Congestion Management Process

Technical Report May 2011

MIAMI VALLEY REGIONAL PLANNING COMMISSION
ONE REGION... ONE VISION... ONE FUTURE

One South Main Street
Suite 260
Dayton, OH 45402
tel. 937.223.6323
fax 937.223.9750
www.mvrpc.org
TTY/TDD 800.750.0750

mvrpc

Miami Valley Regional Planning Commission

Dayton, Ohio

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1 Roadway Congestion Overview

In response to the 1991 Intermodal Surface Transportation Equity Act (ISTEA), the Miami Valley Regional Planning Commission (MVRPC) produced its first Congestion Management System (CMS) Technical Report in 1998. The 1998 report, with recurring roadway congestion as its sole focus, used performance measures to uncover roadway congestion concerns, identify possible causes of congestion, and find potential corrective actions for congestion in the Dayton Region. These measures provided the basis for identifying the extent and severity of congestion over time. The 2003 update of the CMS Report presented an expanded analysis to include studies of non-recurring congestion, transit performance, and several regional operational roadway congestion management strategies. In addition to examining recurring and non-recurring congestion, the 2007 update introduces several new elements and analyses into the regional CMP report. For example, national and state trends in traffic congestion are reviewed to provide perspective for the current and future roadway congestion in the Dayton Region. In addition, an investigation into the relationship between traffic congestion and safety and a review of various operational congestion management strategies are included. Finally, the 2007 CMP update outlines other federal, state, and regional congestion management activities.

MVRPC has produced the 2011 Congestion Management Process (CMP) Technical Report to update the progress of the Region's congestion management strategies and their integration into MVRPC's transportation planning processes. The newer sections in this report include a discussion of the travel time reliability analysis based on travel time data recorded by freeway sensors and supplied by ODOT as well as a discussion on the Complete Streets Policy and various livability/sustainability initiatives.

The Ohio Department of Transportation (ODOT) has been at the forefront of congestion management for Ohio since 1993 with the development of the statewide Traffic Congestion Management System (TCMS) and the TCMS Work Plan in 1994. As stated in the Work Plan, the primary goal of the TCMS was "to provide a management tool for use in the identification and ultimate remediation of congestion through implementation strategies that provide for the most efficient use of the existing and future transportation system." Objectives of the TCMS included:

- Identifying locations of existing and future congestion
- Specifying strategies to minimize or eliminate congestion
- Evaluating effectiveness of implemented strategies
- Providing input to the MPO's Long Range Transportation Plans

In addition to those outlined by the state TCMS, objectives of the 2011 CMP Technical Report include:

- Document the locations of peak and off-peak period traffic crashes
- Identify locations where congestion may be impacting roadway safety
- Document travel time reliability statistics for the Region

The results of the analysis indicate that recurring congestion on the Region's transportation network is on the rise. The peak morning and evening travel periods are becoming particularly prone to longer delays as a result of recurring congestion. In addition, many of the Region's freeways may be experiencing significant non-recurring congestion due to random and unpredictable events, such as traffic crashes, and an aggressive freeway re-construction and modernization program. Analyses indicate that implementation of the MVRPC Long Range Transportation Plan could significantly reduce roadway congestion on much of the regional transportation system. Other local strategies to manage congestion include integrating alternative forms of transportation (i.e. public transit, walking/bicycling, and carpooling), and operational management solutions, such as traffic incident management. State and federal agencies are also mobilizing significant technical and financial resources to slow the growth of roadway congestion.

The 2011 CMP Technical Report will be made available to the public in electronic format on MVRPC's website. In addition, presentations will be made to a variety of public entities in preparation for the 2012 update of the Long Range Transportation Plan. These results will also be presented at various public participation meetings.

1.1 Regional Context

The Miami Valley Regional Planning Commission is the federally designated Metropolitan Planning Organization (MPO) for the counties of Miami, Montgomery, and Greene in western Ohio, plus the cities of Carlisle, Franklin, and Springboro in northern Warren County (See Figure 1-1). With Dayton as its largest city (pop. 166,179), approximately one million people reside within the 82 jurisdictions that comprise the MPO region. The primary focus of this report is the regional freeway network (I-75, I-70, I-675, SR4, and US-35) as it carries the highest traffic volumes relative to surface arterial and collector roadways. Hereafter, the MVRPC planning area will be referred to as the 'Dayton Region', or simply the 'Region'.

1.2 Introduction to Congestion

For roadway users, the best transportation system would move people and goods to where they need to be in a quick, safe, and cost effective manner. However, the traffic demand placed upon the current roadway system is increasing more quickly than can be accounted for by projects and programs to expand roadway capacity. Congestion continues to grow in both time and geographic extent on the nations most heavily traveled corridors, many of which are located in highly urbanized regions where roadway expansion may not be politically and/or economically feasible. Therefore, an increasing importance has been placed on maximizing roadway capacity through a combination of physical and operational roadway improvements, as well as alternative modes of transportation.

"Congestion" is generally defined from the perspective of the roadway user. The public's perception of congestion relies primarily on their own experiences when traveling on the nations roadways. For example, roadway congestion experienced by a rush-hour commuter in Dayton, Ohio will be much different than that experienced by a rush-hour commuter in a much larger city, such as Chicago or New York City. It is these differences in experiences that create difficulties when attempting to define congestion. However, an engineer would describe congestion as the condition where traffic demand approaches and/or exceeds the roadway's ability to facilitate travel at normal speeds. Typically, roadway congestion manifests itself as "stop-and-go" traffic conditions.

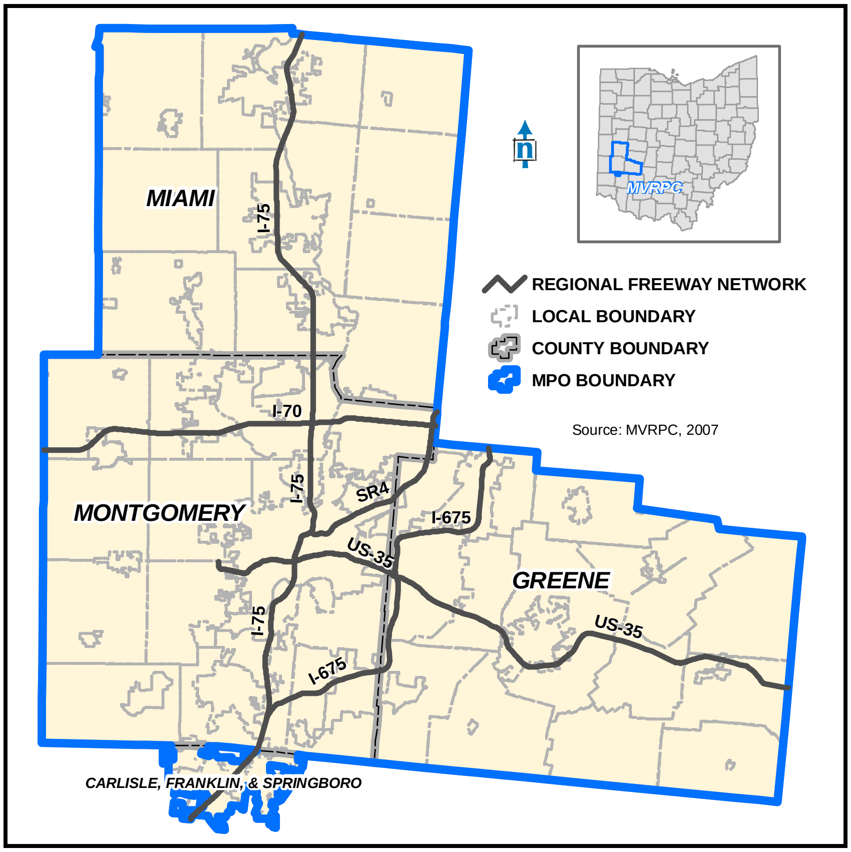

Figure 1-1: MVRPC Planning Boundary and Regional Freeway Network

According to the Federal Highway Administration (FHWA), roadway congestion is comprised of three key elements: severity, extent, and duration. The blending of these elements will determine the overall effect of congestion on roadway users. The severity of congestion refers to the magnitude of the problem at its peak. The extent of congestion describes the geographic area or number of affected motorists, while the duration describes the length in time that users experience congested conditions. Because these elements have a positive relationship, any increase in one will subsequently result in an increase in the others. Therefore, as roadway congestion continues to build (increased severity), more travel will occur under congested conditions (increased duration) affecting an increasing number of motorists and roadway facilities (increased extent).[1]

Roadway congestion occurs due to a number of planned and unplanned events either in isolation or in tandem. In some cases, the clockwork nature of recurring congestion can be the sole event. However, presented below, research by FHWA has identified several additional root causes for roadway congestion along with their percent contribution as a cause of national roadway congestion.

