 Corridor, we have identified several key challenges and barriers that have prevented a comprehensive and successful implementation of TDM strategies. Through this interview process valuable insight into what has prevented effective TDM implementation in the past and what could be done to avoid the same failures from reoccurring in the future was gained. In addition to this, stakeholders provided guidance on how they felt TDM programs and policies should be implemented in communities in the corridor. The stakeholders interviewed included regional and county planning commission professionals, municipal officials, PennDOT staff-members, and representatives of economic development organizations and private corporations. Individual interviewees were selected based on their ability to make important TDM implementation decisions within their organizations.

Defining TDM

Each stakeholder defined TDM differently, but all interviewees agreed that successfully implemented TDM strategies have the potential to help reduce congestion.
Some interviewees also suggested that TDM can help to improve air quality. It was evident that some respondents had briefly researched the acronym to prepare for the interview, while others had a strong working knowledge of the concept that predated the interviews. The level of familiarity with TDM correlated with the field the interviewee worked in. The interviewees from municipalities and corporations were less familiar with the acronym than planners and engineers. The planners and engineers tended to be more familiar with the term; however, even they indicated that the term TDM is not often used in their day to day work activities.

Though the level of familiarity with the term TDM varied, almost every interviewee could describe TDM in at least its broadest sense. The most common reply when asked to define TDM was that it was the term used to describe strategies that provided alternatives to the single-occupancy vehicle (SOV).

The inability for interviewees to clearly and consistently define TDM and the lack of awareness of the term among non-transportation professionals is an implementation barrier. A clear definition that is consistent among all professionals needs to be developed and incorporated across disciplines.

Education

All of the interviewees stressed the importance of educating municipal officials and the public on the importance of TDM strategies because of TDM’s potential to help reduce congestion and improve air quality. These strategies are also more cost effective than highway expansion. Many interviewees suggested that adding capacity to the US 422 Expressway is not the most efficient use of limited transportation dollars. Most of the interviewed stakeholders pointed toward Transportation Management Associations as a key player in the education process.

Experienced municipal and economic development professionals, as well as representatives of large private corporations located within the corridor, insisted that members of younger generations are beginning to understand the benefits of TDM. These interviewees believed that younger people should be the target of education efforts as they are more likely to adapt commuting habits that include a variety of travel modes. The interviewees based their statements largely on first hand professional observations and experiences. Most agreed that younger people are more open to mixed-use and higher density zoning, alternative transportation options, and new TDM technologies. Interviewees believed that younger, tech-savvy generations are environmentally conscious and want to bike, walk and use mass transit, which means that sustainable transportation and TDM could be in higher demand as time goes on. These generational differences will be important for stakeholders to be cognizant of when implementing TDM programs.

But researchers have come to some contradictory findings concerning generational differences in travel behavior. Researchers at the University of California Transportation Center, for example, found “moderate generational effects on travel behavior” leading them to conclude that younger commuters appear to drive alone to work as frequently as
similarly aged workers from earlier generations, though they make slightly fewer trips and travel fewer miles. A report by the FHWA states that social media is an integral part of reaching Millennials with transportation updates. It also states that technology has helped make Millennials smarter and more efficient travelers. These reports illustrate that younger generations are more tech-savvy and knowledgeable about travel updates, but when they travel younger people still generally prefer to use single-occupancy vehicles.

The need to better educate municipal officials was mentioned in approximately 70% of the interviews. Within a municipality many people including elected officials, municipal managers, and volunteer boards all make decisions that significantly impact TDM strategies. A common theme throughout the interviews was that some of the officials that hold these positions lack the appropriate knowledge about the importance of TDM and the affect it has on the community. The interviewees suggested that more directed education and training focused on TDM is needed. This education and training could be conducted by local TMAs. Stakeholders also stressed the importance of educating municipal officials and the public on the high return on investment of TDM initiatives in comparison to building new infrastructure. Many of the interviewees explained that finances are an integral part of public sector decisions, and that marketing the fiscal benefits of TDM will be critical to successful TDM implementation within the US 422 corridor.

Funding Priorities

The failure of the Schuylkill Valley MetroRail project is an example of the need for better education and more TDM funding along the US 422 Corridor. This proposed to extend SEPTA regional rail to Phoenixville, Pottstown, and eventually to Reading, Pennsylvania. In an effort to generate revenue for the project a campaign to establish tolling on Route 422 was launched. The failed attempt to institute tolling was the only TDM strategy mentioned in the interviews that had been met with political opposition. The public discontent led to a lack of political will to pursue tolling, which would eventually lead to the demise of the entire project. Interviewees stated that past tolling failures will make future tolling efforts much harder. Despite a lack of funding, both county planners and municipalities still hope that regional rail will be extended in the future.

Interviewees suggested that a lack of funding is one of TDM’s greatest challenges to successful implementation along the corridor. It should be noted that despite the funding deficiencies, significant TDM investments have been made along the corridor. These investments include Intelligent Transportation System (ITS) camera installations up to Route 29 at the Oaks interchange, multi-use trail development, and park and ride lots. Historically, on a regional level, priority has been given to adding capacity through the widening of highways. Route 202 between Upper Merion and Exton is an example of this. Route 202 section 400 was expanded from four lanes into six lanes and currently section 300 is being expanded to six lanes. The Route 422 Bridge over the Schuylkill River south of the Trooper Road interchange is scheduled to be expanded as well. Interviewees emphasized that in order for TDM to be implemented successfully and compete against highway expansion, TDM has to be a priority for the region and the corridor. In order for TDM to become a priority the interviewees felt that people need to better understand the
economic and environmental impact TDM can have as opposed to highway expansion projects.

To help with TDM implementation DVRPC receives approximately $64 million in CMAQ funds each year, with approximately $4.0 million (6 percent) allocated to TDM each year. The majority of this funding is allocated to the area’s TMA organizations including GVF TMA. PennDOT provides funding for each TMA through two funding mechanisms: 1) the TMA Assistance Grant and 2) the Mobility Alternatives Program.

In addition to providing important insight on what challenges and barriers exist, stakeholders also provided insight on how to address these issues. One of the most common responses received was that better utilization of advanced technologies in the form of Intelligent Transportation Systems (ITS) and user friendly mobile applications is key to successful TDM implementation along the US 422 Corridor.

User Friendly Technology Platforms

The consensus among interviewees was that going forward a more user friendly application of some sort must be developed and deployed. Suggestions for this application (app) varied, but each one included a smartphone app that allowed commuters the ability to view and compare transportation options available to them in real time. Despite the widespread agreement on the need for user friendly technology to be developed, none of the interviewees gave concise or specific suggestions on exactly what they would like to see implemented. Generally interviewees agreed that a “one stop shop” for transportation options was needed.

Marketing

Several of the interviewees indicated that existing TDM strategies, such as carpooling, bus service, and biking are underutilized. Despite its underutilization many of the interviewees were optimistic that biking is becoming a more common way to travel. The interviewees all emphasized the importance of better marketing transportation alternatives that are available in addition to educating people about the benefits of TDM. Marketing TDM initiatives through websites, social media, direct employer outreach, and events is needed to inform people about available transportation options. Local TMAs and other organizations do currently market transportation options, but more can be done to reach out to the public through the use of new and innovative technologies.

Intelligent Transportation Systems (ITS)

Most stakeholders view ITS as a form of TDM. ITS is a way to better manage the entire transportation system in a coordinated way through the use of advanced communication technologies and smart transportation infrastructure. ITS includes coordinated traffic light signal timing, dynamic message boards (DMS), and real time travel
data capture among other technologies. ITS can be utilized to enhance ridesharing, traveler information, shoulder running, ramp metering, and incident management communication.

Land use

All interviewees felt that the demand for suburban style housing opportunities has decreased the prospect for successful TDM implementation along the corridor. “Sprawl” has created isolated and fragmented land uses that are not conducive to TDM initiatives like public transit, carpooling, biking and walking. Pronounced AM and PM rush hour peaks identified by DVRPC are a result of these sprawling development patterns. Beyond these peak periods, there is little to no congestion on weekdays.

Short term solutions

The respondent’s solutions to more effectively implementing TDM can be broken into short term solutions and long term solutions. Short term solutions are often less costly, yet still very effective initiatives. The private sector plays a major role in implementing short term solutions. Long term solutions are generally more expensive and require more political backing. These projects are often initiated by the public sector.

Stakeholders believed that developing better ways to promote existing transportation options and current TDM strategies are the most cost effective ways to utilize existing TDM initiatives. Many of the interviewees felt that one of the best ways to encourage commuters to utilize transportation options that are currently available, is to work directly with private corporations. Interviewees believed that private corporations have the ability to encourage and incentivize carpooling, teleworking, flex time, and biking. Many of the public sector organizations interviewed highlighted the important role that the private sector has in implementing these TDM strategies. Some corporations like GlaxoSmithKline (GSK) are already implementing TDM even though they were unaware of the term. GSK provides biking amenities for employees, promotes carpooling, and encourages the use of public transit.

Short term initiatives identified by interviewees include:

- Preferred parking for carpooling,
- Companywide carpooling databases,
- Shuttle services,
- Connections to public trails,
- Bike and pedestrian amenities that include lockers, showers, and bike parking, and
• Creation of flex time and telework policies

Long term solutions

Interview respondents felt as though long term solutions are generally costly, initiated by the public sector, and more political in nature. The potential for rail service along the corridor was discussed during most of the interviews. A small number of stakeholders were optimistic about the possibility of rail service, while the majority stated they would like to see rail service but did not think it was a feasible reality presently. Providing rail service within the corridor would be very expensive and many interviewees felt that a bus rapid transit or an express bus service is a more viable option. Others wanted to see more shuttle services similar to theconnector shuttle that operates in King of Prussia.

Many interviewees felt as though land use is one of the greatest barriers to TDM implementation. Interviewees suggested that for TDM to be effective, land use patterns need to shift to include higher densities and a mix of uses. The majority of public sector interviewees agreed that future growth should be focused in urban core municipalities within the corridor. Interviewees from both Chester and Montgomery Counties mentioned that they have developed comprehensive plans that encourage urban growth. At the municipal level, Phoenixville Borough has begun to see revitalization efforts and now Pottstown is starting to see increased investment in the downtown. Pottstown would like to see more commercial redevelopment to help diversify the tax base and allow residents to live, work, and play in the same community. There was a common belief among stakeholders that development in these urban cores will help to reduce the demand for Route 422. According to one interviewee, King of Prussia would also like to see increased development but in the form of residential housing. The King of Prussia area has over 57,000 jobs but limited residential options. The interviewee felt that by encouraging residential growth, people will be able to both live and work in the same area, which would increase the viability of biking, walking, and public transit use.

Long term solutions identified by public sector officials:

• Hard shoulder running (PennDOT is currently studying feasibility),

• Ramp metering (has potential at some of the intersection points along the corridor),

• Bus rapid transit/express bus/ and shuttles are seen as possible public-private partnership opportunities,

• Trail extensions and connections,

• Addition of ITS infrastructure,

• Rail service extension, and
• Creation of mixed use and dense development districts

Other Key Commonalities

• Almost all of the stakeholders had a slightly different version of TDM. While all of the interviewees were familiar with TDM strategies, they were not all familiar with the acronym “TDM”. Some were more familiar with the term than others. Generally speaking, most felt that TDM is about providing transportation options.

• Most stakeholders would like to see concise implementable recommendations as an end product of this study.

• Some interviewees indicated that many plans have been completed in the past, but no plan has comprehensively addressed TDM. One suggestion was to complete a US 422 TDM based Master Plan as a follow up initiative.
IV. National Best Practices in TDM Implementation

Though TDM strategies have been inconsistently applied by private employers and local, county and regional governments in the corridor, it has not been for lack of successful examples of effective TDM policies in other parts of North America. A review of the professional literature and select interviews with stakeholders involved in key TDM programs and strategies across the country suggest the following best practices:

- Integrated TDM programs across jurisdictions;
- Integrating TDMs into land use and transportation planning processes;
- Performance measurement;
- Decentralized implementation of TDM strategies;
- Pricing and incentives to influence mode choice and travel demand;
- Communication techniques and other technologies;
  - Public and institutional outreach and promotion; and
  - Multimodal traveler information and coordination systems; and
  - Other ITS Technologies

Each of these practices has distinct applications along the 422 Corridor which are discussed briefly after presenting the findings of the review.

Integrated TDM Programs across Agencies and Jurisdictions

A number of recent publications on TDM implementation highlight the importance of consistency and integration of TDM programs across jurisdictions. This is particularly important from the traveling public’s perspective, since users of TDM programs (e.g., rideshare or traveler information) are easily turned off when forced to navigate through multiple organizations or programs. While some TDMs require implementation at the site (e.g., a shuttle service at an individual employer) or municipal levels (e.g., transit-oriented development zoning codes), there are usually substantial benefits that result from consistency, cooperation, and coordinated program funding efforts within a transportation corridor, county, region, or state.

To accomplish this, the programs are closely coordinating their efforts with city and county governments as well as transit agencies, MPOs, and state DOTs. This coordination and collaboration serves to make a consistent experience for the traveling public and enhances the benefits to them while helping achieve the policy goals of all participating agencies.
Encouraging the formation of Transportation Management Associations (TMAs) such as Greater Valley Forge Transportation Management Association is an effective approach to providing a consistent and integrated set of TDM programs. TMAs provide an institutional framework for TDM programs and services. Since they are generally public-private partnerships, TMAs can effectively bridge the gap between public agencies and private employers, providing a means by which a private company can provide commuter trip reduction services directly to their own employees, thereby avoiding challenges sometimes associated with government-run programs. Measuring the effectiveness of TMAs and other multi-jurisdictional TDM programs are discussed in the Performance Measurement section below.

By coordinating with employers and their TMAs, public agencies can provide consistent, cross-jurisdictional TDM services while leveraging the efficiencies and customer responsiveness of privately-run organizations. Coordination and collaboration between employers through TMAs can also level the playing field between large and small companies, providing equivalent services to all, as well as providing those services with greater efficiencies with economies of scale.

At first glance many TDM implementation challenges appear technical in nature, when in fact they are more institutional requiring coordination between agencies and jurisdictions. For example, in 1990s the San Francisco Bay Area’s MPO (the Metropolitan Transportation Commission, or MTC) started to develop a unified transit trip planner website for the region’s 15 transit agencies. While the challenges appeared to be technical, requiring the adoption of or migration to a coordinated system of data transfer standards and procedures for all agencies, getting all these agencies to agree on what those standards should be and committing the resources to make it happen proved a long and difficult process. Building collaborative partnerships between MTC and the region’s transit agencies was the key to the successful roll-out of the 511.org transit trip planner web application. Since MTC had no money available in the early years with which to pay the transit agencies for this collaborative work, they had to encourage their cooperation by focusing on developing the trip planner’s systems in ways that would have direct benefits to the transit agency’s own operations.