- Traffic Incidents (25%) — Random events occurring in the travel lanes that disrupt otherwise “normal” traffic flow, such as crashes, disabled vehicles, or roadway debris.

[1] “Status of the Nation’s Highways, Bridges, and Transit: Conditions and Performance”, *FHWA* (2008)

- Bad Weather (15%) — Environmental conditions can affect driver behavior, causing motorists to drive more slowly and/or allow for larger gaps between cars.
- Work Zones (10%) — Construction activities that alter traffic flow due to lane or shoulder restrictions, lane shifts, or temporary closures.
- Traffic Control Devices (5%) — Poorly timed or spaced signals and railroad crossings can cause intermittent disruptions in traffic flow.
- Special Events (5%) — Sudden increases in traffic demand due to planned events, particularly in rural areas, can temporarily overburden the roadway system.
- Physical Bottlenecks (40%) — Sections of the roadway system that have reached their operational capacity.
- Fluctuations in Normal Traffic Flow (Unknown) — Day-to-day changes in the traffic demand placed on the system due to random unknown causes.

Though these events typically result in traffic congestion, it is almost impossible to predict when they might occur. Other than bottlenecks resulting from maximized roadway capacity, the above listed events take place with irregularity throughout the day. According to FHWA, 60% of roadway congestion can be attributed to traffic incidents, inclement weather, work zones, poorly timed traffic control devices, or special events.[2] Therefore, accurately predicting travel times between two points becomes increasingly difficult as congestion caused by irregular events disrupts the transportation network over longer periods of time and larger sections of roadway, leading to frustration for commuters, commercial operators, and public officials.

Currently, there are a number of strategies that transportation planners and engineers implement to reduce the geographic and temporal extent of roadway congestion. These countermeasures include both physical and operational roadway improvements. More often, two or more of these strategies are combined to provide for maximum congestion relief. Below is an abbreviated list of potential roadway congestion countermeasures:

- Access Management — These physical roadway treatments attempt to regulate the manner in which motorists access adjacent land uses by consolidating multiple driveways, providing exclusive turning lanes, and/or incorporating various median treatments including two-way left-turn lanes and non-traversable barriers.
- Traffic Signal Timing — Adjusting signal times for current roadway demand can be a cost effective way to increase roadway capacity and is one of the most basic roadway congestion countermeasures.
- Freeway Management Systems — These systems integrate a number of operational enhancements, such as cameras, dynamic message signs, and highway advisory radio, into a traffic management center which provides the motoring public with up-to-the-minute updates on current traffic conditions, allowing them to by-pass areas with roadway congestion.
- Travel Demand Management — A transportation policy that aims to spread transportation demand amongst numerous modes, including carpooling, transit, and bikeway/pedestrian pathways, to reduce dependence on the automobile.

[2] "Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance", *FHWA* (2008)

- Traffic Incident Management — A program that encourages the quick, safe, and coordinated removal of traffic incidents to restore normal traffic flow.
- Value Pricing — A strategy that charges travelers a user fee to access congested corridors during pre-determined periods of high demand.
- Adding Capacity – By increasing the carrying capacity of a roadway, the growth of congestion may be alleviated.

As technologies emerge and our understanding of roadway congestion expands, the use of these and other strategies will have a significant effect on reducing roadway congestion, thus providing a safer and more reliable transportation network.

1.3 National and State Congestion Trends

Nationally, roadway congestion is on the rise, and has been for the majority of the last four decades. An increasing amount of personal and commercial travel is accommodated by the nation's highway network. Congestion has spread to more cities and now occurs for greater lengths of time on more days of the week. In fact, 76% of respondents to a recent Harris Poll[3] felt that roadway congestion was a moderate to serious problem in their community.

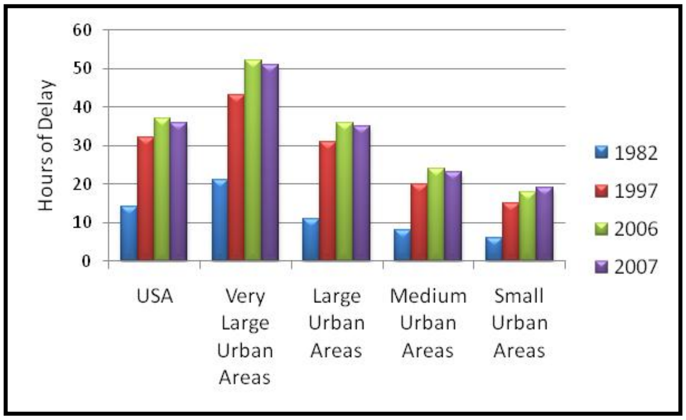

Figure 1-2: Average Annual Hours of Peak Period Traveler Delay, USA ***(Source: TTI)***

One of the premier sources of statistics and analysis on the current state of roadway congestion comes from the Texas Transportation Institute (TTI). The *2009 Urban Mobility Report* gives a detailed description of congestion conditions for 439 urban areas with populations ranging from a few hundred thousand to large urbanized regions with populations of over 3 million people. According to the TTI, in 2007, congestion caused urban Americans to travel 4.2 billion hours more and to purchase an extra 2.8 billion gallons of fuel for a congestion cost of $87.2 billion — an increase of more than 50% over the previous decade. Small traffic volume declines brought on by an increase in fuel prices over the last half of 2007 caused a small reduction in congestion from 2006 to 2007. In all 439 urban areas, the worst congestion levels affected only 1 in 9 trips in 1982, but almost 1 in 3 trips in 2007. Free flowing traffic is seen less than one-third of the time in urban areas over one million population. Finally, the TTI found that delay has grown over 5 times larger since 1982. The second largest percentage increase in annual hours of peak period traveler delay from 1982 to 2007 occurred within urbanized areas of 500,000 to 1 million people, which includes the Dayton Region (See Figure 1-2[4]).

Traffic congestion in Ohio closely mimics congestion at the national level. In fact, the Ohio Department of Transportation (ODOT) has identified congestion as "the

[3] The Harris Poll #16 of 2,337 U.S. adults between January 11 and 18, 2007

[4] Very Large (>3 million), Large (1 – 3 million), Medium (500, 000 – 1 million), Small (<500,000)

most serious of all the transportation system performance measures forecasted by ODOT." According to ODOT, though the current transportation management program will be able to adequately maintain pavement and bridge conditions into the future, the growth of congestion is outstripping the department's ability to alleviate it. As of 2000, ODOT had only enough capital to expand the state highway network by one-third of one percent per year, while traffic had grown 2 percent annually since 1970.[5]

Similar to national patterns of urban expansion, the State of Ohio has seen a rapid decentralization of population since 1970. According to ODOT projections, this pattern will continue well into the 21st Century.[6] The effect of these settlement patterns will be new transportation needs that will undoubtedly be met by personal modes of transportation, most notably the automobile. For example, in 2008, the State of Ohio recorded the 3rd highest percentage of commuters driving alone in the nation (82.6%). Furthermore, Ohio ranked 44th in percentage of carpoolers, 22nd in use of public transportation, and 19th in average travel time to work for commuters. Therefore, tremendous strain will continue to be placed upon the existing transportation network to meet the ever increasing demand. In order to meet this demand, the State of Ohio spent the 9th highest dollar amount on transportation nationally in 2007, totaling approximately $5.90 billion.[7]

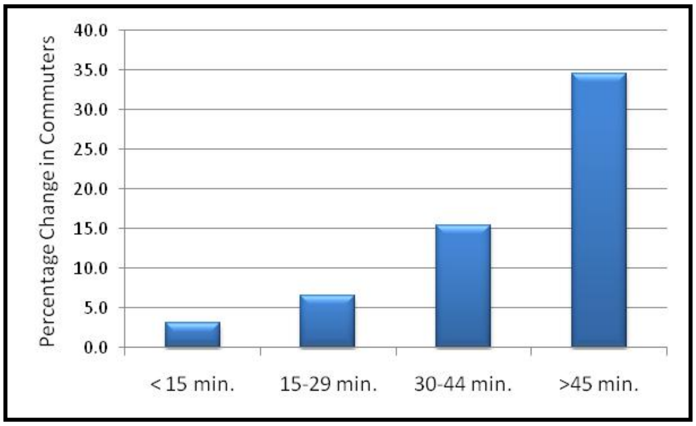

Figure 1-3: Percent Change in Commuters by Commute Time in Ohio, 1990-2000

Statewide, commute times in Ohio have been on the rise. In fact, those commuting 45 minutes or longer showed the greatest increase in both percentage (34.5%) and total number of commuters (+138,301) between 1990 and 2000. Membership in this group grew more rapidly than any other group in Ohio (See Figure 1-3).

As reported by ODOT, vehicle miles traveled (VMT) increased in 23 of the 25 years from 1975 to 2000, growing anywhere between one percent to more than five percent annually. During that same time period, vehicle miles traveled by commercial traffic (i.e. trucks) increased 78 percent. Because trucks travel at lower speeds and have slower acceleration rates, they can compound the congestion problem at interchanges and signalized intersections. As a result of this increased demand, 27.7 percent of Ohio's freeway network operated at a Level of Service D[8] or worse in 2000[6].

1.4 Effects of Congestion

Simply stated, the effects of roadway congestion can be profound, in terms of lost time, lost income, and reduced safety. In some cases, these effects can be quantified in terms of production costs, such as the costs associated with wasted fuel. Quality of life can also be affected by roadway congestion, but is more difficult to

[5] "State of the Transportation System" *Ohio Department of Transportation* (2000)
[6] "Access Ohio 2004-2030" *Ohio Department of Transportation* (2004)
[7] "State Transportation Statistics: 2008" *Bureau of Transportation Statistics* (2008)
[8] For an explanation of Level of Service, refer to Chapter 2 of this report.

quantify in monetary terms. Presented below is a small sample of the adverse effects of roadway congestion:

- Wasted Fuel — Each year, millions of gallons of fuel are wasted as a result of roadway congestion. This represents billions of dollars in losses to both commercial and private interests. The costs associated with wasted fuel are typically passed on to the consumer.
- Diminished Quality of Life — Every minute wasted in congestion reduces the available time for family, friends, errands, hobbies, exercise, and other life pursuits. In addition, evidence has suggested that increases in commuter times can negatively affect involvement in community affairs.[9]
- Lost Economic Productivity — Due to the costs associated with storing excess production materials, many industries have implemented 'just-in-time' delivery systems where materials arrive shortly before they are put into production. As traffic congestion grows, this system can be easily disrupted, raising transportation and manufacturing costs while reducing productivity. The costs associated with lost productivity are often passed on to the consumer.
- Reduced Safety — Frustrated drivers can exhibit aggressive driving behaviors, increasing the potential for angle and rear-end crashes. Highway interchanges that require weaving maneuvers on congested roadways also pose significant safety hazards.
- Slowed Emergency Response — Delays caused by roadway congestion can severely impact response times that most often make the difference in emergency situations. Emergency vehicles are also more likely to be involved in traffic crashes on congested roadways, creating a safety hazard for both roadway users and emergency responders.
- Degraded Air Quality — In general, vehicles emit far more pollutants that contribute to ground-level ozone and smog during stop-and-go traffic than under free flow conditions. Greenhouse gas emissions also increase as a result of roadway congestion.
- Decreased System Reliability — Reliability in the transportation system begins to decrease as roadway congestion grows to absorb longer periods of time and more stretches of highway. Additional "buffer" time must be committed in order to arrive at a destination on-time, reducing market access and competitiveness. To remain competitive, businesses may choose to re-locate away from congested urban corridors to avoid the need for buffer time. This can have a direct impact on center city decline, creating urban sprawl and suburban roadway congestion.
- Increased Spending on Infrastructure — Local, state, and federal governments must now allocate an increasing amount of resources to simply keep pace with growing roadway congestion. As a result, fewer funds are available for other government services, such as education, health care, and social services.

[9] "National Strategy to Reduce Congestion on America's Transportation Network" *USDOT* (2006)

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2 Recurring Congestion Trends

Roadway congestion occurs when travel demand is close to or exceeds the traffic carrying capacity of the roadway. It appears on a regular basis at expected locations along the roadway network, typically developing on commuter corridors during the morning and evening peak travel periods. Recurring congestion can also occur outside of these travel periods, most often as a result of holidays or planned special events. However, the time, location, and length of recurring roadway congestion can change from day-to-day, due to fluctuations in daily travel demand.

The following sections provide an overview of travel conditions in the Dayton Region and are based on the regional roadway network resulting from projects in the 2008 update to the 2030 Long Range Transportation Plan.

2.1 Methodology

MVRPC used its regional travel demand model to develop scenarios consistent with the LRTP list of projects. The complete list of LRTP projects is included in MVRPC's 2030 Long Range Transportation Plan which is available on the internet on MVRPC's website[10]. Three scenarios were developed: 2005 Base conditions, 2030 Existing plus Committed (E+C), and 2030 Plan. The 2030 Plan scenario includes all projects in the Long Range Transportation Plan (LRTP), while the E+C scenario includes only projects that are funded in the SFY 2008-2011 Transportation Improvement Program (TIP). Socioeconomic data from 2000 is used on the base scenario, while 2030 forecasted socioeconomic data is used on the 2030 E+C and Plan scenarios. For more information on socioeconomic data assumptions, refer to the May 2008 update of the 2030 Long Range Transportation Plan.

Congestion statistics for the base and future year scenarios were generated for each roadway segment by using CMAQT software developed by the Ohio Department of Transportation (ODOT). Congestion was identified by location and quantified by severity using the following performance measures:

- Roadway Congestion Index (RCI)
- Level of Service (LOS) and Volume-to-Capacity Ratio (V/C)
- Vehicle Delay
- Person Delay
- Cost of Delay

Daily regional summaries are presented for RCI, vehicle and person delay, and cost of delay. Morning and afternoon peak hour summaries by functional class and corridor are presented by level of service/volume-to-capacity ratio, delay, and percent congested Vehicle Miles of Travel (VMT) or Lane Miles.

In addition, MVRPC utilized travel time data supplied by ODOT for SFY 2010 to determine travel time reliability trends in the Miami Valley. Travel time reliability is measured through several mobility and reliability indicators that impact the individual traveler such as travel time index, buffer time index, and planning time index. The supplied data was also used to calculate area measures of travel time

[10] http://docs.mvrpc.org/lrtp/2008/ChapterV.pdf

reliability, such as misery index, that are better suited to large scale systems planning analysis.

2.2 Regional Roadway Congestion

The Roadway Congestion Index (RCI) identifies total recurring delay on both freeways and arterials. This value does not include delay that results from accidents or disabled vehicles, nor does it account for traffic bottlenecks such as river crossings. Calculation of the index is based on the Texas Transportation Institute (TTI) 2004 Urban Mobility Report.

RCI is defined as follows:

$$\mathrm{RCI} = \frac{\dfrac{\text{freeway vehicle-miles-traveled}}{\text{freeway lane-miles}} + \dfrac{\text{arterial vehicle-miles-traveled}}{\text{arterial lane-miles}}}{(14{,}000 * \text{freeway vehicle-miles-traveled}) + (5{,}500 * \text{arterial vehicle-miles-traveled})}$$

An RCI equal to or greater than 1.0 indicates that congested conditions exist region-wide, with moderate congestion for not more than 1½ to 2 hours during each peak-period. Urban areas with an RCI less than 1.0 may have sections of roads that experience periods of heavy congestion, but the average mobility level of roads in the Region could be defined as un-congested. The index evaluates the entire Dayton region, not specific roadway segments. Figure 2-1 shows the roadway congestion index by time of day for each of the analyzed scenarios.