Application to 422 Corridor

Despite the involvement of various State, County, and Regional agencies it is apparent that many TDM efforts are implemented in a piecemeal fashion in the US 422 Corridor by municipalities or individual employers. In addition to the work of GVFTMA, another notable exception to this is the considerable contributions that various entities have made towards completing different parts of an extensive system of multi-use trails that provide access for biking to and along the corridor. Nonetheless, an important goal for the corridor will be to apply similar principles to other TDM elements ideally based on a plan that allows individual actors to fill in pieces as their own resources allow.
Integrating TDMs into Land Use and Transportation Planning Processes

Collaboration between partners to implement and manage TDM policies and programs can take many forms, but one best practice approach attracting a lot of attention recently involves the coordinated adoption of policies that support TDMs into the land development and transportation planning processes at the regional level. By firmly rooting TDMs into the everyday and long-range planning processes, TDM programs make themselves relevant and important to the day-to-day work of planners, engineers, public decision-makers and developers.

Contra Costa County in California provides a useful example of how this can be done. Their countywide transportation plan requires all city governments to adopt a resolution that commits them to participate in the county’s TDM programs. Without this resolution, the county may elect to withhold local streets and roads capital improvement funds until the city complies. To maximize efficiency, the county delivers these programs on behalf of its constituent local governments. Every year the county measures the effectiveness of these countywide TDM programs. For example, in 2008 they reported that their transit incentive program reduced the number of trips by 22,455 and VMT by more than 36 million miles in the previous year. (Note: CFA is investigating the requirements of this system and the outcomes/benefits of the countywide requirement for a TDM resolution.)

One prominent method of TDM and planning process integration involves including TDM principles into transportation and land use policies and long-range plans. A recent study by the Volpe National Transportation Systems Center found that TDMs are increasingly being seen by regional agencies as important, mission-critical elements of their regional planning processes. The Volpe report highlights four MPOs—Denver Regional Council of Governments (Denver, CO), Metropolitan Council of the Twin Cities (Minneapolis/St. Paul, MN), Pima Association of Governments (Pima, AZ), and the Sacramento Area Council of Governments (Sacramento, CA)—that have been working to integrate TDMs into their regional and local planning processes, thereby yielding benefits from TDMs that are “greater than the sum of their parts.” Specifically, these MPOs have embraced TDM by including it explicitly in their visions and long-range plans, requiring new transportation projects use (or at least consider) TDM alternatives, and using standalone plans, special funding programs, and collaborative working groups to promote TDM programs in their regions. By incorporating TDM principles throughout the transportation planning process, rather than as a separate or add-on activity, some MPOs are beginning to reap richer rewards from these policies and programs than would be possible without this more holistic, regional approach.

One approach to integrating TDMs into the planning process at the regional level involves the MPO providing guidance and encouragement to local governments. The San Diego Association of Governments (SanDAG), the MPO for the San Diego region, recently developed a set of reference guidelines for its constituent local governments, titled “Integrating Transportation Demand Management into the Planning and Development
Process.” The document provides guidance on how local governments can fit TDMs into their long-, mid-, and short-range plans.

**Long Range Plans:** This includes guidance for general plans, and climate action plans. Compact land development strategies (such as transit- and pedestrian-oriented development and smart growth) are useful long-term TDM measures that regional and local land use and transportation planners can incorporate into their planning processes. To capture the maximum benefits, TDM professionals should get involved in the land development process as early as the rezoning application stage.

**Mid-range plans:** Highlights include master plans, corridor plans, parking management plans, and municipal TDM plans. These plans are often developed with the understanding that more than one jurisdiction will have stake in the outcomes. Even if there is a State or County level agency that takes the lead in developing and promoting the plan, there is usually a strong emphasis on establishing coordination of both vision and implementation among co-equals jurisdictions. The State of Maine’s Gateway 1 corridor planning process is a good example where coordination among nearly 20 municipalities and several other agencies succeeding in establishing effective land use planning policies with the specific intention of managing congestion. This experience highlights the benefit of a State agency facilitating a memorandum of understating among independent stakeholders where external authority to compel coordination is weak or non-existent.

**Short-range plans:** TDM programs and policies can be integrated most effectively with short-range plans such as mitigation plans. Cities like San Francisco and Alameda in California are working to adopt multimodal and transit-supportive level of service (LOS) analysis methods to augment or replace the standard, auto-oriented LOS methods typically used for environmental review. By adopting more multimodal and transit-friendly analysis methods, development impact mitigation can support the development of pedestrian- and transit-oriented environments, in contrast to the mitigation initiatives often used for auto-oriented LOS deficiencies which typically address congestion by building more road capacity.

At the state level, departments of transportation such as New Jersey’s NJDOT are working with stakeholders—including MPOs, local governments, and businesses—to incorporate TDMs into the state’s strategic plan. This plan will link department TDM goals to evaluation metrics that can help NJDOT and their stakeholders make decisions about which strategies they should pursue. Similarly, Georgia’s department of transportation (GDOT) has worked with a multi-agency group of stakeholders to develop that state’s equivalent of a strategic plan; one that includes the implementation and expansion of TDM services in the state.

The California Department of Transportation (Caltrans) has incorporated an explicit TDM performance-based objective into its statewide strategic plan to reduce the share of commute trips made by SOVs by 5 percent from 2005 levels by 2012. In parallel, the plan also provides a list of eight strategies for Caltrans to implement to achieve this objective.
These strategies include working closely with local jurisdictions on land use issues to promote mode shift and partnering with stakeholders and regions on implementing TDMs.

States can also play an important role in coordinating, supporting and funding the TDM programs of local governments. The New York State DOT (NYSDOT) works collaboratively with local governments to provide TDM services and programs at both the statewide and local levels. At the local level, NYSDOT funds three TMAs that are designed, implemented, and managed by local partners. At the statewide level, NYSDOT funds individual TDM programs with statewide significance and impacts.

Individual agencies, or even departments, can increase the benefits of TDM programs by establishing agency- or department-level protocols for integrating TDM into projects. However, it is important to note that these protocols and policies need to be integrated with and complement the TDM programs and land use and transportation policies of other governmental agencies in the region of interest. In the case of Caltrans, TDM programs are incorporated into the project initiation phase of planning for new transportation projects. Caltrans’ decentralized organizational model promotes the involvement of local and regional governments in planning and implementing TDM programs, and helps ensure that the project-level TDMs associated with Caltrans’ transportation projects are consistent with local and regional policies.

Whether it’s a transportation construction or a land development project, procedures and requirements should be established for considering and/or incorporating TDM into traffic mitigation and management plans, construction mitigation plans, and the incorporation of alternative mode facilities into new highways and roads. Planning departments should consider adding a step to their project planning phase to consider and incorporate TDM; both as a project alternative (instead of a construction project) and as a project mitigation. A recent report for the Washington D.C. Department of Transportation takes this a step further, recommending the district require all development plans, regardless of size, address TDM requirements.

Coordination across stakeholders can be facilitated and encouraged by developing a common set of TDM performance measures that inform stakeholders and direct resources to partners and programs that need it most. The next sub-section provides discussion of the performance measurement and collaborative methods regional partnerships can use to facilitate successful TDM program implementation and operations.

*TDM without Land Use Controls*

The consensus appears that to be most effective TDM requires some form of land use controls. However, there are avenues to pursue specific goals that do not involve direct government regulation of land use to succeed. The benefit of land use controls is that they focus efforts by reinforcing the incentives to take the long view on aggregate outcomes. Without land use controls, it is acknowledged that the pain inflicted by congestion can serve as an inspiration to organize, but also a warning that the tendency of commuters to
adapt to hardship could mean that by the time private actors are motivated to address the relationship between land use and congestion it may be too late.

The best approaches to take in these instances appear to be incentive based. Direct financial incentives can be supplemented by demonstrating the benefits to developers to voluntary participation in TDM or TDM like initiatives at the site and building level. In this regard LEED certifications have been a useful way to leverage private sector interest and similar effects have been attributed to Best Workplaces for Commuters (BWC) recognition.

Application to 422 Corridor:

Home rule considerations are a clear constraint on integrated long range planning. Nonetheless, a committed and well-organized process that focusses on building consensus around what the problems are and a shared vision for solving them is worth floating at the regional level. In the interim, a corridor planning effort that seeks to educate municipal officials and promulgate agreements such as memoranda of understating across the 422 “travel shed” could be extremely useful to align both land use goals and implementation strategies across boundaries. In the immediate situation, the tools that encourage voluntary engagement in TDM at the site and building level are worth consideration.

Performance Measurement

The measurement of the impacts of TDM programs and policies is an important issue, though a complex one. The most significant issue involved in measuring TDM performance is the difficulty in disentangling the benefits of one program from other concurrent programs and the whole package of TDM programs from other factors affecting travel behavior. The range of TDM effectiveness varies from site to site from program to program and region to region - this is certainly in part due to variations in context as well as variation in performance. It has been suggested that the focus on accuracy in estimating trip reduction effects, for example, be compared by analogy with the widespread tolerance for uncertainty when applying average rates for trip generation for uses that exhibit wide ranges according to the local data. The fact that trip reduction measures can vary wildly has been taken as a justification for dismissing TDM effectiveness raising the question why “trip reduction estimates should be held to a higher standard than estimates for trip generation.”

The difficulty establishing performance measurement practices has also been exacerbated by the tendency in many settings to give credit for simply making an effort – especially early in the proliferation of TDM programs, where emphasis on responsibility for providing programs did not always translate into accountability for their effectiveness. While program participation is certainly an important goal, measures that illustrate effective outreach are equally important and ultimately attention will be drawn to progress in terms of mode split or vehicle trip and VMT reduction.
TABLE 5: SAMPLE FINDINGS ON INDIVIDUAL TDM INITIATIVE EFFECTIVENESS

<table>
<thead>
<tr>
<th>TDM Initiative</th>
<th>Mode Share</th>
<th>New Transit Riders</th>
<th>Peak-Hour Traffic</th>
<th>Vehicle Trips</th>
<th>VMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanpools</td>
<td>2%-8% vanpool mode share</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Park- &amp; Ride Lots</td>
<td></td>
<td>0.2 transit riders added for every P&amp;R space</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employer Parking Pricing</td>
<td>-21% Avg. SOV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-10% SOV transit-poor areas</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-36% transit-rich areas</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>CBD Parking Supply Restrictions</td>
<td>Avg. &lt; 50% SOV, while those w/out &gt;50%</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Congestion Pricing (20-50% reduction in “shoulders-of-the-peak” tolls)</td>
<td></td>
<td>Avg. between -4% &amp; -5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employer Support Actions (travel alt. info., assistance seeking out &amp; using alt., marketing &amp; promotional activities)</td>
<td>Avg. between 0% &amp; -5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guaranteed Ride Home</td>
<td>Avg. between 0% &amp; -5%</td>
<td></td>
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<tr>
<td>Employer Transportation Services</td>
<td>Avg. -9% w/out modal subsidies</td>
<td></td>
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<tr>
<td></td>
<td>Avg. -27% w/ modal subsidies</td>
<td></td>
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<td></td>
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<tr>
<td>Compressed Work Week</td>
<td>Reduce % traffic in ½-hour peak by avg. 14%</td>
<td>-15% among participating employees</td>
<td></td>
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<tr>
<td>Telecommuting</td>
<td></td>
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<tr>
<td>HOV Lanes</td>
<td>6%-20% increase in freeway avg. vehicle occupancies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional Effect of TDM Programs</td>
<td></td>
<td>Between -3% &amp; -5%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data Sources: See Appendix D.

Finally it is worth noting that the effectiveness of any form of TDM is significantly enhanced by the coincidence of other supporting forms of TDM. It has been observed that levels of participation and trip reduction outcomes based on transit vouchers alone may improve more than proportionately when coupled with a guaranteed ride home program, for example. Unfortunately according to a recent study by the Volpe National Transportation Systems Center, TDMs are typically incorporated into regional transportation and land use plans piecemeal. As a result, most regions miss out on capturing the full range and power of TDM benefits that comes from developing an integrated system of TDM programs and policies. So, where it is possible to systematically combine TDM efforts, estimates of the effectiveness of any isolated type of activity could be
interpreted as a floor, or lower bound to expectations. In any case, with these necessary caveats in mind, Table 5 above presents a sample of findings from research on the effectiveness of discrete types of TDM initiatives.

In addition to measuring the effectiveness of isolated initiatives, emphasis has been placed on the measuring the performance of whole TDM programs. This emphasis has tended to come from the regional level and where this has been successful, MPOs and their partners develop a common set of performance metrics specifically designed to capture both the operational effectiveness and travel behavior outcomes of TDM programs. By regularly monitoring and evaluating TDM strategies, responsible public agencies can help their partners select the strategies best-suited for their needs and set realistic policy goals and objectives.

Contra Costa County in California uses a simple, straight-forward set of performance measures to track the effectiveness of their TDM programs. These include estimates of trip reductions, VMT reductions, greenhouse gas emissions reductions, and funds expended for each of their TDM programs. For example, in 2007 the county’s free transit pass program resulted in a reduction of an average 22,455 vehicle trips per day, 36 million vehicle-miles, and 16,000 tons of CO2 at a cost of $466,000. These performance measures help guide the county’s allocation of resources to its various programs and collaboration on them across a diverse group of stakeholders.

Arlington County Commuter Services in metropolitan DC has a well-established TDM performance measurement program that piggybacks off of data sources and models developed by the MPO (MWCOG) and supplements it with surveys and other tools specific to the programs it supports on its own. For each goal in its strategic plan, it has isolated a specific set of performance measure as well as the data sources to support them. This has allowed tracking performance on a quadrennial basis for mode share, VMT, program participation and commuter spatial characteristics since 2001, and to isolate specific performance such as a program wide shift of 41,000 trips from SOV to other modes in 2011.

SanDAG’s “Integrating Transportation Demand Management into the Planning and Development Process” guide suggests the following set of performance measures to evaluate and measure the success of TDM programs:

- Awareness – the portion of potential users who are aware of a program or service.
- Participation – the number of people who respond to an outreach effort or request to participate in a program.
- Utilization – the number of people who use a service or alternative mode.
- Mode split – the portion of travelers who use each transportation mode.
- Mode shift – the number or portion of SOV trips shifted to other modes.
• Average Vehicle Occupancy - Number of people traveling in private vehicles divided by the number of private vehicle trips. This excludes transit vehicle users and walkers.

• Average Vehicle Ridership (AVR) - All person trips divided by the number of private vehicle trips. This includes transit vehicle users and walkers.

• Vehicle Trips or Peak Period Vehicle Trips - The total number of private vehicles arriving at a destination (often called “trip generation” by engineers).

• Vehicle Trip Reduction – the number or percentage of automobiles removed from traffic.

• Vehicle Miles of Travel (VMT) Reduced – the number of trips reduced multiplied by average trip length.

• Energy and emission reductions – these are calculated by multiplying VMT reductions by average vehicle energy consumption and emission rates.

• Cost Per Unit of Reduction – these measures of cost-effectiveness are calculated by dividing program costs by a unit of change. For example, the cost effectiveness of various TDM programs could be compared based on cents per trip reduced, or ton of air pollution emission reductions.