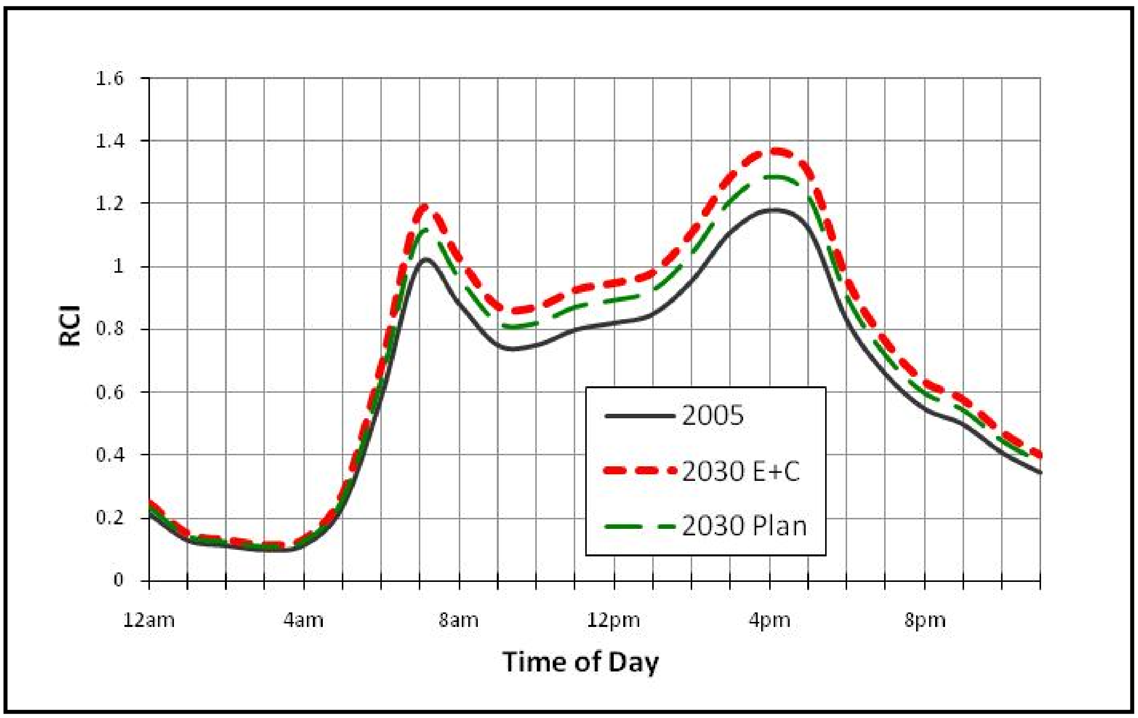

Figure 2-1: Roadway Congestion Index by Time of Day, Dayton Region

In 2005, congestion on regional freeways and arterials peaked during two 1-hour intervals, 7am-8am and 4pm-5pm. However, the Region's freeways and arterials were congested for up to 3 hours (3pm-6pm) during the evening peak period in 2005.

If no other roadway operation or capacity improvements were implemented beyond the current TIP (2030 E+C scenario), roadway congestion during the AM and PM peak periods would increase in both severity and duration by 2030, plus an additional hour of region-wide congestion (8am-9am and 2pm-3pm) would be incorporated into both peak periods. With the implementation of all LRTP projects (2030 Plan scenario), regional roadway congestion would continue to occur for only one hour during the AM peak period and, though PM peak period congestion would still be 4 hours long — as under the 2030 E+C scenario — its severity would be considerably less. In summary, while the Dayton Region experiences significant roadway congestion during two distinct periods, the cumulative roadway conditions over a 24-hour period could be defined as 'un-congested' under all three scenarios.

It is anticipated that recurring congestion will grow between 2005 and 2030 — regardless of any current or planned operational or capacity improvements — due to future changes in regional socioeconomic characteristics and associated travel patterns. However, the RCI data in Table 2.1 illustrates that implementation of all LRTP projects by 2030 results in considerably less congestion on regional freeways and arterials, when compared to the 2030 E+C scenario, during the AM and PM peak periods.

Table 2.1: Roadway Congestion Index by Peak Period, Dayton Region

TIME PERIOD	2005	2030 E+C	2030 LRTP
7:00-8:00am (AM Peak)	1.01	**1.18**	***1.10***
8:00-9:00am	0.88	1.02	*0.96*
2:00-3:00pm	0.95	1.10	*1.04*
3:00-4:00pm	1.10	1.28	*1.21*
4:00-5:00pm (PM Peak)	1.17	**1.36**	***1.28***
5:00-6:00pm	1.12	1.30	*1.22*

2.3 Summary of Travel Characteristics

Regional daily travel characteristics of the base and future year networks are presented in Table 2.2. Delay in vehicle and person hours is calculated for the base and future year networks and is used to identify the severity of congestion.

In 2005, approximately 605,500 vehicle hours of travel (VHT) were spent on the Region's roadways per day, resulting in 5,049 hours of daily vehicle delay, or 0.8 percent of the total daily VHT. By 2030, if only the projects funded in the TIP are built (E+C), total vehicle delay increases 76 percent, to almost 8,880 hours. The implementation of all LRTP projects reduces the hours of delay from nearly 8,800 per day to approximately 5,680, or 0.8 percent of the total daily VHT.

Though daily vehicle miles and vehicle hours of travel are expected to increase under each scenario, the growth in daily vehicle and total person delay may be significantly slowed by the implementation of 2030 LRTP projects. With less roadway congestion, the Dayton Region may be better positioned to efficiently facilitate personal and commercial travel.

Table 2.2: Summary of Daily Travel Characteristics, Dayton Region

	2005			2030 E+C			2030 LRTP		
	Freeway	Arterial	Total	Freeway	Arterial	Total	Freeway	Arterial	Total
Lane-Miles (Two-way)	688 *(13%)*	4,675 *(87%)*	5,363	733 *(13%)*	4,719 *(87%)*	5,452	815 *(15%)*	4,755 *(85%)*	5,570
Daily VMT (1000s)	8,612 *(40%)*	12,679 *(60%)*	21,291	10,671 *(43%)*	14,040 *(57%)*	24,711	10,886 *(44%)*	13,889 *(56%)*	24,775
Daily VHT	300,479 *(50%)*	305,016 *(50%)*	605,495	372,305 *(53%)*	336,527 *(47%)*	708,832	379,249 *(53%)*	331,940 *(47%)*	711,189
Daily Vehicle Delay (Hours)	3,880 *(77%)*	1,166 *(23%)*	5,049	6,810 *(76%)*	2,069 *(24%)*	8,879	3,898 *(68%)*	1,784 *(32%)*	5,682
Total Person Delay (Hours)	5,349 *(76%)*	1,671 *(24%)*	7,020	9,448 *(76%)*	2,967 *(24%)*	12,415	5,374 *(67%)*	2,560 *(33%)*	7,934
Weekday Cost of Delay (2010)	$87,189	$27,237	$114,426	$154,002	$48,362	$202,365	$87,596	$41,728	$129,324

Table 2.2 displays estimated cost of delay as a function of total person delay based on the value that motorists place on their time and the actions that they are willing to take to save time based on findings by the Texas Transportation Institute's 2004 Urban Mobility Study. Time saving actions included the use of a toll facility, frequent lane changing maneuvers, close headway driving, or using alternative routes to bypass congested facilities. The study considered most urban areas in the nation and used an average cost of time of $13.45 (2002 dollars) per person per hour. Consumer Price Indices by the U.S. Department of Labor were used to convert the 2002 dollars to 2010 dollars, resulting in an average of $16.30 per person per hour. Implementation of Long Range Plan projects results in approximately $73,000 per weekday in savings, or nearly $19 million per year.

2.4 Level of Service, Volume-to-Capacity Ratio, and Delay

Level of Service (LOS) is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists. Volume-to-capacity (V/C) ratio is a measure of the traffic volume on a road compared to the capacity of the road. The capacity of a road depends on its physical and operational characteristics and varies by functional class. A higher V/C ratio indicates that the traffic volume of the road is nearing its capacity and is becoming congested.

The analyses presented in this section are based on calculations by CMAQT software and its definition of LOS and V/C ratio. LOS is broken down into six levels (A through F), with significant traveler delay and recurring congestion occurring at LOS D, E, and F. The corresponding volume-to-capacity ratios for each LOS level are defined below:

- LOS A represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The level of comfort and convenience provided to the motorist is excellent. LOS A represents volume-to-capacity ratios less than **0.35**.
- LOS B is in the range of stable flow but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is slight decrease in the freedom to

maneuver compared to LOS A. LOS B represents volume-to-capacity ratios ranging from **0.351 to 0.500**.

- LOS C is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by the presence of others. The level of comfort and convenience declines noticeably at this level. LOS C represents volume-to-capacity ratios ranging from **0.501 to 0.750**.
- LOS D represents high density but stable flow. Speed and freedom to maneuver are severely restricted, and the driver experiences a generally poor level of comfort and convenience. LOS D represents volume-to-capacity ratios ranging from **0.751 to 0.900**.
- LOS E represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform, value. Freedom to maneuver within the traffic stream is extremely difficult. Comfort and convenience levels are extremely poor, and driver frustration is generally high. LOS E represents volume-to-capacity ratios ranging from **0.901 to 1.000**.
- LOS F is used to define forced or breakdown flow. Queues are formed very often. Operations within the queue are characterized by stop-and-go waves, and flow is extremely unstable. LOS F represents volume-to-capacity ratios greater than **1.001**.

LOS was used to identify specific locations of congestion in the Base (2005), Existing plus Committed (2030 E+C) and the Long Range Transportation Plan (2030 LRTP) networks. Figures 2-3, 2-4, and 2-5 identify roads having LOS D (V/C>0.751) or worse. In the Base (2005) network, roadway congestion is located mainly on I-75 and US-35 in Montgomery County, particularly in the downtown Dayton area. Roadway congestion is also present on surface roadways near local-access interchanges. Roadway congestion is increasingly present in the 2030 E+C network. The majority of freeway sections in Montgomery County will operate at LOS D, E, or F, with significant roadway congestion along I-75 through downtown Dayton, in Miami County and near the Warren County border in Montgomery County. Congestion will also spread to I-70 and on surface roadways in rural sections of Greene County, particularly US 42 and US 68. Various projects, including interchange and freeway reconstruction, are included in the 2030 LRTP to improve the freeway performance; this is reflected in Figure 2-5 representing the 2030 Plan scenario. Under the 2030 LRTP scenario, only a few isolated freeway and surface roadways will operate at LOS E or F. This represents a significant improvement compared to the Base and 2030 E+C scenarios. Furthermore, no significant portion of the regional freeway network mainline registered an LOS F under the 2030 LRTP scenario. A more detailed analysis of roadway congestion on the regional freeway network is presented in Section 2.5.

Tables 2.3 and 2.4[11] show detailed congestion statistical summaries by functional class for the morning and afternoon peak periods. Table 2.3 summarizes the statistics by lane miles while Table 2.4 summarizes the statistics by vehicle miles of travel (VMT). Percent congested is defined as the percent of total lane miles or VMT having a level of service D or worse, or a V/C ratio greater than 0.751.

[11] Individual cells are rounded to the nearest unit for display purposes, so totals might not add up to the values shown on individual cells but are correct for the system.

Figure 2-2[1] shows graphs summarizing the findings by functional class. According to Figure 2-2, a comparison of the 2005 Base network with the 2030 E+C network illustrates that the overall quality of travel decreases with more roads across functional class categories experiencing congested conditions. Congestion is more pronounced during the afternoon peak period and, as expected, interstates, expressways, and arterial roads experience the highest level of congestion. Compared to the 2030 E+C network, implementation of all Long Range Transportation Plan projects has a positive impact on congestion, reducing congested lane miles and VMT by 16 and 30 percent, respectively, during the afternoon peak period and total delay by 46 percent, or over 780 hours, during the same time period.

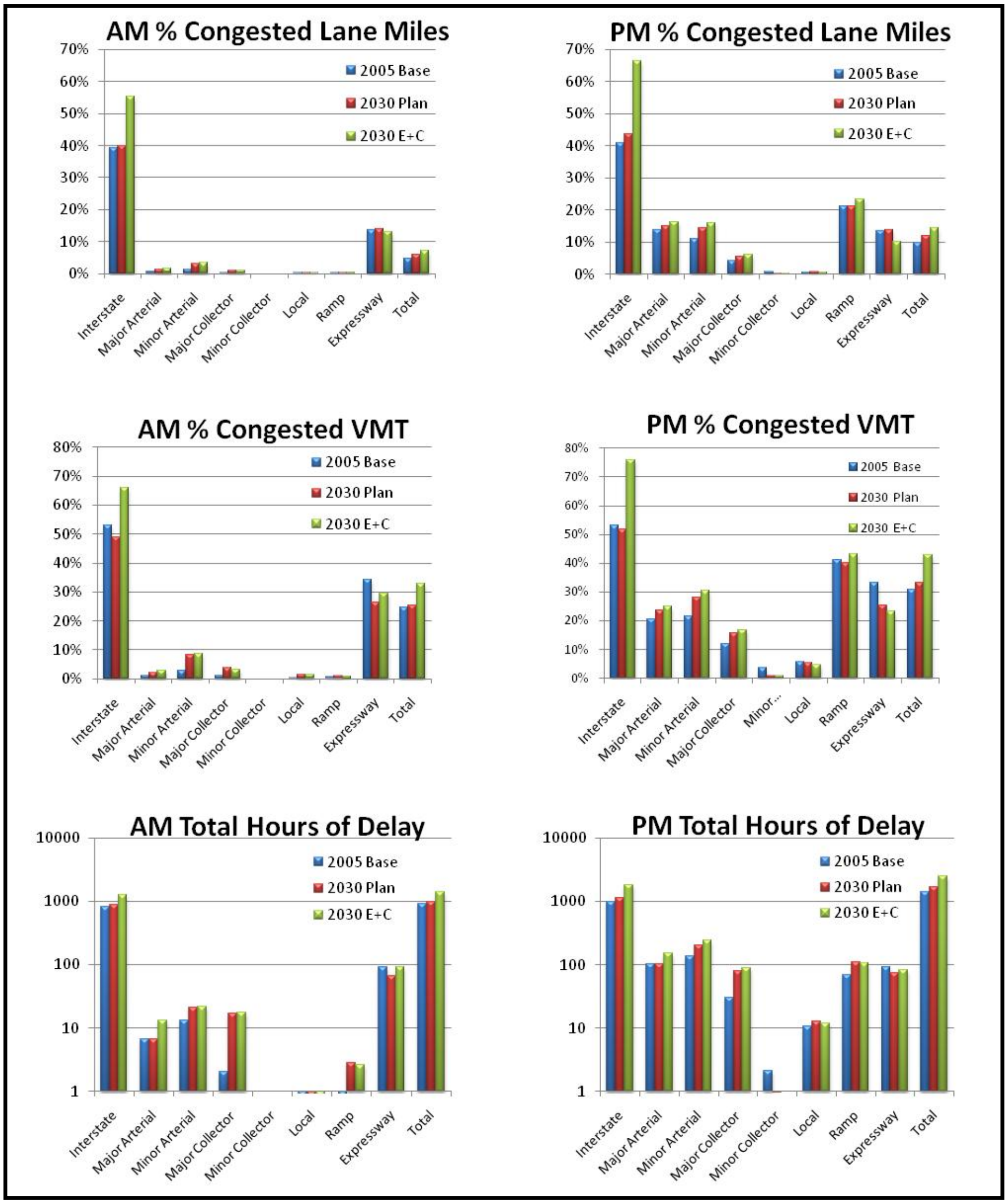

Figure 2-2: AM and PM Summaries by Functional Class, Dayton Region

Figure 2-3 Existing 2005 LOS Map

Back of Figure 2-3

Figure 2-4 Existing + Committed 2030 LOS Map

Back of Figure 2-4

Figure 2-5: LRTP Plan 2030 LOS Map

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Table 2.3: Lane Miles Statistics for AM and PM Peak, Dayton Region