The Freeway Performance Initiative (FPI) in the San Francisco Bay Area is another example of a TDM program that is built on a foundation of performance measurement that will serve to provide consistent assessment across corridors and reflect region-wide, multi-agency priorities. Using a robust set of performance measures helps this program to communicate effectively and coordinate the planning and implementation of TDM and construction projects across multiple agencies involved in any particular corridor. An FPI analysis of ramp metering, HOV, and other ITS and capacity enhancements for the State Route 4 corridor in Contra Costa County found that they would reduce vehicle-hours of travel by 48 percent, reduce VMT by 22 percent, reduce average corridor travel time by 56 percent, and total delay by 82 percent during the AM peak hour.

Measurement at the sub regional level has been more of a challenge but there are best practices to consider there as well. To address the variability in outcomes while still providing guidance the Center for Urban Transportation Research (CUTR) has developed a free modeling tool that assesses trip reduction impacts of mobility management strategies (TRIMMS). TRIMMS is an FHWA accepted tool for evaluating the costs and benefits of trip reduction tools based on program or initiative characteristics, supporting programs and other contextual inputs. Additional findings on measurement at the sub regional level are addressed in the following section on decentralized implementation.
Application to 422 Corridor:

Common definitions and measures are a foundation for coordinated action. Any planning process that seeks to establish supportive programs and/or land use policies across multiple entities must be able to communicate to each of these entities the costs and benefits in a broadly agreed upon manner. The issue is not simply one of building understanding of the implications of taking action versus failing to act in the face of growing congestion. This is also crucial to ensure accountability among all parties involved.

Decentralized Implementation of TDM Strategies

Tyson’s Corner’s Trip Reduction Program and WashDOT’s Trip Reduction Performance Program both exemplify the benefits of a decentralized implementation approach. The flexibility and improved accountability are significant benefits of these approaches. Another benefit is the manner in which performance measurement is integrated into the program implementation from the start.

The Tyson’s Corner Trip Reduction Program establishes trip reduction goals for developments based on both the size of the development and the distance to rail for the new DC Metro Silver line extension to Dulles Airport. This program has been able to capitalize on development pressure to ensure developer’s good faith participation across a menu of TDM options including ridesharing and transit subsidies as well as site specific elements such as bike lockers and showers, parking reductions etc. The distinguishing elements of the program arise from the fact that developers are not uniformly required to participate in specific elements of the program but that they are responsible for site specific trip reduction goals relative to ITE trip generation rates. They pay an upfront fee each year and success in meeting trip reduction goals results in rebates.

Furthermore, the program provides the tools and each property manager takes responsibility for applying these tools successfully. To help out, the TMA provides assistance that is targeted to the individual employees. This points to a second distinctive element: individualized marketing.

Whereas many TDM programs use surveys to monitor the efforts of employers and property managers in terms of promoting TDM, the Tyson’s Corner example involves surveying individual employees to relate travel behavior to origin and destination patterns and then customizes outreach to different segments of the traveling public based on the most realistic travel alternatives for that person or segment of people to contribute towards trip reduction. If a site fails to meet its goals everything is in place to conduct highly targeted outreach to maximize the potential change in behavior for the amount of outreach effort that is expended.

Washington State’s Trip Reduction Performance Program illustrates an even more dramatic approach to decentralized implementation, in this case, market-based to trip
reduction. This was originally instituted as a pilot in 2003 based on a $1.5 million grant authorized by the state legislature and operated through 2007. The program originated with the premise that WashDOT was essentially in the “capacity business” and that one alternative to paying to build new capacity was to “buy capacity” by paying for trip reductions. Each year the DOT estimated a dollar amount that it was willing to pay for each trip’s worth of road capacity saved through trip reduction. This DOT then accepted bids up to that amount from entrepreneurs with ideas on how to achieve these reductions. The final payment is based on the grantee’s success in achieving the performance they proposed. Over the first four years of the program ending in 2007, WashDOT saw a reduction of roughly 10,000 trips for an average cost of less than $250 per trip, well below WashDOT’s $460 willingness to pay.

In 2007 the program was renewed for another two years running through 2009 and funded by a $2.5 million grant. Due to budgetary constraints, the program has not been carried forward to today.

**Application to 422 Corridor:**

Decentralized approaches appear well suited to addressing the limitations identified in the 422 Corridor. Decentralized implementation encourages experimentation and the need to experiment is established by the difficulty of pursing TDM that has persisted to this point. Assuming measurement challenges can be addressed, the benefits of having individual actors figure TDM based on incentives structured by the region or the state has the appeal of demonstrating that if a set of solutions is available, some program participants will identify them. And if they work well, they will be emulated by others and attract energy and resources as a consequence.

**Pricing and Incentives to Influence Mode Choice and Travel Demand**

Congestion pricing methods, while often greeted initially with skepticism, have steadily gained attention in the past few decades. These methods include variably priced high occupancy toll (HOT) highway lanes, variable tolls on entire highway facilities, cordon charges, area-wide charges, and variably priced highway ramps. In this area of TDM practice, technological improvements have been driving institutional and regulatory changes that have led to pilot congestion programs in places like Miami, Denver, San Diego, and the San Francisco Bay Area.

Recent academic studies on the effectiveness of HOT and other managed lanes have found that in general, HOV (carpool) lanes are more efficient than HOT (priced) lanes when congestion is heavy since they offer a strong incentive to carpool, while general purpose lanes are more efficient than HOV lanes when congestion is light since they result in underutilization of lane capacity. Comparing HOT and HOV lanes overall (under all traffic conditions), HOV lanes provide more benefits directly to the traveling public, while HOT lanes provide more benefits in terms of social welfare since their tolls contribute to public coffers. A study of successful HOT lane projects found that early and intensive public
outreach efforts coupled with studies to assess travelers’ support and travel behavior reactions to variable pricing, were key elements in helping build political support. Finding local and state officials who will champion these projects is also important. FHWA’s recently released, “A Guide for HOT Lane Development,” recommends using measures of performance such as travel time and travel reliability to highlight the benefits of HOT lanes to the public and their representatives.

Pricing incentives can also be used to influence travel behavior through measures such as parking pricing, transit subsidies, and pre-tax benefits for non-auto travel costs.

Policies aimed at the management of parking availability and price have been shown to have direct and powerful effects on single-occupancy vehicle use. Effective methods to influence parking costs include parking charges, unbundling free or subsidized parking costs from employee benefits (such as so-called, “parking cash-out” programs), and variable parking charges based on real-time occupancies and demand.

Other financial incentive-based TDM programs include transit subsidies and pre-tax benefits offer the traveling public more affordable options to driving alone. By subsidizing the costs of riding transit—either through free or reduced-cost transit passes, providing free shuttles, or providing vanpool vehicles—public agencies can target specific corridors, trips, employers and even travelers and effectively reduce their costs of taking transit compared to driving alone. These financial incentives can substantially improve the desirability of leaving a car at home and using alternative modes.

Isolated evaluations of incentive based pilots have shown reductions in absolute drive alone trips of 27 percent (Seattle, CUTR) 24 percent, (King County) and VMT reductions of 28 percent relative to a control group (Florida, CUTR) for programs that lasted from between six weeks to several months and involved incentives of under $100. The difficulty in extrapolating from these findings is inherent in the short durations, as well as the small sample sizes resulting from the research focus of such pilots. An interesting finding of one study is that incentive programs that provide an incentive up front and then take it away or reduce when there is no change in travel behavior are more effective than programs that offer a reward to individuals after a goal has been met.

Application to 422 Corridor:

Although the cost of incentive programs always threatens to dispel the low-cost appeal that makes TDM an attractive option in general, a benefit in the context of the 422 Corridor is that without strong land use coordination this is a quick way to galvanize interest along the corridor on services and benefits that commuters may take advantage of to preserve their mobility while reducing their contribution to congestion. The drawback is that with a limited palette of existing options, kicking off with an elaborate incentive program may be putting the cart before the horse. Of course doing otherwise by providing transit improvements might be prohibitively expensive.
Communication Techniques and Technologies

Public/Institutional Outreach, Education and Promotion

According to a 2009 National Cooperative Highway Research Program (NCHRP) study, the success of 511.org is due in part to MTC’s effective marketing and outreach programs. Effective and innovative public outreach is often at the heart of any successful TDM program. Public outreach and promotion programs should not just be thought of as mere advertising, but should be built around providing information people need to improve their travel options, or in the case of outreach to public agencies, the tools they need to embed TDM programs into their day-to-day planning and operations.

Social marketing and incentive programs have become powerful tools for promoting non-SOV travel options. Social marketing efforts use educational programs, workshops, and other community outreach techniques to promote awareness and interest in TDM programs. Incentive programs can enhance the public interest in, and consequently, the effectiveness of, TDM outreach efforts. Metro, Seattle’s transit agency, promotes its TDM programs by offering prizes to commuters who switch from driving alone to an alternative mode.

Employers can also help with TDM outreach efforts, providing information to their workers on commute options (including bike-to-work days, transportation fairs, and contests). Some large employers (or smaller ones with the assistance of a good Transportation Management Agency) provide transportation coordinators who can help employees find travel options and develop transportation programs for them.

There is an important role for outreach and education efforts to developers and building managers as well, where a public agency can increase interest in and voluntary adoption of TDM measures. Public agencies can set up dedicated Commuter Services organizations, tasked with engaging these employers and other private entities to promote the benefits of TDM programs. Arlington County Commuter Services (ACCS) uses a “professional sales force” to educate employers, residential complexes, and developers on the business-friendly TDM programs available to them. A sales agent will often work with a liaison in the business to develop internal marketing and incentives for TDM programs using, for example, the Federal tax-free transit benefit. This employer services program is credited with roughly 60 percent of daily trip shifting attributable to ACCS.

As mentioned above, the Tyson’s Corner TDM program utilizes email to conduct surveys of employees to target their marketing. This is based on questions that request location of residence data for employees or location of work fields for residents. The Salesforce™ software suite is linked to GIS based analysis to identify target audiences for different encouragements.
**Multimodal Traveler Information and Coordination Systems**

Real-time traveler information systems about road congestion, construction, weather, and special events have been shown to be effective tools to help the traveling public make these decisions, improving their traveling experiences, helping to reduce congestion, and using our existing transportation capacity more efficiently.

Since the 1990s, an impressive number of traveler information systems have been built across the U.S. These include publicly- and privately-operated telephone support systems, internet websites, in-vehicle and handheld devices, and smart phone applications. The previously mentioned 2009 NCHRP study surveyed 42 systems operating nationwide at the time and concluded that they share three common challenges:

1. **Challenge 1:** The use of some aspects of the traveler information that is being delivered is limited.
2. **Challenge 2:** A gap exists between what is possible in the state of the art in data collection, information generation, and delivery and what occurs in today's state of practice.
3. **Challenge 3:** Both public and private traveler information providers face funding and budget challenges.

The study's author suggests six possible ways to address these challenges, including better information sharing between traveler information system programs highlighting the successful ones; developing consistent icons and nomenclature for traveler information websites; improving the performance measures for these systems, including information content delivered, information missing, and traveler reactions to the information delivered; instituting regular and improved user surveys to better track user reactions and satisfaction; investigating the possibility of centralizing call centers nationally or at the state-level to improve efficiencies and consistency of user experience; and providing more detailed and specific weather conditions, thereby taking full advantage of the capabilities of today's weather forecasting industry.

Despite the variety of operators and services available, as of the 2009 NCHRP survey more than 20 million calls (20% of the national total) were received by the 511.org system serving the San Francisco Bay Area's 7 million residents. The study concluded that the variety and accuracy of real-time information available by phone and the website (real-time traffic conditions and special events, as well as detailed transit information); the region’s large population, strong tourism industry, and geographic limitations (e.g.; the San Francisco Bay); and a strong marketing program all play a role in the success of this system. The majority of this system’s phone calls are for road conditions, while the majority of website visits are for transit information.
Many of the Metropolitan Transportation Commission’s (MTC’s) experiences setting up and operating the 511.org system are informative for other regions looking to replicate their successes. While the technical challenges were significant—such as getting detailed and consistent real-time information from numerous and diverse partner agencies with different protocols and equipment—the institutional challenges involved with coordinating this diverse set of partners proved to be the biggest challenge. These institutional challenges and opportunities (at MTC and in other TDM programs) are discussed in greater detail in the following sub-section.

**BRT-Focused Enhancements**

ITS and related traffic management strategies are potentially effective ways to improve the attractiveness of bus travel along corridors. Real time information through automated displays at bus stops are a widely accepted means to reduce the perception of waiting time and improve transit quality of service. Arrival updates are also accessible by smart phones through transit providers as well as from third parties as part of trip planning applications.

Direct improvements to real (versus perceived) travel times are achievable through interventions such as transit signal priority along corridors. These are often most effective when combined with geometric improvements to lane and intersection configurations, stop locations involving measures such as far side stops, queue jump lanes, pre-boarding fare payment, and in some circumstances dedicated bus lanes. Dedicated bus lanes can come in many shapes and sizes. Los Angeles County’s Orange Line BRT system uses a combination of an exclusive right-of-way (essentially, a bus-only street) and bus signal prioritization at intersections to minimize travel times. A majority of the bus signal priority system runs transponder-activated loop detectors, embedded in the pavement, at intersection approaches while a small share use on-board computers to wirelessly request signals for priority. Grade-separated (elevated or below-grade) intersections or over the entire right-of-way—such as seen in Pittsburgh’s East Busway—can relieve operators of the need for signal prioritization infrastructure, but the capital requirements for such facilities can be cost prohibitive. Therefore, ITS infrastructure can sometimes serve both a TDM purpose and a way to avoid more costly infrastructure investments.

Perhaps the best example of this ITS-for-infrastructure tradeoff is where signal prioritization is used instead of a dedicated BRT right-of-way. Where right-of-way for dedicated bus lanes are unavailable and BRT must run in mixed traffic conditions, ITS improvements such as signal prioritization can help to substantially improve travel times over conventional bus technologies. Kansas City’s MAX BRT line uses signal prioritization technologies to improve travel times by 20 percent over conventional bus routes in its corridor.

Generally, on corridors with balanced flows alignment options may involve expanded right of way or hardened shoulders to tolerate bus travel during peak periods, but with imbalanced flows, a time based contra-flow lane making use of underused lane capacity on the off-peak direction is another option. All of these alternatives require study to determine which sections of a corridor are appropriate for which service options.
Unconventional ITS Applications

The proliferation of Smart phones and other mobile devices has set off a wave of entrepreneurial activity to help commuters solve mobility problems in novel ways. On the one hand, ride services such as Uber and Lyft offer peer-to-peer services that link travelers to ride providers. On the other hand, they are providing a for profit service that is setup to allow the drivers to pick whom they want to ride in their vehicle. Questions of environmental justice will have to be reviewed as all public/open door mobility options have to factor in all of the population. There are also many issues that have arisen with the rapid growth of this type of shared use technologies and applications.

Some questions need to be addressed regarding this issue. If the driver of the vehicle is deriving a profit should it, in fact, be called ridesharing? (Ridesharing has traditionally been between individuals who are looking to share the cost of travel or share the ride during their commute.) Do these type of services offer any type of congestion reduction? And is there any type of air quality benefit to these type of services? It remains too early to answer these questions empirically.

Another issue is that traditional taxi cab services are regulated and carry insurance premiums significantly higher than these types of services. Does this type of regulation put the taxi cab services at an unfair competitive advantage and could they offer another alternative if that system was restructured? As the shared use network evolves and people’s commuting habits evolve with them, it is important to recognize these ongoing activities and continue to monitor their promoted and actual impacts on traffic congestion and air quality.

Bridj is another recent web-based transit service innovation that provides flexible transit services, in this case in the Boston area. Bridj uses the analysis of crowd-sourced travel data to identify pop-up bus stops for a base of “luxury bus” service subscribers. In a region that has the third-highest share of households without cars in the country and where only about 30 percent of jobs are accessible to the average resident within 90 minutes via transit, Bridj is moving to leverage the power of “big data” to provide transit services to fill in the gaps of Boston’s conventional transit system.

Application to 422 Corridor:

The US 422 Corridor has suitable spatial and socio-demographic characteristics to support the communication techniques and technologies identified in other regions. The success of Smart phone based ITS programs depends considerably on what role they are expected to play. It is evident, for example, that smart phone based ridesharing and luxury bus services are not yet a robust form of congestion mitigation. Applications such as Uber and Lyft have not yet demonstrated significant impacts in terms of trip reduction and Bridj has not operated at a scale where potential corridor level impacts are clear. These may be reasonable complements to other programs, however, as part of guaranteed ride programs.

The legal and policy hurdles of operating these services along the US 422 Corridor must also be considered. At the time of this writing, Uber has just recently obtained permission to begin operation in the City of Pittsburgh, but no action has been taken to allow these types of services to operate in other parts of the state.
V. Concluding Remarks / Looking Ahead

Transportation demand management strategies have proved effective in addressing the causes of traffic congestion on major highways and arterials when implemented in an appropriate policy environment and in a coordinated and consistent manner. Planners and elected and government officials in the Delaware Valley and the US 422 Corridor have long recognized the potential for using TDM as part of a comprehensive approach to traffic congestion relief. But to date TDM initiatives have had little effect on highway and arterial traffic volumes in the area, even though they have been beneficial to some stakeholders and area travelers.

Our analysis of prior TDM studies and plans has documented the twenty-year history of efforts to promote TDM policies and programs in the US 422 Corridor. Building on that effort, we have identified significant barriers to effective implementation of TDM policies through interviews with stakeholders responsible for planning and decision-making in the corridor today and through review of the professional and academic literatures on TDM best practices.

Some of these barriers—funding constraints, inconsistent definitions of “TDM,” and insufficient promotion and education efforts—can be addressed through a collaborative planning process that allocates resources to TDM policy and program implementation. The framework for such an effort already exists in the US 422 Corridor. We will expand upon this concept in the follow-up to this report, a Policy Brief for TDM Strategies in the US 422 Corridor.

Assessing TDM best practices in other regions of the United States and Canada, however, has highlighted the critical nature of policy and governance environments on the effectiveness of TDM strategies. Particularly important are state-, region- and local-level policies that facilitate coordinated regional land use planning practices.

Pennsylvania’s tradition of strong home rule policies related to land use planning means that under current conditions TDM policies must be voluntarily adopted at the municipal level and implemented in a decentralized manner. The provision of technical assistance from county, regional and state government agencies and from public-private Transportation Management Agencies, like GVFTMA, is an important condition for success under such circumstances. Modifying funding programs to incentivize TDM policies and programs is equally important.

In our Policy Brief we will provide detailed recommendations for two approaches to TDM implementation. The first identifying those policies and programs that can be initiated or strengthened under existing policy and governance environments and the second describing potentially more effective policies that could be implemented were links between transportation and land use planning strengthened and requirements and incentives for regionally coordinated efforts provided.
## VI. Appendices

### Appendix A: Prior Studies and Plans Reviewed

The following table lists the prior studies and plans reviewed for the Background Analysis Report. These are studies and plans that are either directly or contextually relevant to the US 422 corridor. The table is followed by a narrative summary of prior planning efforts relevant to the scope of this project.

<table>
<thead>
<tr>
<th>Report Title</th>
<th>Publication/Author</th>
<th>Date</th>
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<tbody>
<tr>
<td>Route 422 Corridor Development Potential and Growth Management Strategies</td>
<td>DVRPC Publication 92006</td>
<td>June 1992</td>
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<tr>
<td>Pottstown Bypass (US 422) Reconstruction Traffic Study</td>
<td>DVRPC Publication 02043</td>
<td>December 2002</td>
</tr>
<tr>
<td>Phoenixville Area Intermodal Transportation Study</td>
<td>DVRPC Publication 03001</td>
<td>January 2003</td>
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<tr>
<td>Valley Forge National Historic Park - Alternative Transportation Feasibility Study</td>
<td>National Park Service/Volpe</td>
<td>June 2004</td>
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<tr>
<td>Montgomery County Transportation Plan</td>
<td>Montgomery County Planning Commission</td>
<td>2005</td>
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<tr>
<td>Pottstown Metropolitan Regional Comprehensive Plan - Transportation Chapter</td>
<td>Pottstown Metropolitan Regional Planning Committee</td>
<td>2005</td>
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<tr>
<td>PennDOT District 6-0 Regional Operations Plan</td>
<td>Jacobs, Edwards and Kelcey for PennDOT</td>
<td>2007</td>
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<tr>
<td>Smart Transportation Program</td>
<td>PennDOT, NJDOT</td>
<td>March 2008</td>
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<tr>
<td>US 422 Corridor Master Plan</td>
<td>DVRPC Publication 09035</td>
<td>2009</td>
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<tr>
<td>R6 Norristown Line Service Extension Study</td>
<td>DMJM Harris/AECOM for Montgomery County Planning Commission</td>
<td>2009</td>
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<td>Phoenixville Borough, Chester County Congestion and Crash Site Analysis Program</td>
<td>DVRPC Publication 09016</td>
<td>2010</td>
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<tr>
<td>State Land Use and Growth Management Report</td>
<td>PA DCED/Governor’s Center for Local Government Services</td>
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In 1992, DVRPC prepared a plan entitled the *US 422 Corridor Development Potential and Growth Management Strategies* which recommended TDM policies with minor success. Though traffic congestion problems in the Corridor intensified in the 1990s, the next significant round of planning for the corridor did not begin until the early 2000’s. In January 2003, DVRPC published a Phoenixville Area Intermodal Transportation Study. In 2005, both Montgomery County and the Pottstown Metropolitan Regional Planning Committee released comprehensive plans which incorporated planning for areas within the US 422 Corridor. The most recent wave of planning in the Corridor was sparked by the US 422 Corridor Master Plan, published by DVRPC in 2009. At about the same time, the Montgomery County Planning Commission was preparing a feasibility study looking at the extension of regional rail service west of Norristown along an existing freight rail line. As a follow up to the corridor master plan and the regional rail feasibility study, DVRPC commissioned the development of the 422 Corridor Plus report in 2011 which investigated the possibility of tolling the US 422 expressway to generate local revenue to address the corridor’s future mobility needs.

In Pennsylvania, statewide and regional planning efforts have, at times, created a fertile context in which to propose TDM recommendations. Though they have not been specific to the US 422 Corridor, policies and initiatives released by state agencies and DVRPC have made TDM policies appear more likely to be supported. The State of Pennsylvania, for example, released the Keystone Principles and Criteria for Growth, Investment and Resource Conservation in 2005 which, among other policy recommendations, promoted the concepts of revitalizing existing downtowns and concentrating future growth and development. PennDOT’s Smart Transportation Guidebook in 2008 made similar recommendations, recommending that planners and elected officials work to integrate transportation and land use in local ordinances to promote alternative transportation modes. DVRPC’s most recent long-range plan update for the region, entitled Connections 2040: Plan for Greater Philadelphia, calls for infill and redevelopment as well as consideration of the land use impacts of transportation development.
Appendix B: Statewide Policies, Incentives, Regulations

The table below lists the state-level policies identified and reviewed for context in preparation of the Background Analysis Report. The policies are grouped into four categories:

- Updates to internal PennDOT procedures and operating policies
- Guidance and technical assistance for municipal government
- Funding incentives for projects and municipalities
- Interagency state regulations or publications with land use/transportation implications

The table is followed by a chart showing the timeline in which these state-level policies were adopted.

**Table 6: Statewide Policies, Incentives, and Regulations**

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<tr>
<th>Category</th>
<th>Policies</th>
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| **Updates to internal PennDOT procedures and operating policies** | “PennDOT Sound Land Use Implementation Plan”  
PennDOT Improved the Highway Occupancy Permit (HOP) process to promote coordination between PennDOT District permitting staff and local jurisdictions  
“Community Impact Assessment Handbook”  
“Pennsylvania Mobility Plan”  
“Statewide Bicycle and Pedestrian Master Plan”  
PennDOT “Strike-Off Letters” which incorporated Bicycle and Pedestrian Facilities and Project “Right Sizing” into agency design manuals  
“Smart Transportation Guidebook”  
Revised delivery process for all projects – goal to streamline project delivery without compromising community involvement or environmental review |
| **Guidance and technical assistance for municipal government** | “Traffic Calming Handbook”  
“Walkability Checklist”  
“Access Management: Model Ordinances for Pennsylvania Municipalities Handbook”  
“Transportation Impact Fee Handbook”  
“Integrating Transportation and Land Use in Comprehensive Plans” |
### Funding incentives for projects and municipalities

- Home Town Streets program
- Safe Routes to School program
- Pennsylvania Community Transportation Initiative (PCTI)
- PennDOT Transportation Enhancements Program
- Funding to planning partners to carry out studies that help coordinate transportation and sound land use planning
- Funding to municipalities to help fund comprehensive planning efforts

### Interagency state regulations or publications with land use/transportation implications

- Land Use Planning Executive Order (1999-1)
- Acts 67 and 68 Amend Municipalities Planning Code (MPC)
- “Interagency Land Use Team Supplementary Report”
- “Action Plan Resulting from May 2003 Conference on Transportation and Land Use for Economic Development”
- Act 238 of 2004 creates framework for designation and implementation of Transit Revitalization Investment Districts (TRID)
- “Keystone Principles and Criteria for Growth, Investment, and Resource Conservation”
- Act 89 – Created a new Deputy Secretary for Multimodal Transportation and a new funding stream dedicated to multimodal projects
### Table 7: Adoption Timeline of Statewide Policies, Incentives and Regulations

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<th>Updates to internal PennDOT procedures and operating policies</th>
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<td>Interagency state regulations or publications with land use/ trans implications</td>
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<td>• Act 238 of 2004 creates framework for TRID</td>
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### Updates to internal PennDOT procedures and operating policies

- “Community Impact Assessment Handbook”
- “Pennsylvania Mobility Plan”
- "Statewide Bicycle and Pedestrian Master Plan”
- “Right Sizing” Strike-off Letter
- “Sound Land Use Implementation Plan” v2
- “Smart Transportation Guidebook”
- PennDOT implemented a revised delivery process (2010)

### Guidance and technical assistance for municipalities

- “Access Management: Model Ordinances”
- “Transportation Impact Fee Handbook”
- “Integrating Transportation and Land Use in Comprehensive Plans”

### Funding incentives for projects and municipalities

- Pennsylvania Community Transportation Initiative (PCTI)

### Interagency state regulations or publications with land use/transportation implications

- “Keystone Principles and Criteria”
- Act 89 – Multi Modal Trans (2013)

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Appendix C: Interviews Conducted

The table below lists the local stakeholders interviewed in the preparation of the Background Analysis Report. These interviews were conducted by GVFTMA.

**Table 8: List of Interviewees**

<table>
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<th>Interviewee</th>
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<td>Eric Goldstein</td>
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<td>Jody Holton</td>
<td>Montgomery County Planning Commission</td>
<td>Executive Director</td>
<td>6/30/2014</td>
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<tr>
<td>Leo Bagley</td>
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<tr>
<td>Jesse Buerk</td>
<td>DVRPC</td>
<td>Senior Transportation Planner</td>
<td>7/1/2014</td>
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<tr>
<td>Greg Krykewycz</td>
<td>DVRPC</td>
<td>Manager of Bike, Pedestrian, and Transit Planning</td>
<td>7/1/2014</td>
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<td>Chris King</td>
<td>DVRPC</td>
<td>Principal Transportation Planner</td>
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<td>Randy Waltermeyer</td>
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<td>Bill Deguffroy</td>
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<td>Stacy Bartels</td>
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<td>Manager of Marketing and Commuter Services</td>
<td>7/3/2014</td>
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<td>Louis Belmonte</td>
<td>PennDOT District 6</td>
<td>District Traffic Engineer</td>
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<tr>
<td>Manny Anastasiadis</td>
<td>PennDOT District 6</td>
<td>Assistant District Traffic Engineer for ITS and Traffic Operations</td>
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<td>Erika Weekley</td>
<td>Pottstown Borough</td>
<td>Assistant Manager</td>
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<td>Jean Krack</td>
<td>Phoenixville Borough</td>
<td>Manager</td>
<td>7/21/2014</td>
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<td>Ronald Wagemann</td>
<td>Montgomery County Development Corporation</td>
<td>Director of Municipal Services</td>
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<td>Interviewee</td>
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<td>Karen Romano</td>
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<td>Kate Sussman</td>
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<td>Justin Land</td>
<td>The DOW Chemical Company</td>
<td>Public Affairs Manager</td>
<td>7/21/2014</td>
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<tr>
<td>Dan O’Leary</td>
<td>GlaxoSmithKline</td>
<td>Site Operations Director</td>
<td>7/7/2014</td>
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<tr>
<td>Angelo Voutsines</td>
<td>GlaxoSmithKline</td>
<td>Manager US Ground Transportation</td>
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The table below lists the national TDM experts and stakeholders interviewed in the preparation of the Background Analysis Report. These interviews were conducted by CFA Consultants.

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<th>Interviewee</th>
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<tr>
<td>Justin B. Schor</td>
<td>Fairfax County, VA (Wells+Associates)</td>
<td>Senior TDM Specialist</td>
<td>07/17/2014</td>
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<tr>
<td>Philip Winters</td>
<td>Center for Urban Transportation Research</td>
<td>TDM Program Director</td>
<td>07/28/2014</td>
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<tr>
<td>Emily Van Wagner</td>
<td>San Francisco Bay Area Metropolitan Transportation Commission</td>
<td>Former MTC 511.org Project Manager</td>
<td>07/10/2014</td>
</tr>
<tr>
<td>Todd Litman</td>
<td>Victoria Transport Policy Institute</td>
<td>Executive Director</td>
<td>07/25/2014</td>
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Appendix D: Annotated List of References

II. Study Area: The Corridor and the Expressway


Page 12: Concerning the increase in real estate value of municipalities in the corridor, refer to the “Route 422 Corridor Development Potential and Growth Management Strategies” document published by DVRPC. Regarding population projections to year 2030 for the US 422 Corridor area, see the “US 422 Corridor Master Plan – Background Materials” produced by DVRPC and included as an appendix to the corridor master plan.