Functional Class	2000 Base Summary Statistics by Functional Class																	
	AM Peak									PM Peak								
	Lane Miles by LOS							Total Delay (Hours)	% Congested Lane Miles	Lane Miles by LOS							Total Delay (Hours)	% Congested Lane Miles
	A	*B*	*C*	*D*	*E*	*F*	*Total*			*A*	*B*	*C*	*D*	*E*	*F*	*Total*		
Interstate	25	122	166	112	55	35	516	806	39%	25	71	208	122	51	39	516	979	41%
Major Arterial	351	224	128	3	2		707	7	1%	198	162	251	74	12	11	707	104	14%
Minor Arterial	595	229	121	7	4	0	956	13	1%	380	236	236	71	17	17	956	136	11%
Major Collector	1,197	172	73	3	0		1,446	2	0%	997	216	174	34	20	6	1,446	30	4%
Minor Collector	373	7	4				383	0	0%	356	17	7	3	0		383	2	1%
Local	977	28	12	0	0		1,018	0	0%	942	38	31	4	1	2	1,018	10	1%
Ramp	56	20	13	0			90	0	0%	38	14	19	13	4	3	90	69	21%
Expressway	79	22	29	5	3	12	150	90	14%	79	22	29	6	2	12	150	92	14%
Total	3,653	824	547	131	64	48	5,266	919	5%	3,014	775	955	325	108	89	5,266	1,423	10%

Functional Class	2030 E+C Summary Statistics by Functional Class																	
	AM Peak									PM Peak								
	Lane Miles by LOS							Total Delay (Hours)	% Congested Lane Miles	Lane Miles by LOS							Total Delay (Hours)	% Congested Lane Miles
	A	*B*	*C*	*D*	*E*	*F*	*Total*			*A*	*B*	*C*	*D*	*E*	*F*	*Total*		
Interstate	6	35	209	125	116	67	557	1,237	55%	6	35	147	166	129	74	557	1,810	66%
Major Arterial	325	223	135	8		2	694	13	2%	179	158	246	82	16	14	694	149	16%
Minor Arterial	550	253	166	28	2	3	1,002	22	3%	344	231	268	93	31	35	1,002	241	16%
Major Collector	1,146	190	113	10	2	0	1,462	17	1%	898	261	215	50	23	16	1,462	90	6%
Minor Collector	368	12	4				383	0	0%	339	33	11	1			383	1	0%
Local	950	39	21	2			1,012	1	0%	907	45	53	4	1	2	1,012	12	1%
Ramp	54	19	18	0	0		92	3	0%	33	16	21	11	5	6	92	107	23%
Expressway	64	31	37	7	3	11	152	92	13%	66	35	37	2	3	11	152	83	10%
Total	3,463	803	703	181	122	84	5,355	1,385	7%	2,773	813	996	408	207	157	5,355	2,492	14%

Functional Class	2030 Plan Summary Statistics by Functional Class																	
	AM Peak									PM Peak								
	Lane Miles by LOS							Total Delay (Hours)	% Congested Lane Miles	Lane Miles by LOS							Total Delay (Hours)	% Congested Lane Miles
	A	*B*	*C*	*D*	*E*	*F*	*Total*			*A*	*B*	*C*	*D*	*E*	*F*	*Total*		
Interstate	6	64	305	152	82	14	624	881	40%	6	34	311	174	85	14	624	1,124	44%
Major Arterial	343	230	125	8			706	7	1%	209	150	242	79	12	13	706	103	15%
Minor Arterial	575	256	160	25	3	2	1,023	21	3%	385	237	255	91	22	33	1,023	205	14%
Major Collector	1,208	178	107	15		0	1,508	17	1%	966	259	198	50	18	17	1,508	79	6%
Minor Collector	366	15	3				384	0	0%	340	34	9	1			384	1	0%
Local	959	50	12	2			1,023	1	0%	923	39	53	5	1	2	1,023	13	1%
Ramp	55	22	17	0	0		94	3	0%	33	17	24	10	5	5	94	111	21%
Expressway	66	26	45	18	4		159	66	14%	66	28	43	18	4		159	73	14%
Total	3,578	841	775	220	90	16	5,520	996	6%	2,928	800	1,135	427	148	84	5,520	1,709	12%

Table 2.4: Vehicle Miles of Travel Statistics for AM and PM Peak, Dayton Region

2000 Base Summary Statistics by Functional Class

Functional Class	AM Peak									PM Peak								
	Vehicle Miles of Travel by LOS (1000s)							Total Delay (Hours)	% Congested VMT	Vehicle Miles of Travel by LOS (1000s)							Total Delay (Hours)	% Congested VMT
	A	*B*	*C*	*D*	*E*	*F*	*Total*			*A*	*B*	*C*	*D*	*E*	*F*	*Total*		
Interstate	12	82	148	140	76	57	514	806	53%	13	54	209	166	76	68	586	979	53%
Major Arterial	75	82	56	2	1		215	7	1%	52	68	147	51	10	9	337	104	21%
Minor Arterial	80	63	45	4	2	0	194	13	3%	57	75	105	41	12	12	302	136	21%
Major Collector	107	41	24	2	0		174	2	1%	110	60	66	17	12	4	269	30	12%
Minor Collector	19	2	1				21	0	0%	24	4	3	1	0		32	2	4%
Local	26	5	3	0	0		33	0	0%	33	7	9	1	1	1	52	10	6%
Ramp	8	8	7	0			24	0	1%	6	5	11	9	3	3	38	69	41%
Expressway	16	12	21	5	4	16	74	90	34%	20	13	23	7	3	18	84	92	33%
Total	342	294	306	152	83	74	1,250	919	25%	316	287	572	293	116	115	1,699	1,423	31%

2030 E+C Summary Statistics by Functional Class

Functional Class	AM Peak									PM Peak								
	Vehicle Miles of Travel by LOS (1000s)							Total Delay (Hours)	% Congested VMT	Vehicle Miles of Travel by LOS (1000s)							Total Delay (Hours)	% Congested VMT
	A	*B*	*C*	*D*	*E*	*F*	*Total*			*A*	*B*	*C*	*D*	*E*	*F*	*Total*		
Interstate	3	22	193	152	161	110	640	1,237	66%	3	25	149	224	198	133	732	1,124	44%
Major Arterial	70	80	63	5		2	220	13	3%	48	66	143	61	12	13	344	103	15%
Minor Arterial	74	70	64	17	1	2	227	22	8%	51	73	121	56	21	31	353	205	14%
Major Collector	109	44	38	5	1	0	198	17	3%	104	67	82	25	14	11	304	79	6%
Minor Collector	23	2	1				26	0	0%	27	8	4	0			40	1	0%
Local	27	7	5	1			39	1	1%	34	9	15	2	0	1	61	13	1%
Ramp	9	8	10	0	0		27	3	1%	5	6	12	8	4	6	43	111	21%
Expressway	14	18	28	6	3	15	84	92	29%	20	22	32	2	4	17	97	73	14%
Total	329	251	401	186	166	128	1,462	1,385	33%	294	277	559	378	253	212	1,973	1,709	12%

2030 Plan Summary Statistics by Functional Class

Functional Class	AM Peak									PM Peak								
	Vehicle Miles of Travel by LOS (1000s)							Total Delay (Hours)	% Congested VMT	Vehicle Miles of Travel by LOS (1000s)							Total Delay (Hours)	% Congested VMT
	A	*B*	*C*	*D*	*E*	*F*	*Total*			*A*	*B*	*C*	*D*	*E*	*F*	*Total*		
Interstate	3	42	288	183	114	22	652	881	49%	3	24	333	232	130	24	746	1,124	52%
Major Arterial	71	83	58	4			216	7	2%	56	62	142	58	10	11	339	103	23%
Minor Arterial	76	69	61	16	2	1	225	21	8%	59	77	114	54	15	29	348	205	28%
Major Collector	112	41	35	7		0	196	17	4%	111	67	76	25	11	12	302	79	16%
Minor Collector	22	3	1				26	0	0%	26	8	3	0			38	1	1%
Local	27	9	3	1			39	1	1%	34	8	15	2	0	1	60	13	5%
Ramp	9	9	9	0	0		28	3	1%	5	7	14	8	5	5	44	111	40%
Expressway	14	15	35	18	5		88	66	26%	20	18	37	20	5		100	73	25%
Total	334	271	491	229	120	23	1,469	996	25%	316	271	734	398	176	82	1,977	1,709	33%

2.5 Freeway Corridor Analysis

In the Dayton Region, though freeways represent only 13 percent of the total roadway lane miles, they carry between 40 percent (2005 Base) and 44 percent (2030 LRTP Plan scenario) of the total vehicle miles of travel (VMT). As a result, freeway travelers experience some of the worst congestion levels in the Region.