Page 14: Concerning peak hour traffic congestion on US 422 including the PTI and TTI analysis, information was obtained from a brief report prepared by DVRPC titled “Archived Speed and Travel Time Data for US 422.”

Page 15: Concerning air quality in the region, refer to the Environmental Protection Agency (EPA) state and county emission summaries available at [http://www.epa.gov/air/emissions/where.htm](http://www.epa.gov/air/emissions/where.htm).


Page 17: Concerning private shuttles available in the corridor, information was obtained from the GVFTMA shuttle management site at [http://www.gvftma.com/sustainability/shuttle.php](http://www.gvftma.com/sustainability/shuttle.php).

III. TDM in the US 422 Corridor

Page 20: The TDM definition offered by the Center for Urban Transportation Research can be found at [http://www.cutr.usf.edu/programs-1/transportation-demand-management-2/](http://www.cutr.usf.edu/programs-1/transportation-demand-management-2/) and the TDM definition offered by Michael Meyer can be found in an
article titled “Demand Management as an element of transportation policy: using carrots and sticks to influence travel behavior.” The article was published in Transportation Research Part A.


IV. National Best Practices in TDM Implementation

Pages 35 - 36: Concerning best practices in TDM implementation across jurisdictions, refer to “Transportation Demand Management: State of the Practice” issued by Smart Growth America, “Incorporating TDM into the Land Development Process” by Seggerman, Hendricks and Fleury published by the National Center for Transportation Research (NCTR), as well as “Incorporation of Transportation Demand Management (TDM) into the Development Review Process” completed by Michael Baker Jr., Inc. for the District of Columbia. Information for this section was also obtained from CFA’s interview with MTC’s former 511.org project manager, Emily Van Wagner.

Pages 37 - 40: Concerning best practices with integrating TDM into land use and transportation planning processes, information was obtained from “Transportation Demand Management: State of the Practice” issued by Smart Growth America, “Incorporating TDM into the Land Development Process” by Seggerman, Hendricks and Fleury published by the National Center for Transportation Research (NCTR), “Incorporation of Transportation Demand Management (TDM) into the Development Review Process” completed by Michael Baker Jr., Inc. as well as “Integrating Transportation Demand Management into the Planning and Development Process” published by SANDAG. Information for this section was also obtained from a presentation by Martin Engleman at the Metropolitan Transportation Commission titled “Developing Guidelines for Countywide Transportation Plans,” an article by Fijalkowski, McCoy and Lyons titled “Developing a Regional Approach to Transportation Demand Management and Nonmotorized Transportation: Best Practice Case Studies,” and an article by Kathleen Rooney and Michael Grant titled “State Department of Transportation Role in the Implementation of Transportation Demand Management Programs” available at http://www.nap.edu/download.php?record_id=14408. This section also refers to the California Department of Transportation’s (Caltran) 2007 - 2012 Strategic Plan which can be accessed at http://www.dot.ca.gov/docs/StrategicPlan2007-2012.pdf as well as the


Pages 44 – 45: For the section addressing best practices in TDM implementation, information was obtained from CFA Consulting’s interview with Phil Winters and a 2009 publication by the Washington Department of Transportation titled “DRAFT: Trip Reduction Performance Program Agreement.”

Center for Urban Transportation Research: National Center for Transit Research titled “Improving the Cost Effectiveness of Financial Incentives in Managing Travel Demand Management (TDM).”

Policy Brief

Transportation Demand Management (TDM) Best Practices for Southeast Pennsylvania’s US 422 Corridor

December, 2014
Prepared By:
Policy Brief: Transportation Demand Management (TDM) Best Practices for Southeast Pennsylvania’s US 422 Corridor

December, 2014

A report prepared by:

The Center for Sustainable Communities, Temple University
Bradley J. Flamm, Ph.D., Principal Investigator
Jeffrey Featherstone, Ph.D., Director
Brian Blacker, Graduate Student Researcher
Ashley Nuckles, Undergraduate Student Researcher

GVFTMA
Robert Henry, Executive Director
Kyle Guie, Project Manager
RJ Griffin, Project Coordinator

CFA Consultants
Michael Carroll, P.E., President and Principal
Christopher E. Ferrell, Ph.D., Principal

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The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the US Department of Transportation, Federal Highway Administration, or the Commonwealth of Pennsylvania at the time of publication. This report does not constitute a standard, specification or regulation.

In January 2015, a digital copy of this document will be posted on the Center for Sustainable Communities website at http://www.temple.edu/ambler/csc/.
Transportation Demand Management (TDM) Best Practices for Southeast Pennsylvania’s US 422 Corridor

Policy Brief

Why This Brief?

Three decades of efforts to address traffic congestion in the US 422 Corridor of Southeast Pennsylvania have been met with limited success. Three broad types of responses have been used:

1) investments in new highway and public transit capacity; 2) traffic incident management (TIM) and intelligent transportation systems (ITS) measures, including variable message signs, roving tow trucks, and online and smart-phone traffic information systems; and 3) transportation demand management (TDM) strategies. This three-pronged approach has helped keep traffic congestion from becoming worse than it currently is, but congestion remains a problem.

While capacity expansion and TIM/ITS initiatives will continue to be part of the effort to reduce traffic—funding has been identified in the region’s Connections 2040 Plan for Greater Philadelphia to do so—TDM can and should play a large role in the US 422 Corridor.

This policy brief presents short-, medium-, and long-term recommendations that transportation analysts and practitioners with Temple University’s Center for Sustainable Communities, the Greater Valley Forge Transportation Management Association, and CFA Consultants have identified after detailed study of the Corridor, the 422 Expressway, and planners’ most effective TDM efforts of the past thirty years. Some of the recommendations are straightforward, inexpensive, and simple to implement. Others
Defining “TDM”

TDM is a comprehensive approach to addressing traffic congestion by reducing demand for travel rather than increasing supply of roads. But “TDM” is used to signify many policies and programs, depending upon the context. For this Policy Brief, we adopt the definition used by The Center for Urban Transportation Research (CUTR):

TDM “focuses on helping people change their travel behavior—to meet their travel needs by using different modes, traveling at different times, making fewer trips or shorter trips, or taking different routes.”

While the term is well known to planners, engineers, and researchers, it is jargon not well understood by many other stakeholders. Worse, for some who hear “transportation demand management,” the idea is seen as intrusive or counter to a preferred strategy of increasing roadway supply.

To emphasize the goals of reducing traffic congestion and environmental impacts, many professionals now use other terms instead of “TDM,” including “commuter choices” and “travel options” to refer to demand management policies and programs, emphasizing the many ways travelers can get where they’re going.
Introduction

The US 422 Corridor in Southeastern Pennsylvania has a three-decade history of strong jobs, retail, and residential growth. But an important contributor to that growth – the US 422 Expressway between King of Prussia and the Montgomery / Berks County line – bears the strain of persistent and considerable peak hour traffic congestion.

Municipal, county, regional, and state transportation planners along with elected officials in the 24 municipalities of the region have long worked to address the problem with a combination of:

- Capacity-adding highway and public transit projects,
- ITS (Intelligent Transportation Systems) and other transportation system management (TSM) strategies and tools for managing traffic volumes and modes, and
- Policies and programs to manage demand on the Expressway and other area highways and arterials, commonly referred to as Transportation Demand Management (TDM) strategies.

Over the past three decades efforts a) to add capacity and manage traffic operations have enabled more vehicles to use the Expressway and b) to manage transportation demand have modestly reduced traffic volumes. Nonetheless, these strategies have not eliminated peak hour traffic jams, which continue to be a source of frustration for area commuters.

The 2013 passage of Pennsylvania Act 89 has brought new financial resources to highway and transit projects in the Commonwealth. The US 422 Corridor will benefit with a new lane to the Schuylkill River Bridge on US 422 and the widening of three miles of the Expressway from US 202 to PA 363, along with repaving and alignment projects. New funding also makes a proposal to construct a spur on SEPTA’s Norristown High-speed rail line to King of Prussia more likely to be built as a long-term prospect. PennDOT’s investments in the services of District 6’s Traffic Management Center – including variable message signs, traffic advisory information systems, and roving incident management trucks – have also helped manage traffic volumes on area highways. These investments, while welcome, are not expected to eliminate peak hour traffic congestion.

Commute Choices with TDM Programs and Policies

Experiences in other regions of North America show that reductions in traffic congestion can be realized by managing demand for single-occupancy vehicle (SOV) trips. There is no intrinsic reason that US 422 and other highways in Southeast Pennsylvania would be exceptions to this rule, so long as there is a focus on implementing feasible strategies adapted to local and regional policy environments.
This policy brief identifies recommendations for implementing TDM strategies to achieve traffic congestion reduction in the US 422 Corridor based on three time-frames:

- In the next section of this document, short-term recommendations are identified that build on existing programs, policies, and experience in the US 422 Corridor and are adapted to local administrative and political conditions. The benefits to be expected from the implementation of these recommendations will accrue primarily to employers and commuters who participate in TDM programs. Small reductions in traffic congestion on US 422 and other area highways can be expected, as well as minor pollutant emission reductions. These measures lay the foundation for more substantial TDM measures by engaging stakeholders and building awareness.

- Following that, medium-term recommendations are made that bridge the gap between the most feasible, short-term recommendations and the more ambitious and politically challenging long-term policies and programs. Medium-term measures will have more significant effects on managing demand than short term measures. Some may be as effective as long term measures but, in general, can be easier to implement.
• Then, the policy brief turns to long-term recommendations that are more ambitious and potentially more effective in reducing traffic congestion in the US 422 Corridor. These policies and programs have been successful in other regions of North America, but require sustained, collaborative, and sometimes obligatory regional cooperation among municipalities. The primary objective of such cooperation is to develop and implement land use, zoning, and parking policies that make travel by shared and non-motorized modes of transportation easier and more appealing, while making SOV trips more costly and less convenient.

Policy Environments Supportive of Effective TDM Practices

The North American regions that have most successfully implemented coordinated and sustained TDM programs and policies exhibit five characteristics:

1. TDM policies and programs are developed and implemented across a region, involving all communities within a commute-shed

2. Commuters and other travelers are presented with a variety of appealing transportation choices in travel routes, departure times, and modes of travel

3. Travelers, regardless of their mode, have timely and accurate travel information

4. State and regional policies present
   • travelers with clear incentives to choose shared and non-motorized travel options and disincentives for driving alone, and
   • communities with requirements for adopting TDM-supportive land use and transportation planning policies

5. Coordinated multi-modal transportation and land use planning that ensures connectivity between modes and accessibility to opportunities is practiced by all communities within a corridor or region.

Currently these conditions are only partially met in the US 422 Corridor:

1. Some voluntary collaboration among municipalities exists, particularly on the sub-regional level, but there is:
   • a lack of consensus on shared goals for TDM
   • insufficient regional cooperation

2. Transit and non-motorized modes are not as convenient, accessible, and appealing as they need to be
3. Information dissemination for commuter travel choices needs to be strengthened and more broadly available

4. State and regional policies provide good guidance to municipal leaders, but they depend upon voluntary measures that are not widely adopted

5. Land use patterns supportive of transit, walking, and bicycling exist in several boroughs of the Corridor, but on the whole, travel within and beyond the US 422 Corridor is convenient only by car

Some, but not all, TDM policies and programs can be effective under these existing policy conditions. Stakeholders in the corridor can pursue short- and medium-term TDM policies and programs that are voluntary and depend upon incentives and effective communication. Such policies and programs provide important benefits to employers and commuters, some congestion relief, and reductions in pollutant emissions.

Longer-term strategies are more ambitious and require committed effort to develop consensus among stakeholders. These are likely to be more effective at addressing traffic congestion and pollutant reduction goals, but can be controversial in planning and implementation.

Table 1 on the following page summarizes the TDM recommendations made in this Policy Brief. It is organized by time-frame and the conditions that support their effective implementation. Short- and medium-term recommendations primarily address the first three characteristics of regions that have successfully implemented TDM programs – regional collaboration, effective travel options, and timely and accurate travel information – while long-term recommendations address state and regional policies supportive of TDM and coordination of transportation and land use planning.
### Table 1: TDM Policy Recommendations By Type and Time-Frame

<table>
<thead>
<tr>
<th>Characteristics of Effective TDM</th>
<th>Short-Term Recommendations (0 to 2.5 years)</th>
<th>Medium-Term Recommendations (2.5 to 5 years)</th>
<th>Long-Term Recommendations (5 years or more)</th>
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<tr>
<td>Regional Collaboration</td>
<td>• Revitalize the US 422 Coalition (ST-1)</td>
<td>• Build on existing sub-regional plans (MT-1)</td>
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<td>Effective Travel Options</td>
<td>• Employer-based TDM programs (ST-2)</td>
<td>• Improvements to Shared Modes of Transportation (MT-2)</td>
<td>• Planning for Comprehensive Bicycle Access (MT-3)</td>
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<td></td>
<td>• Municipal and Regional Non-Motorized Transportation Planning (ST-4)</td>
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<td>Timely and Accurate Travel Information</td>
<td>• TDM Promotion and Education, including computer and Smart-Phone Applications (ST-3)</td>
<td>• Further Improvements to Shared and Non-Motorized Transportation Modes Information and Coordination (MT-4)</td>
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<td>TDM-Supportive State and Regional Policies</td>
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<td></td>
<td>• Statewide Transportation Planning Policies (LT-1)</td>
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<td></td>
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<td></td>
<td>• Trip Reduction Ordinances (LT-3)</td>
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<tr>
<td>Coordinated Multi-Modal Transportation and Land Use Planning</td>
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<td>[Discussion and planning of these strategies can begin in the medium-term; implementation will occur in the long-term]</td>
<td>• Regional Land Use Planning Policies (LT-2)</td>
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<td></td>
<td></td>
<td></td>
<td>• Regionally Coordinated Public and Private Parking Policies (LT-4)</td>
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TDM Policies in the Short Term (0 to 2.5 Years)

Stakeholders in the US 422 Corridor have extensive experience with TDM programs and policies initiated and managed with the assistance and support of public and private agencies, including PennDOT, GVFTMA, DVRPC, large area employers, and county and municipal governments.

Many of these programs, however, have been underutilized in the US 422 Corridor and only partially implemented. There is, nevertheless, great potential for expansion of these efforts through voluntary and collaborative measures to improve programs and policies that have, to date, under-performed, while operating within existing governance and organizational constraints. Because most of these are familiar to stakeholders in the corridor, these strategies can be planned and implemented in the short-term, beginning in 2015.

In this Policy Brief, we address four categories of short term recommendations:

- Corridor-wide TDM Coordination
- Employer Based TDM Programs
- TDM Promotion and Education
- Municipal and Regional Non-Motorized Initiatives

ST-1: Corridor-wide TDM Coordination

Traffic patterns and roadways in the US 422 Corridor are part of larger transportation systems in the Delaware Valley region. Congestion is generated not solely by residents and workers in the communities where traffic backs up during peak hours, but by commuters driving into and out of the corridor. Any solution to traffic congestion and the environmental impacts of vehicle use in the corridor will require collaboration and coordination amongst a wide variety of stakeholders and we recommend that two organizations be strengthened to provide forums for discussion, planning, and implementation of TDM policies and programs.

The 422 Corridor Coalition

The 422 Corridor Coalition, established in 2001, is a group of municipal officials, engineers, planners, and business leaders whose purpose is to discuss the challenges presented by traffic
congestion in the area and potential solutions to it. Currently, the majority of active members are from the public sector, which creates an opportunity to expand private sector involvement. Past efforts of the coalition have focused on two main initiatives: the development of the US 422 Master Plan (2009) and the Schuylkill Valley Metro Plan (2003). After the completion of these major efforts the coalition became less active and there is now an opportunity to reenergize it and make it more effective in its work by:

- **Focusing attention** specifically on TDM planning and implementation
- **Building and expanding coalition membership** in both the public and private sectors
- **Advocating for projects that expand opportunities to travel by non-single-occupancy vehicle modes**, thereby enhancing the use of TDM policies and programs by area commuters and other travelers
- **Promoting existing regional TDM programs** and advocating for more TDM resources and technical support
- **Conducting outreach** to employers throughout the corridor and providing technical support when requested
- **Setting an initial set of TDM performance measures** against which to assess progress towards traffic congestion reduction along the US 422 Expressway and other corridor highways and arterials

The US 422 Traffic Incident Management Task Force

The US 422 Incident Taskforce, a Traffic Incident Management (TIM) organization that was formerly very active, currently is focused on traffic impacts of US 422 construction improvements in the Pottstown area.

Effective and efficient incident management has the potential to greatly reduce delays, so supporting a TIM group’s efforts to facilitate coordination between emergency responders, traffic control, and tow truck operators can help manage travel demand, reducing traffic congestion. We recommend that the US 422 Incident Taskforce

- **Rename itself the “US 422 Traffic Incident Management Task Force”** to reflect its focus on traffic congestion and accepted terminology
- **Rebuild a comprehensive, corridor-wide membership** list to include municipalities all along the Expressway
- **Collaborate consistently and effectively** with county, regional, and state traffic incident management organizations, and particularly with PennDOT District 6’s Traffic Management Center staff
ST-2: Employer Based TDM programs

Employer based TDM strategies help to reduce traffic congestion by providing employee-commuters with incentives and alternatives to driving alone during peak travel hours. Recent studies, such as one completed by the Washington State Department of Transportation along a corridor with attributes similar to the US 422 corridor, have found that providing commute alternatives information to employees can reduce vehicle trips by 1% to 18%, depending upon whether associated services and incentives are part of the TDM strategy implemented. The most successful employer based TDM programs include the elements described below, and we recommend that large US 422 Corridor employers consider, plan for, initiate, and support the following programs and policies:

- **Provide detailed information to employees** about alternatives to single occupancy vehicle commuting: this can be done by distributing pamphlets and communicating via company e-mail messages, setting up information kiosks, establishing carpool networks, and inviting transportation experts from local organizations to provide transportation alternatives training seminars.

- **Promote non-single occupancy vehicle travel** by providing company amenities: sheltered and secure bicycle racks and bicycle lockers, showers, shuttle services, vanpool vans, internal carpool networks, and guaranteed ride home programs.

- **Establish preferred parking spaces and policies** for employee carpoolers and vanpoolers.

- **Increase enrollment in the RideECO program**, a commuter benefit program coordinated by the Delaware Valley Regional Planning Commission: the program allows employers and commuters to save.
money by putting pre-tax dollars towards public transit fares and passes

- **Implement flexible work schedule policies** that provide incentives to telecommute, establish compressed work weeks, permit alternative arrival and departure hours, and other flextime options

Within the Corridor, several large employers have already initiated TDM programs. For example, GlaxoSmithKline (GSK), a major pharmaceutical company, has implemented a ride-share system, a carpool heat map, a bike share program, and shuttle services to and from their regional offices and mass transit hubs. They also participate in a transit subsidy program, flextime and telework programs, and provide onsite bicycle racks as well as amenities such as showers.

Employer based TDM programs like these benefit participating employees, who have more commute options and can select those that are most valuable to them. But they also benefit employees who continue to commute alone by car because there are fewer co-workers competing for parking spaces. Employers benefit too from employee satisfaction with the travel options and, in some cases, by being able to reduce expenses for parking facilities and maintenance.

**ST-3: TDM Promotion and Education**

In interviews conducted in the summer of 2014, key stakeholders along the corridor emphasized the importance of educating municipal officials, private employers, and the public about the benefits of TDM strategies. This education and training can be conducted by local and regional organizations through websites, direct employer outreach, smart-phone applications, and marketing and promotional events. When marketing TDM strategies, emphasis should be placed on the cost-savings, as well as the environmental benefits of transportation demand management.

We recommend that area stakeholders:

- **Disseminate detailed information on TDM** methods, planning, benefits, and required resources to policy makers, municipal officials, and private employers

- **Be explicit that TDM policies and programs are meant to provide more and better commuter choices and traveler options**, using those terms when appropriate instead of “TDM”

- **Provide promotional materials to commuters** on existing TDM programs, policies, and incentives

- **Designate employer transportation alternative liaisons** within companies and participating businesses
Promote carpooling, park and ride lots, ridesharing, vanpooling and other alternative commute modes to single-occupant vehicle trips

An increasingly important method of TDM promotion and education is the use of web-based computer and smart-phone commute choice applications. Innovative ridesharing websites and mobile technologies are changing the ways in which people commute and travel and hold potential to help reduce traffic congestion and manage transportation demand. The use of Internet and Smartphone technologies and apps has dramatically increased over the last few years, giving travelers options for ride-sharing, bicycle-sharing, using innovative taxi services, and charting driving routes to avoid congested sections of regional highway networks.

The rapid rise of companies like Uber, Lyft, and Sidecar reflect a demand for mobile technologies that expand transportation options and permit electronic payment transfers. The TDM and ridesharing community – aware of a) the rapidly rising popularity of smartphones and smartphone applications and b) the payment, informational, and organizational capabilities these applications support – is paying much more attention to them. In the Philadelphia region we have not yet seen widespread adoption of many of these apps, sometimes because state laws have prohibited them (as is the case with those used to organize informal taxi rides) and sometimes because inconsistencies across jurisdictions hinder their introduction.

DVRPC operates Share-A-Ride, a free, comprehensive, computerized commute match service that provides commuters with information on transit options and connects them with others who have similar commute routes. The system, however, is underutilized and outdated.

To bring the region and the US 422 Corridor up to date, we recommend stakeholders take the following actions:

- Promote existing tools that facilitate travel choices, such as SEPTA apps for smartphones and the 511PA.com website
- Support electronic fare payment technologies, such as SEPTA’s in-development system, and be attentive to future opportunities to expand and coordinate such systems
- Advocate for the modernization of corridor and regional ridesharing databases with the development of mobile apps that are user friendly, comprehensive, and multi-modal

ST-4: Municipal and Regional Non-Motorized Transportation

Improvements to bicycling and walking infrastructure and services are important elements of a comprehensive TDM program because they provide safe and appealing alternatives to single-occupant vehicle travel for shorter trips. There are many opportunities along the US 422 Corridor to make bicycling and walking preferred transportation options for a larger proportion of daily trips.
Boroughs and Townships in the corridor should continue to a) identify opportunities for bicycling and pedestrian projects within their municipal boundaries, b) coordinate with municipal neighbors and county planning agencies to connect municipal bicycle and pedestrian networks with regional networks, and c) identify planning expertise and funding sources for these projects. These efforts will draw from and reinforce the principles of “complete streets” that PennDOT has emphasized in several documents focused on context-sensitive design, bicycle and pedestrian planning, and smart transportation guidelines.

We recommend that stakeholders in the US 422 Corridor make the following efforts priority components of a comprehensive TDM strategy:

**Bicycle Lanes and Paths**
- Continue to work with state, regional, and county planning agencies to **identify state, county, and local roads that have potential for bike lanes and paths**: dedicated bicycling lanes and paths increase safety and convenience for bicyclists, provide clarity for motorists on the requirement to share roads with non-motorized vehicles, and enhance the bicycling experience so that more travelers are attracted to this commute option
- Work to secure funding through federal, state, regional, county, and local sources to **expand the network of bicycle lanes and paths**

**Regional Trails**
- **Support the Connect the Circuit initiative** which was established to advocate and promote a regional 750 mile trail network; the Schuylkill River Trail, a key element of the Circuit, is an important transportation asset – for both recreational and commuting use – along the US 422 corridor
- Work to secure funding to **connect missing trail sections, improve at grade crossings, and develop linkages to employment centers**

**Bicycle Parking**
- Plan, obtain funding for, and construct **secure bicycle parking facilities** in public and private spaces to encourage travelers to use bicycles as a mode of transportation
- Municipalities along the corridor should **identify priority locations** to install bike rack within the public right way
- Office parks, businesses, shopping centers, and other destinations should identify locations to install bicycle racks in **prominent locations on private property**
- **Coordinating bicycling and public transit** is important in order to create opportunities for
TDM Best Practices for Southeast Pennsylvania’s US 422 Corridor

travelers to combine shared and non-motorized modes of transportation: bicycle racks exist already on SEPTA buses and can be added to private shuttle buses; bicycle parking should be incorporated at public transit stops and stations (this is currently being studied, for example, for the Norristown Transportation Center with its direct access to rail and bus transit services, the high-density, mixed-use town center, and the Schuylkill River Trail)

Sidewalk and Crosswalks

- Work to identify missing segments in sidewalk networks (within many communities along the US 422 Corridor, sidewalk construction is often completed one parcel at a time) and develop a plan to fill in the gaps that exist in sidewalk connectivity

- Assess the condition and functionality of existing crosswalks and pedestrian signalization in corridor communities

- Where appropriate, identify streets and roads that are candidates for traffic calming, road diets, and complete streets redesigns, then identify funding sources for planning, design, and construction

- Use the Walk Bike Pottstown initiative, which recently received a $1 million grant to create better walking and biking connections to schools, as a model for using schools and other community facilities as the focus of pedestrian and bicycling enhancement efforts

Figure 4: State Farm Highway Emergency Vehicle

Figure 5: Employer’s Bike and Learn Workshop

Figure 6: Pedestrian Crosswalk
TDM Policies in the Medium Term (2.5 to 5 Years)

TDM policies and programs appropriate for the US 422 Corridor fall along a spectrum. Short-term TDM strategies, like those described in the previous section, are primarily voluntary and cooperative policies and programs. They provide incentives to commuters to take shared and non-motorized modes of transportation, but do not affect the conditions of single occupant vehicle travel. On the other end of the spectrum are more ambitious, politically challenging, long-term TDM strategies that involve ongoing and collaborative regional planning. A primary goal of such strategies is to adopt zoning and land use planning policies that make shared and non-motorized modes of transportation more convenient, reliable and appealing, while at the same time making the use of single occupant vehicles less convenient and more costly.

In between the two ends of this spectrum are strategies that are straightforward and feasible, although more time- and resource-intensive than short-term strategies. They can bridge the gap with more ambitious, long-term, land use based TDM strategies. These approaches include:

- Building on existing sub-regional planning initiatives
- Improving public transit options for residents and employees of the US 422 Corridor
- Constructing more bicycle facilities to provide safe and convenient routes between major origins and destinations, and
- Investing in additional Intelligent Transportation System and traffic systems management (TSM) initiatives

MT-1: Build on existing sub-regional planning initiatives

As regional collaboration is one of the key conditions that make effective TDM implementation possible, planners and elected officials in the US 422 Corridor should consider ways to build on regional and sub-regional efforts that have already been initiated. Three of the most important efforts are the Pottstown Metropolitan Regional Planning Committee, the Phoenixville Area Regional Planning Commission, and the 422 Corridor Coalition.

The Pottstown Metropolitan Regional Planning Committee (PMRPC) brings together eight communities: five townships in Montgomery County and two in Chester County, centered on Pottstown Borough. Formed in 2005 with an Intergovernmental Cooperative Implementation
Agreement for Regional Planning, the PMRPC soon thereafter released a Comprehensive Plan (currently under revision, an update is scheduled to be released in 2015). iv

The current version under consideration emphasizes:

- new strategies to encourage economic development, while maintaining earlier goals of
- protecting natural, historic and cultural resources,
- preserving open space and agriculture,
- improving transportation choices,
- encouraging walkable communities,
- maintaining recreational opportunities,
- pursuing environmentally friendly development policies, and
- respecting the unique conditions of member communities.

The plan identifies the regional core in Pottstown Borough and primary and secondary growth areas, conservation areas, and highway commercial overlay areas.

The Phoenixville Area Regional Planning Commission was created in 2008 when six communities (five townships and Phoenixville Borough) signed an Intergovernmental Cooperative Implementation Agreement for Regional Planning and adopted a Regional Comprehensive Plan. v An update to the plan is currently being undertaken. Reflecting a keen concern with land use changes leading up to its initial adoption, the comprehensive plan identified goals similar to the Pottstown region’s plan.

The 422 Corridor Coalition, described above in the section on short-term TDM recommendations, differs from the sub-regional models in Pottstown and Phoenixville by
TDM Best Practices for Southeast Pennsylvania’s US 422 Corridor

bringing together the public and private sectors to address a narrower set of goals, primarily focusing on solutions to traffic congestion and traffic-related environmental pollution along the US 422 Expressway and within the Corridor.

These three multi-community groups have faced challenges in implementation of plan goals and objectives. One past member of the Phoenixville Area Regional Planning Commission, for example, noted the lack of multi-community zoning as a significant barrier to the effective application of a regional vision. The voluntary nature of the agreement and the lack of enforcement for failing to implement plan recommendations are two more characteristics of the sub-regional planning effort that hinder effectiveness. Nevertheless, the two commissions and the coalition convene and facilitate multi-municipal conversations that provide a model for corridor-wide collaboration. Their past experiences reveal weaknesses and opportunities that can be addressed in future efforts.

Based on these examples and lessons learned, we recommend that

- Members of existing sub-regional planning groups renew their commitment to consistent, comprehensive, and coordinated planning
- Sub-regional groups establish TDM as an organizing goal around which to set specific performance measures, identify TDM projects and programs to pursue in member communities, and establish land use and transportation planning and funding priorities

MT-2: Improve Public Transit Service in the US 422 Corridor

For decades planners in the Delaware Valley and the US 422 Corridor have conducted studies and developed plans to improve public transit service, primarily with the goal in mind of extending rail service to King of Prussia, or even farther west. Funding gaps have frustrated these plans, though with efforts to obtain federal resources and the November 2013 passage of PA Act 89, the construction of a spur from the Norristown High-Speed Rail line to King of Prussia may move forward sometime in the medium- to long-term.