Table 2.5 presents summaries of the corridor level statistics for each of the following corridors during the morning and afternoon peak hours: I-70, I-75, I-675, US-35 and SR-4. Congestion is most noticeable on I-70, I-75, and US-35, reaching its highest levels during the evening period. Over the past decade, MVRPC has funded a number of studies to address congestion on freeways. Several projects, including interchange modifications and freeway widening and reconstruction, are included in the LRTP to improve freeway performance. Intelligent Transportation Systems (ITS), currently implemented as a pilot in the Region are also planned for full deployment in 2011 to improve freeway performance.

Since the publication of the 2007 CMP report, the most significant change was in the reduced levels of service (LOS) on the I-70 corridr. This increase in demand may be due to a number of regional factors, including higher rates of car ownership, added truck traffic, more frequent non-recurring congestion, new residential and commercial development, or increased dispersal of employment centers. In addition, a number of construction projects initiated throughout the Region will further degrade roadway capacity in the near future, but can be expected to increase LOS on the regional freeway network over time. These capacity improvements are reflected in both the 2030 E+C and Plan scenario analyses.

Major findings of the corridor level analyses are discussed below:

During the AM and PM peak, the Base (2005) scenario shows that 65 percent of the total VMT on I-75 were congested. By 2030, in the E+C scenario, this value increases to 80 and 91 percent, respectively, for the AM and PM peaks. Implementation of all 2030 Long Range Transportation Plan projects decreases congested VMT for the I-75 AM and PM peaks to 62 and 63 percent, respectively. Of all the corridors, I-75 has the highest total delay in both periods under each scenario.

During the AM peak, the Base (2005) scenario shows that 61 percent of the total VMT on I-70 were congested. By 2030, in the E+C scenario, this value increases to 74 percent. For I-70, implementation of all LRTP projects decreases congested AM VMT by 46 percent when compared to the Base scenario.

Though increases in congested lane miles and VMT are expected by 2030 on most of the regional roadway network, further examination confirms that several recently completed or committed TIP projects will improve levels of service along multiple corridors. Most significant among these anticipated improvements, various existing or committed projects along I-70 (Airport Access to SR4) and US-35 (I-75 to Steve Whalen) will deliver a 2030 LOS of D at these locations. This represents a substantial improvement over the Base scenario (2005) LOS E or worse. Completed or committed projects on or near multiple freeway-to-arterial interchanges, and some arterial and collector surface streets, will also result in LOS improvements by 2030.

Table 2.5: Summary Statistics by Corridor for AM & PM Peak, Dayton Region

2005 Base Summary Statistics By Corridor

		AM Peak								PM Peak							
		Level Of Service							%	Level Of Service							%
Corridor		*A*	*B*	*C*	*D*	*E*	*F*	*Total*	Congested	*A*	*B*	*C*	*D*	*E*	*F*	*Total*	Congested
I-675	Lane Miles	25	65	40				130	0%	25	64	40	0			130	0%
	VMT (1000s)	12	45	33				89	0%	13	49	36	0			98	0%
	Delay (Hours)	0	0	0				0	NA	0	0	0	2			2	NA
I-70	Lane Miles		15	33	24	11	9	92	48%			44	28	11	9	92	52%
	VMT (1000s)		9	30	31	15	15	98	61%			44	38	16	16	114	62%
	Delay (Hours)		0	0	81	39	51	170	NA			0	102	44	80	226	NA
I-75	Lane Miles	0	43	89	85	44	26	287	54%	0	7	120	91	40	29	287	56%
	VMT (1000s)	0	29	82	106	61	42	319	65%	0	5	125	124	60	52	366	65%
	Delay (Hours)	0	0	0	280	163	183	626	NA	0	0	0	338	174	231	743	NA
SR 4	Lane Miles	24	8	11	0			43	1%	21	11	11	0			43	1%
	VMT (1000s)	7	4	7	0			19	2%	8	7	8	0			23	2%
	Delay (Hours)	0	0	0	1			1	NA	0	0	0	1			1	NA
US 35	Lane Miles	79	24	18	4	3	12	141	14%	71	19	31	6	2	12	141	14%
	VMT (1000s)	17	14	13	5	4	16	70	36%	19	12	27	7	3	18	85	32%
	Delay (Hours)	0	0	0	13	11	65	89	NA	0	0	0	20	8	63	91	NA

2030 E+C Summary Statistics By Corridor

		AM Peak								PM Peak							
		Level Of Service							%	Level Of Service							%
Corridor		*A*	*B*	*C*	*D*	*E*	*F*	*Total*	Congested	*A*	*B*	*C*	*D*	*E*	*F*	*Total*	Congested
I-675	Lane Miles	6	35	89				130	0%	6	35	89				130	0%
	VMT (1000s)	3	22	79				104	0%	3	25	86				114	0%
	Delay (Hours)	0	0	0				0	NA	0	0	0				0	NA
I-70	Lane Miles			35	53	9	12	109	68%			17	64	9	19	109	84%
	VMT (1000s)			34	64	12	20	131	74%			19	87	14	33	153	87%
	Delay (Hours)			0	160	33	65	258	NA			0	234	38	142	414	NA
I-75	Lane Miles	0		85	72	107	55	319	73%	0		41	102	121	55	319	87%
	VMT (1000s)	0		80	88	148	90	405	80%	0		43	137	185	100	466	91%
	Delay (Hours)	0		0	233	395	351	979	NA	0		0	375	534	487	1,396	NA
SR 4	Lane Miles	24	10	9	0			43	1%	21	17	5	0			43	1%
	VMT (1000s)	8	6	6	0			20	2%	9	11	4	0			25	2%
	Delay (Hours)	0	0	0	1			1	NA	0	0	0	1			1	NA
US 35	Lane Miles	59	32	35	6	3	11	145	14%	59	22	42	8	3	11	145	15%
	VMT (1000s)	13	19	27	6	3	15	83	29%	19	14	39	10	4	17	102	29%
	Delay (Hours)	0	0	0	17	9	65	91	NA	0	0	0	5	11	66	82	NA

2030 Plan Summary Statistics By Corridor

		AM Peak								PM Peak							
		Level Of Service							%	Level Of Service							%
Corridor		*A*	*B*	*C*	*D*	*E*	*F*	*Total*	Congested	*A*	*B*	*C*	*D*	*E*	*F*	*Total*	Congested
I-675	Lane Miles	6	34	89				130	0%	6	34	89		0		130	0%
	VMT (1000s)	3	22	81				105	0%	3	24	88		0		116	0%
	Delay (Hours)	0	0	0				0	NA	0	0	0		3		3	NA
I-70	Lane Miles		4	91	36			131	28%			88	42			131	32%
	VMT (1000s)		2	87	44			133	33%			98	57			155	37%
	Delay (Hours)		0	0	115			115	NA			0	155			155	NA
I-75	Lane Miles	0	26	125	116	82	14	364	58%	0		133	132	85	14	364	63%
	VMT (1000s)	0	18	121	139	114	22	414	66%	0		148	174	130	24	475	69%
	Delay (Hours)	0	0	0	373	305	88	766	NA	0		0	480	379	110	969	NA
SR 4	Lane Miles	25	7	12	0			43	1%	21	11	11	0			43	1%
	VMT (1000s)	8	4	8	0			20	2%	9	7	8	0			25	2%
	Delay (Hours)	0	0	0	1			1	NA	0	0	0	1			1	NA
US 35	Lane Miles	61	31	39	17	4		152	14%	59	22	44	23	4		152	18%
	VMT (1000s)	13	18	31	18	5		86	26%	19	13	41	26	5		105	30%
	Delay (Hours)	0	0	0	51	14		65	NA	0	0	0	56	16		72	NA

An in-depth comparison of the 2030 E+C and Plan scenarios, as shown in Table 2.5, verifies that implementation of the Long Range Transportation Plan consistently reduces the amount of delay the average vehicle would experience on the regional freeway network for every time period along Interstates 70, 75, and 675; SR4; and US-35.

2.6 Travel Time Reliability Analysis using Freeway Management System Data

In late 2008, ODOT implemented the first phase of the Dayton FMS to aid with the on-going I-75 reconstruction project. MVRPC, using data provided by ODOT, has analyzed the speed and resulting travel times collected by over 100 doppler radar sensors to assess the reliability of the freeway system. This analysis uses archived freeway data to illustrate ways of reporting reliability, analyze changes in travel time reliability using different performance measures, and exploring methods for prioritizing freeway corridors.