Improvement in the quality of public transit options for corridor commuters and travelers, however, need not depend upon a single type of public transit technology. Lower cost alternatives may provide equally high quality service. The goal of establishing appealing, safe, affordable travel choices that meet people’s needs effectively has been achieved in other regions through many types of technologies. While it usually is more cost-effective to provide such service – whether by rail, bus, trolley, or another transit mode – where the populations of people living and working within comfortable walking distance of transit are high, effective transit service can be designed for lower density regions like the US 422 Corridor.
Bus Rapid Transit (BRT), for example, provides light-rail or subway speeds and quality of service with the lower capital costs of bus-based transit. BRT does this using a combination of pre-payment systems, widely spaced stops, rapid boarding and alighting, dedicated travel lanes, and signal prioritization technologies. Reserving dedicated lanes is often the most challenging element of designing and operating a BRT system because to do so requires a) building new lanes in what are generally the most built up parts of a corridor or region or b) taking general purpose lanes, reducing capacity for SOV commuters and other travelers. The former approach is expensive and the latter controversial and politically unpopular, so some agencies implement BRT without dedicated lanes, accepting slower speeds on shared traffic lanes.

Other shared travel options for the Corridor’s commuters and travelers exist, including innovative, private shared-mode services that provide high-quality buses and shuttles. Bridj is one example of a private transit service provider that evaluates trip origin and destination patterns using a combination of real-time data (from cell phones and Twitter) and traditional travel surveys to identify routes and stops for their shuttles. Although typically Bridj first establishes service to and from core urban areas when entering new markets, its managers have expressed interest in the possibility of setting up services in the US 422 Corridor, which could set a precedent for suburb-to-suburb transit service that would be important to the future of shared modes of travel.\vi

Based on these findings, we recommend:

- A comprehensive, region-wide assessment of current and potential shared modes of transportation with the participation of area transit providers: SEPTA, Pottstown Area Rapid Transit, and privately operated shuttle services

A Long-Term Focus on TDM in the US 422 Corridor

The history of TDM in the US 422 Corridor spans nearly two decades with almost twenty corridor area studies and plans recommending the development and implementation of TDM policies and programs as complements to major infrastructure investments meant to add new highway and transit capacity.

Proposed strategies have included new travel options (new rail lines and bus rapid transit routes), park-n-ride facilities, the promotion of comprehensive land use planning and “smart growth” policies, as well as the utilization of Intelligent Transportation Systems (ITS) and transportation systems management to tackle congestion.

The actual implementation of TDM recommendations has consisted largely of improvements to bicycling and pedestrian infrastructure, the provision of ITS incident management and traveler information services, the establishment of stakeholder groups, and the provision of employer-based ridesharing, shuttle, and flextime programs. Smart growth policies, zoning changes to promote higher-density, mixed-use residential and commercial development, and major investments in new transit systems have not been widely adopted.
Analysis of multi-modal facilities that connect cars, transit services, bicycling, and walking and the identification of specific improvements that can be made to facilitate shared and non-motorized travel in the Corridor

Identification of mode-neutral performance measures for evaluating the effectiveness of shared modes of travel in addressing traffic congestion and the environmental impacts of transportation systems

Ongoing participation by Corridor stakeholders in studies and planning for the extension of rail service to King of Prussia, while keeping in mind the comparison of costs and benefits with other shared-mode alternatives

A study of BRT for the US 422 Corridor, including analysis of surface street routes (along High, Ridge, and Main Streets) and routes with segments using US 422

Consideration of both the public and private provision of shared modes of transportation, including employer-provided transportation and new startup services, like Bridj, Uber, and Lyft

MT-3: Planning for Comprehensive Bicycle Access

Important progress has been made in recent years to construct facilities for safe bicycling in the US 422 Corridor, most notably on sections of the Delaware Valley’s 750-mile plan for the Circuit. Promotion of the concept of “complete streets”—roads and streets designed and constructed with users of all modes of transportation in mind—and the development of bicycle sharing programs in Phoenixville and Pottstown are other important accomplishments.

Several recommendations for building on the success of the Circuit and other bike trails in the region are included in the short-term strategies already covered in this Policy Brief. In the medium term, we recommend that:

- A more comprehensive approach to bicycle planning should be initiated with the goal of developing a Corridor-wide plan to make bicycling safe, convenient, and effective within each one of the 24 communities of the Corridor and between them

Such a plan would include

- A commitment to adopting “complete streets” guidelines

- The construction of bicycle facilities (bicycle lanes, paths, and trails) connecting major and minor origins and destinations within the corridor. Recreational use would be included,
but the emphasis would be on commuting and other travel purposes (e.g., personal business and social)

In addition,

- Safe and convenient **bicycle parking** infrastructure should be a high priority
- **Educational programs** for a diverse population of bicyclists should be developed and disseminated
- Policies and regulations regarding the safe and equitable use of the roadway network should be **enforced**

**MT-4: Implement New Technologies for Ride-Sharing and Traveler Information Dissemination**

The introduction of new communication technologies via the Internet, cellular phone networks, and smart phones has been extraordinary in the past five years. Applications to address specific needs and desires have been developed rapidly and transportation- and commute-related apps are part of this phenomenon. Companies like *Waze* and *Google* provide real-time roadway traffic information and multiple route choices. *Transit App, Smart Ride, and Roadify*, among many others, give transit users up-to-the-minute information on mass transit alternatives for individualized trip origins and destinations. Even bicyclists and pedestrians have apps available to them for identifying routes based on multiple criteria.

As the concept of a “sharing economy” grows more important, some analysts, application developers, and investors predict that vehicle and bicycle ownership will decrease as travelers opt for using shared cars and
bicycles. Uber, Lyft, and Sidecar hope to provide higher quality taxi service (a form of shared vehicle ownership through hiring cars and drivers for specific trips), while also entering the market for ride-sharing. Ride-sharing has traditionally relied upon employers or public agencies providing matching services for commuters traveling from roughly the same origins to the same destinations, but new communications technologies open up the possibility for new, faster, more efficient means of connecting drivers and passengers on a regular basis (as traditional ride-share programs were set up to do) or on an individual, single-ride basis.

How these technologies will actually affect vehicle ownership and use remains unclear, however. It would be impossible to know at this point which companies and apps will survive in the medium-term and what travel management choices commuters and other travelers will have in 2020 and beyond. Even more difficult to know are the long-term changes that will occur in traffic volumes, vehicle occupancy rates, congestion levels, and pollutant emissions related to the dissemination and use of these apps. We recommend that stakeholders in the US 422 Corridor:

- **Pay attention to these developments** and follow evaluations and research results, particularly those concerning traffic congestion and pollutant emissions impacts.

- ** Remain skeptical of extraordinary claims,** attentive to the debates and controversies (for example, concerning worker compensation and liability for providers and users of smart-phone app taxi services), yet open to the opportunities for more efficient use of roadway, transit, bicycle and pedestrian infrastructures.

These innovative uses of computing and communications technologies may provide significant opportunities for addressing traffic congestion and the environmental impacts of transportation systems in ways that build on traditional TDM strategies.
TDM Policies in the Long Term (5 Years and Beyond)

In the long-term, stakeholders in the US 422 Corridor could pursue more ambitious policies based upon close collaboration with state, regional, and local policy-makers aimed at stronger and more consistent coordination of transportation and land use planning efforts. Such policies would build upon and reinforce the short- and medium-term TDM policies outlined in the previous sections of this Policy Brief and result in more significant reductions in traffic congestion in the US 422 Corridor. But they are more politically challenging to initiate and maintain. They require levels of coordination between the public and private sectors and between local, county and regional governments far beyond what currently exists in the Corridor or elsewhere in Pennsylvania.

If stakeholder commitment to traffic congestion reduction through TDM policies in the US 422 Corridor is sufficiently strong these policy changes would address:

- Statewide transportation planning
- Regional land use planning
- Trip reduction ordinances
- Parking pricing policies

To do so would require policy-makers and stakeholders to discuss several key questions and make some important, and potentially difficult, decisions. Should US 422 Corridor stakeholders:

- Revise transportation funding priorities to favor projects for shared and non-motorized modes of transportation over highway and roadway capacity-adding projects?
- Establish performance measures and goals that become increasingly more ambitious over time?
- Lobby for legislative changes at the state level to require coordination between land use and transportation planning and between communities within the region?
- Facilitate the introduction of private investments in and management of shared modes of transportation?
- Adopt policies that make single-occupancy vehicle travel more costly and less convenient?

These questions are politically charged—they present options that in some ways break with longstanding traditions and preferences—and, therefore, are difficult to address directly. Answering yes to them, however, helps create the policy environment in which TDM strategies are likely to be the most effective. In either case, TDM can make positive contributions to reducing traffic congestion and pollutant emissions, but where these approaches are considered undesirable
or infeasible, the impacts will be less significant and the benefits will accrue mainly to individuals and employers.

LT-1: Statewide Transportation Planning Policies

While regional, county, and local stakeholders have the primary responsibility for the development of TDM policies and programs in the US 422 Corridor, in the long term statewide transportation planning policies play an important role too if the most significant reductions in traffic congestion and transportation-related pollutant emissions are to be achieved. Statewide policies can provide incentives to communities to adopt land use planning policies, transportation funding priorities, and TDM programs that make shared and non-motorized travel more convenient and less expensive, giving people many good choices when commuting or traveling for other purposes.

Such TDM policies are challenging, however, because where they work most effectively they also make the costs of single-occupant vehicle travel more transparent, connecting them directly to people’s travel choices. When the costs of using private cars directly reflect environmental, social, and land use impacts, SOV travel becomes more expensive and less convenient than it currently is.

Statewide transportation and land use planning policies can promote smart growth at the local and regional levels, making it more likely that TDM efforts in the US 422 Corridor succeed. This may take the form of encouraging land use policies as a means of addressing other mandates such as clean air or climate change (as is the case in California where Senate Bill 375, passed in 2008, requires coordination of transportation and land use planning) or watershed management (as is the case in Ohio).

Although PennDOT’s ongoing work on its Long Range Transportation Plan update does not explicitly emphasize...
TDM strategies, the recognition of land use-transportation interactions can promote coordinated land use planning initiatives at the regional and sub-regional levels. The plan’s multimodal focus can be used to reinforce performance measures established for the short- and medium-term strategies already outlined above.

To obtain the full benefits associated with long-term TDM strategies for the US 422 Corridor, stakeholders should evaluate opportunities to:

- Incorporate clear, measurable TDM goals and performance measures (including land use planning goals) into future revisions of the state’s transportation plan
- Incentivize compact land use planning requirements for regional and local governments that apply for transportation improvement funding from the state, for example, by increasing preference to fund projects where these policies have been enacted
- Enhance the role of TDM policies and programs in state planning processes and promote best-practices for local governments to incorporate them into their land use and transportation planning processes

**LT-2: Regional Land Use Planning**

Transportation and land use policies are inherently broad in impact, even if they are local in design and implementation. Policies in one municipality often affect traffic congestion, air quality, and economic activities in neighboring communities. Methods of coordinating transportation and land use planning

**PennDOT Policies and Initiatives Supportive of TDM**

PennDOT has long provided timely and substantive guidance on the linkages between transportation and land use planning to municipalities, counties, and MPOs in the state.

These include PennDOT
- Procedures and operating policies, such as the 2008 joint New Jersey / Pennsylvania Smart Transportation Guidebook.
- Technical documents, including the 2012 Pennsylvania Traffic Calming Handbook, and
- Incentives programs, like the Home Town Streets and Safe Routes to School programs.

The technical advice and analysis provided by these handbooks, policies, and reports are of the highest quality, but a significant challenge to implementing them is their voluntary nature. Some municipalities, counties, and regions put the recommendations into effect, but most do not. While this approach respects home rule traditions in the Commonwealth, it ensures that transportation and land use planning remain inconsistently coordinated, limiting the effectiveness of TDM policies and programs.
vary from state to state in the US, with some states vesting strong powers at the regional level. Oregon, with its Land Conservation and Development Commission and statewide transportation and land use planning goals, is the best known example of this.\(^x\)

On the other hand many states in the country, including Pennsylvania, have strong traditions of local government control of land use planning based on the idea that home rule devolves a great deal of decision-making power to the smallest geographic administrative units. In these cases, regional efforts to coordinate land use and transportation planning depend on voluntary, collaborative, and/or incentives-based systems.

Collaboration between regional and local stakeholders is the common denominator of successful regional land use planning efforts, whether through statutory requirements or voluntary agreements. Cooperation in the US 422 Corridor between local governments will be easier and more effective with the involvement of Southeast Pennsylvania’s Metropolitan Planning Organization, the Delaware Valley Regional Planning Commission (DVRPC). DVRPC can help foster integrated transportation and land use planning among local governments by providing targeted technical assistance. DVRPC’s current Municipal Outreach Program, by which it works with local governments to assess their current smart growth planning practices and promote the adoption of best practices throughout the region, is an important step in this direction.

The recent update of the Pennsylvania Transportation Improvement Program (TIP) project scoring system includes DVRPC’s “centers” designation as a criterion as well as the calculated Transit Score as a basis for prioritizing projects. Additional criteria for assessing projects could explicitly reward successful TDM programs or designate priority corridors that have adopted multi-jurisdictional land use and TDM policies.\(^x\) In the long term DVRPC could be encouraged to:

- Establish a smart growth collaborative task force for the US 422 Corridor
- Establish region-wide policies to encourage TDM and Transit-Oriented Development (TOD) planning in the US 422 Corridor and other area corridors eligible for new transit service investments

**LT-3: Trip Reduction Ordinances**

Trip Reduction Ordinances (TROs), designed to reduce single occupant vehicle trips and increase shared and non-motorized travel, have been promoted as a method of addressing air quality non-attainment status since the 1980s. Typically, authors of TROs establish mandates for employers or developers that are then enforced at the state, regional, or local level, but in some jurisdictions they rely on voluntary participation or assess compliance only through reporting requirements.
Typically Trip Reduction Ordinances feature the following characteristics. They:

- Designate employer-based Transportation Coordinators
- Establish incentive and / or disincentive programs to manage travel demand and parking supply
- Subsidize travel by public transit, shuttles, and ridesharing
- Promote outreach to commuters to promote use of alternatives to SOV travel
- Require site plan review for new or renovated development projects
- Publish site planning guidelines to promote amenities supportive of travel alternatives
- Require annual surveys, measurement, and reporting on travel behavior
- Impose penalties at the establishment level for failure to achieve trip reduction targets or waive fees for successful achievement of targets
- Permit quid quo pro arrangements to leverage developer and employer actions as conditions of land use approval or in exchange for relaxation of zoning requirements

TROs can be pursued through collaboration at the state, regional, and local level. At the state level, DOTs can sponsor the development and adaptation of a model TRO consistent with state laws, including Municipal Codes. By working with regional partners, model TRO ordinances are generally tailored to individual contexts. For example, along the US 422 Corridor consistent ordinances ought to be enacted in each of the municipalities and the three counties.
This is not to suggest that even at the corridor level one size fits all. Nevertheless, it is important that ordinances that operate on a voluntary basis in one jurisdiction not undercut the effectiveness of mandatory requirements in place in an adjacent one. One solution would be for requirements to switch from voluntary to mandatory in a township once a predetermined trip generation or development threshold is crossed.

While reduced vehicle trip generation is the long term goal of a trip reduction ordinance, it is important not to minimize the value of creating awareness and informal accountability by developers and other employers for the congestion they help create. Requirements to survey employees, measure trip generation, and report these findings is an effective first step towards the eventual implementation of TROs.

**LT-4: Parking Pricing Policies**

Parking management and pricing policies can influence travel behavior, discouraging single occupant vehicle use and encouraging the use of shared and non-motorized modes. Transit-supportive parking policies have gained prominence in recent years as researchers and practitioners – Donald Shoup, a researcher at the University of California at Los Angeles and the author of the award-winning book *The High Cost of Free Parking* (APA Planners Press, 2005), is the best known of this group – have identified their importance in managing mode choice and promoting transit ridership. Policies and programs that charge motorists for parking cars in public (and sometimes in private) locations work best when applied to a corridor-wide area where alternative modes of travel are available and local governments coordinate the pricing and supply of parking.

The effectiveness of parking pricing can also be enhanced using variable parking rates determined by computer systems that dynamically change the price to match real-time parking supply and demand information from sensors. These intelligent transportation systems (ITS) tools can help set the best price to accurately match supply and demand while also informing travelers about the price, availability, and location of parking. Prices can also be set to proactively discourage driving. Where pricing information is provided to the public through Internet, smartphones, and other media, ITS-based parking management systems could reduce traffic congestion and emissions in the US 422 Corridor.

Parking pricing and supply policies are particularly effective over the long term when coupled with transit-oriented land use planning policies. For example, when coordinated with transit investments, Transit-Oriented Development (TOD) and smart growth policies, relaxed parking standards (or parking maximums) are widely seen by practitioners as an effective means to jump-start TOD and build transit ridership over the long-run.
However, the influence of parking policies on TOD and travel behavior also depends on how planners interpret, calculate, and implement them. Standard practices for calculating parking demand (for example, using the Institute of Transportation Engineers’ *Parking Generation* handbook) for a TOD have been criticized as statistically unsound, based on inappropriate land use categorizations, and inattentive to the influences of transit supply, surrounding urban context, and time-of-day variations in parking demand. To be successful, transit-oriented parking policies must be implemented with attention to these issues and a willingness to adapt conventional engineering practices to innovative efforts to design, implement, and manage TDM policies and programs.

Effective implementation of parking pricing policies could be encouraged and enhanced through:

- Creating a **corridor-wide parking policy task force** with the mandate to study, identify, and promote a unified, comprehensive set of parking pricing and development policies
- Identifying resources for the development of a **corridor-wide parking pricing and policy study**
- Developing a corridor-wide ITS-based **parking pricing and information management system**
Recommended Action Plan for Moving Ahead with TDM Planning in the US 422 Corridor

The short-, medium-, and long-term strategies outlined in the preceding sections represent opportunities, challenges, and choices for stakeholders in the US 422 Corridor.

To move ahead, we recommend the following steps be pursued in the spring of 2015:

- **Disseminate this Policy Brief** widely to: a) public officials at all relevant levels of government in the US 422 Corridor, from the municipalities to state agencies; b) employers, developers, contractors, and others in the private sector with an interest in transportation within the area; and c) the public who live and work within the region

- **Careful review of this Policy Brief by the 422 Corridor Coalition**: This consideration should be undertaken in close collaboration with state, regional, county, and municipal leaders in corridor communities

- **Establish feasible goals and performance measures for the short-term** and identify lead agencies to monitor progress

- **Address key decisions concerning the following questions**: Should US 422 Corridor stakeholders:
  - Revise transportation funding priorities to favor projects for shared and non-motorized modes of transportation over highway and roadway capacity-adding projects?
  - Establish performance measures and goals that become increasingly more ambitious over time?
  - Lobby for legislative changes at the state level to require coordination between land use and transportation planning and between communities within the region?
  - Facilitate the introduction of private investments in and management of shared modes of transportation?
  - Adopt policies that make single occupant vehicle travel more costly and less convenient?

  These decisions should be made in the medium-term after careful consideration and open and extensive discussion.

- **Based upon answers to the key decision points, plan for medium- and long-term TDM strategies** that a) emphasize continuity with the existing policy environment and modest potential impacts on traffic congestion and pollutant emissions or b) are more ambitious in pursuing changes to the policy environment that could lead to larger potential reductions in traffic congestion and pollutant emissions

The figure on the following page summarizes the potential TDM strategies US 422 corridor stakeholders can pursue and the key decisions that will need to be made as efforts are implemented.
TDM Best Practices for Southeast Pennsylvania’s US 422 corridor

**Short-Term Actions**
- Organize and set goals (ST-1)
- Work with employers (ST-2)
- Promote and educate (ST-3)
- Improve non-motorized transport (ST-4)

**Medium-Term Actions**
- Larger investments in non-motorized transportation (MT-3)
- Larger investments in public transit (MT-2)

**Decision**
- Revise transportation funding priorities to favor shared & non-motorized transportation?
  - Yes
  - No

**Long-Term Actions**
- Statewide transportation planning policies (LT-1)
- Regional land use planning (LT-2)
- Trip reduction ordinances (LT-3)
- Parking pricing policies (LT-4)

**Decision**
- Promote legislative changes to require coordination b/w land use and transportation planning and b/w communities within regions?
  - Yes
  - No

**Decision**
- Adopt policies that make single-occupancy vehicle trips more costly and less convenient?
  - Yes
  - No

**Decision**
- Promote private investments in and management of shared modes of transportation?
  - Yes
  - No

**Decision**
- Continue with medium-term policies (MT-1 to MT-4)

**Impact on traffic congestion and transport pollutant emissions**
- Timeframe: 0 to 2.5 years for short-term, 2.5 to 5 years for medium-term, and 5 to 10 years or more for long-term

**Impacts**
- Unclear
- Low
- High

**Ambitious**
- Modest
Appendix A: Additional Planning Implementation Steps

TDM Action Steps can be complemented in the short- and medium term by broader planning implementation steps that build on the body of work that has already been undertaken to study the 422 Corridor and that establish Smart Growth strategies and priorities statewide. The immediate purpose is to update, refine, and contextualize the findings and objectives of previous plans, studies, and guidance. The larger goal is to renew the momentum of preceding work as a foundation for effective TDM efforts and to support other land use policies and transportation improvements that can help improve access and mobility.

Table: Additional Implementation Steps

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<tr>
<th>Action</th>
<th>Implementers</th>
<th>Expected Outcome</th>
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| A1. **Update, refine, re-affirm, or retire strategies from US 422 Master Plan Study:** Strategies included in the study as having high or “current need” at the time of the study should be assessed based on relevance and feasibility today. An update to the master plan could establish a working list of program and project priorities and establishes a baseline for future land use and infrastructure while identifying ideas that are no longer feasible. The reviews should establish:  
- What has been done,  
- What is feasible/infeasible and why?  
- What alternatives exist for infeasible concepts | Regional, County, Municipal | Stakeholders can be reengaged around promising ideas that were identified in the master plan process but obscured by the focus on rapid transit and other projects to be funded by tolling. Outreach efforts associated with TDM programs provide a vehicle to build consensus around master plan strategies that remain feasible. Conversely, an attainable long range vision for the corridor can be a catalyst to encourage participation in TDM in the near term. |
| A2. **Update, refine, and contextualize PA smart growth guidance for the US 422:** A comprehensive review of state guidance should be made to assess the strengths, weaknesses, and current relevance to the US 422 Corridor of documents such as:  
  - Smart Transportation Guidebook  
  - Integrating Transportation and Land Use  
  - Transportation Impact Fees Handbook  
  - Sound Land Use Implementation Plan  
  - Growing Smarter Toolkit  
This assessment should look beyond TDM to describe the effectiveness of tools to promote sustainable transportation and land use. | Statewide, Regional | Much of the guidance on sustainable development in Pennsylvania makes reference to these documents; updating and contextualizing them is needed to establish concepts that are out of date or out of place in the US 422 Corridor. For example, appropriate emphasis on multi-municipal planning permits Transferable Development Rights and revenue sharing. However, this may be undercut by limitations on spending impact fees in transportation service areas larger than 7 square miles (the Corridor covers roughly 200 square miles). Nonetheless, strong guidance that is found relevant can refocus planning efforts and establish incentives and disincentives for effective TDM. Ineffective regulatory concepts can be dropped from local planning discourse. |
| A3. **Study and enumerate the costs of sprawl and congestion on US 422 Corridor.** To dispel the notions of zero-sum game approaches to land development a study should be conducted that conservatively quantifies the costs to residents, employees, business and governments of each municipality. | Statewide, Regional, Non-governmental | This study would establish the baseline “win” that each municipality, its businesses and residents would enjoy based on a reduction in the congestion that has been induced by sprawling development patterns. This measure will be the basis for foregoing inconsistent development or contributing fair shares to measures that can reduce congestion or improve access & mobility. |
### B. Refine and Promote Smart Growth Strategies

#### Short Term

<table>
<thead>
<tr>
<th>B1. Audit Land Use Planning along the US 422 Corridor:</th>
<th>Regional, County, Municipal, Non-governmental</th>
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<tr>
<td>An audit of land use planning along the corridor should begin with a review of municipalities that have up to date plans, then extend into determining the consistency of municipal plans with adjoining jurisdictions, counties, and the principles of the US 422 Corridor Master Plan. This audit should address steps that can be taken to harmonize municipal and county plans.</td>
<td>Areas that rely on inconsistent plans and land use policies are likely to promote development patterns that contribute disproportionately to congestion. This audit should reveal the need and opportunities to support or incentivize municipal planning and joint planning efforts in particular. This will highlight the need for good faith negotiation among stakeholders to coordinate corridor-wide objectives.</td>
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#### Short Term

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<tr>
<th>B2. Identify or Facilitate Association of Developers:</th>
<th>County, Non-governmental</th>
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<td>Hosting or providing a forum for developers to meet will allow local officials and non-governmental entities to educate, advocate, highlight, and celebrate development practices that are consistent with master plan goals. Developers could be encouraged to join the association to get information on the coordination of the development process with regional objectives and an overview of rights and responsibilities in participating counties and municipalities.</td>
<td>Promoting exposure to LEED and best workplace certification programs can help dispel the perceived gap between smart growth practices and profitability. Such a forum would provide an early sounding board for model ordinances and other concepts promoted along the corridor.</td>
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#### Medium Term

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<tr>
<th>B3. Draft Model Ordinances for the US 422 Corridor:</th>
<th>Regional, County, Municipal, Non-governmental</th>
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<td>To eliminate gaps in planning consistency, municipalities and land development interests should be engaged to participate in identifying local best practices to manage development in the US 422 Corridor. Model ordinances could include:</td>
<td>It should be possible to advance discussion about consistent land use controls by developing templates. These provide municipalities along US 422 with a reference point for developing their own controls that can be defended in terms of coordinated corridor growth. Ultimately this should result in smoother and more consistent implementation than would otherwise occur. By linking more restrictive land use controls in certain municipalities to transferrable rights and revenue sharing equity among municipalities, growth can be channeled equitably in a manner that can be sustained.</td>
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<th>Sub Division &amp; Land Development Ordinances</th>
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<td>Zoning Ordinances</td>
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<td>Trip Reduction Ordinances</td>
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<td>Transferable Development Rights Agreements</td>
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<td>Impact Fee Ordinances</td>
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<td>Revenue Sharing Agreements</td>
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<td>Site Planning Guidelines</td>
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<th>B4. Develop Access Management Plans and Ordinances for the US 422 Corridor:</th>
<th>Statewide, Regional, County</th>
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<td>Access management should address peak hour turn restrictions, driveway and intersection spacing, access consolidation, and other requirements for parallel and intersection roads along US 422 (e.g. Ridge Ave, PA 23, PA 724, Egypt Road). An Access Management Plan should be coordinated with medium and long term planning efforts to promote TOD and other compact development approaches.</td>
<td>Improvements to access management will reduce congestion and amplify the benefits of signal coordination and other capacity improvements. An effective access management plan will also provide leverage towards effective site planning for private developments and support TDM efforts to foster collaboration and communication including the private sector.</td>
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Appendix B: Endnotes


iii. For more information, see the RideECO website at http://www.rideeco.org/.

iv. See the August 2005 Pottstown Metropolitan Regional Comprehensive Plan at https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxwb3R0c3Rvd25tZXRyb3BvbGl0YW5zZ3g6NGU0YWIwNWY2YmI3YzkzOQ.


vi. In our interview with the organization, Bridj indicated its willingness to speed up implementation in the US 422 Corridor should stakeholders work with them on four actions: 1) Set up a meeting between PennDOT, DVRPC and Bridj to begin discussions, 2) Initiate a survey of local, regional, and state regulations and policies that are potential barriers to Bridj’s initiation of services in the corridor; 3) Identify a motivated, high-level champion for Bridj that can help influence local, regional and state stakeholders to remove the barriers identified in the survey, and 4) Set up a subsidy for Bridj services that will guarantee a revenue “floor” for Bridj operations in the corridor. The project team is not recommending these actions be taken, but wants to convey the types of actions that private transit services like Bridj would like to help them move quickly into operations.

vii. For more information on California’s SB 375, see http://www.leginfo.ca.gov/pub/07-08/bill/sen/sb_0351-0400/sb_375_bill_20080930_chaptered.pdf.

viii. For more information on Ohio’s Watershed Management planning efforts, see http://www2.ohiodnr.com/soilwater/water-conservation/watersheds.

ix. See the PA On Track website at http://www.paontrack.com/.

x. For a brief history of Oregon’s land use planning system, see http://www.oregon.gov/LCD/Pages/history.aspx.

xi. The San Francisco, California Bay Area’s MPO, the Metropolitan Transportation Commission, has prioritized projects in this way through Resolution 3434 and its FOCUS program. See http://www.mtc.ca.gov/planning/rtep/ and http://www.mtc.ca.gov/planning/smart_growth/ for more information.
The Center for Sustainable Communities (CSC) develops and promotes new approaches to protect and preserve quality of life through sustainable development. We act as a resource for government agencies, community organizations, and developers, providing objective information and services to improve decision-making relative to land use, transportation, and water resources planning and development.

580 Meetinghouse Road
Ambler, PA 19002
P: 267.468.8312

Greater Valley Forge Transportation Management Association (GFVTMA) is a not-for-profit organization created to advocate and promote a viable transportation network for the region's economic vitality. To maximize awareness and develop sustainable support, we partner with public and private entities.

1012 West Eighth Avenue, Suite A
King of Prussia, PA 19406
P: 610.354.8899 · F: 610.768.0626