Travel time reliability is a measure of the amount of congestion users of the transportation system experience at a given time. It is the consistency or dependability in travel times, as measured from day to day and/or across different times of the day. Measures of travel time reliability are important indicators of the health of a transportation system, can reveal changes in system conditions from year to year, and, can supplement existing congestion measures such as volume to capacity ratios, vehicle hours of delay, and mean speed. They attempt to quantify both the variability in travel times across different days and months and the variability across different times of day. A network that provides high level of service has a high level of travel time reliability.

ODOT contracted with a data service vendor to provide travel times on 36 corridor segments of the Region's freeway and controlled access roadways. The current system gathers vehicle speed data from Doppler radar sensors located along the highway and uses a variety of algorithms to calculate travel times between points of interest, based on time-of-day, weather event or other roadway conditions. Currently, there are 103 centerline miles (165.8 km) within the Dayton area where travel times are provided. These roadways include:

- I-70 — eastbound and westbound between SR 49 and I-675
- I-75 — northbound and southbound between north and south Montgomery County line
- I-675 — northbound and southbound between I-75 and I-70
- US 35 — eastbound and westbound between I-675 and SR 49
- SR 49 — northbound and southbound between US 35 and I-70
- SR 4 — northbound and southbound between I-75 and I-70

In total, data was provided for 36 travel segments, determined by ODOT, on these corridors from July 1, 2009 to June 30, 2010. Segment length varied with the smallest segment measuring 0.9 miles to the longest segment measuring 13.2 miles.

Travel times are reported for nearly every minute in a 24 hour period for all segments for all weekdays and weekends. This resulted in nearly a million records of data for each month. The data was initially provided by ODOT to MVRPC in Microsoft Excel spreadsheet format and later in Microsoft Access database format.

The raw data was checked for estimation errors for quality control purposes. Segments on I-675, SR 4 and SR 49 were excluded from all analysis due to data inaccuracy concerns on these corridors. The remaining segments were consolidated into 10 segments and the travel time data was summarized to produce hourly average travel times for each segment for each day of each month of the year. Several other travel time reliability performance measures were calculated for each segment from this condensed data:

Free Flow Travel Time for each road section is the 15th percentile travel time during traditional off-peak times (weekdays between 9 am-3pm, 6pm-10pm; weekends between 6am-10pm), not to exceed the travel time at the posted speed limit (or 60 mph where the posted speed is unknown).

95th Percentile Travel Time is the simplest measure of travel time reliability and it indicates how bad delay will be on the heaviest travel days. This time is reported in minutes and seconds and should be easily understood by commuters familiar with their trips. This measure has the disadvantage of not being easily compared across trips, as most trips will have different lengths. Several reliability indices are presented below that enable comparisons or combinations of routes or trips with different lengths.

Travel Time Index is the ratio of the average peak period travel time as compared to free-flow travel time. For example, a value of 1.2 means that average peak travel times are 20% longer than free-flow travel times. In this analysis, the AM peak period is 7am–8am and the PM peak period is 5pm–6pm on non-holiday weekdays.

Buffer Index is a measure of trip reliability that expresses the amount of extra buffer time needed to be on time for 95 percent of the trips (eg., late for work one day out of the typical 20-work-day-month). The buffer index was calculated by subtracting the 95th percentile travel time from the mean travel time, and then dividing that result by the mean travel time, so as to represent the percentage of extra travel time that most people would need to add on to their trip in order to ensure on-time arrival.

Planning Time Index represents the total travel time that should be planned when an adequate buffer time is included. Planning time index differs from the buffer index in that it includes typical delay as well as unexpected delay. Thus, the planning time index compares near-worst case travel time to light or free-flow travel time. The planning time index is computed as the 95th percentile travel time divided by the free flow travel time.

The graphs in Figure 2-6 show the free flow travel time, average travel time and the 95th percentile travel time during peak hours for the ten freeway segments. The graphs indicate that the I-75 N corridor between US 35 and I-70 is the most congested freeway corridor in the Miami Valley while I-70 E from I-75 to I-675 is the least congested.

Figure 2-7 shows a map of the average speed distribution during the AM and PM peak hours. Average speeds were calculated for all the segments for each hour over a 24 hour period based on average travel times and segment lengths. The figure shows that average speeds remain close to the set speed limits on all corridors except the I-75 corridor during peak hours.

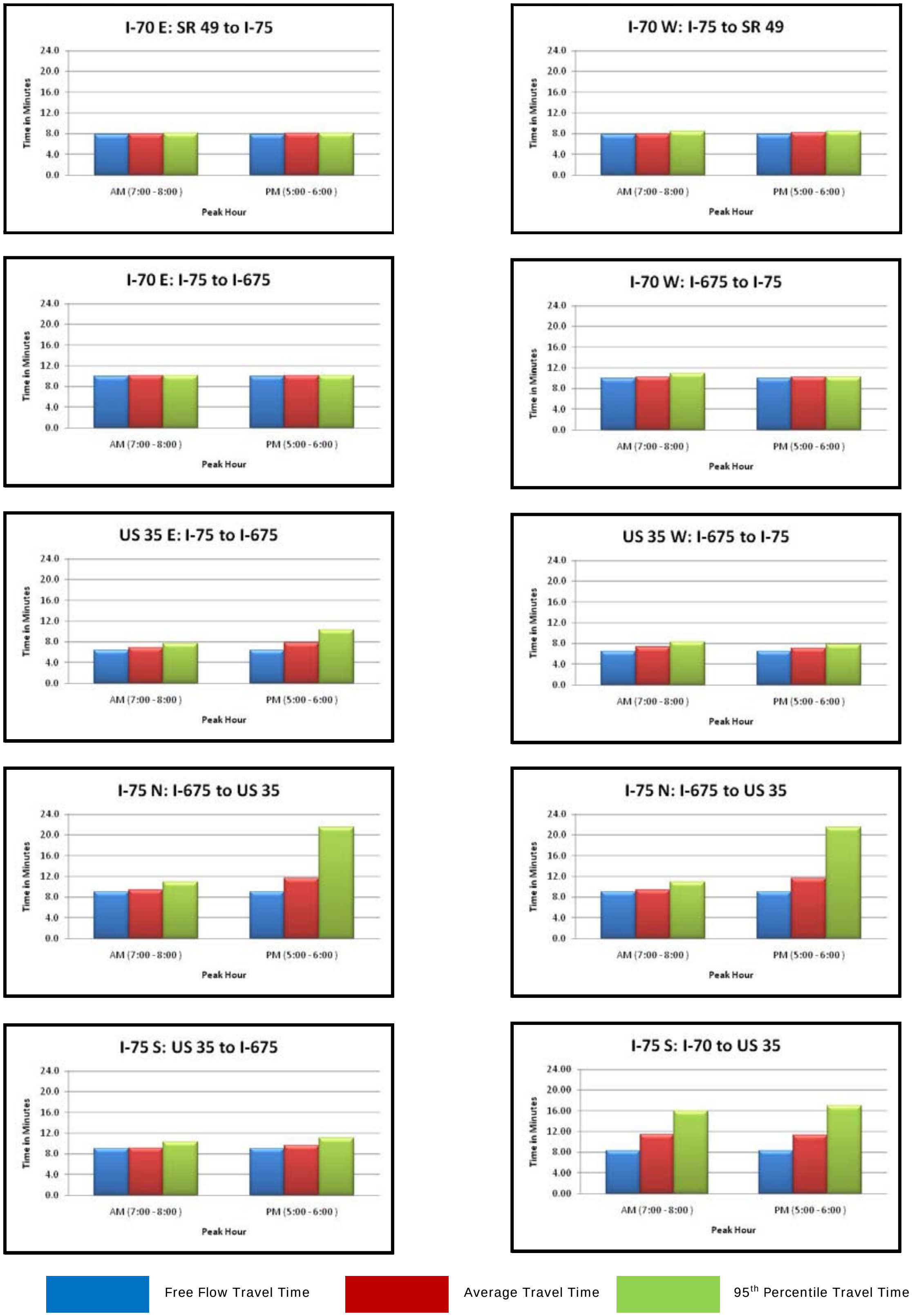


Figure 2-6: Travel Time Reliability Analysis on the 10 Freeway Segments

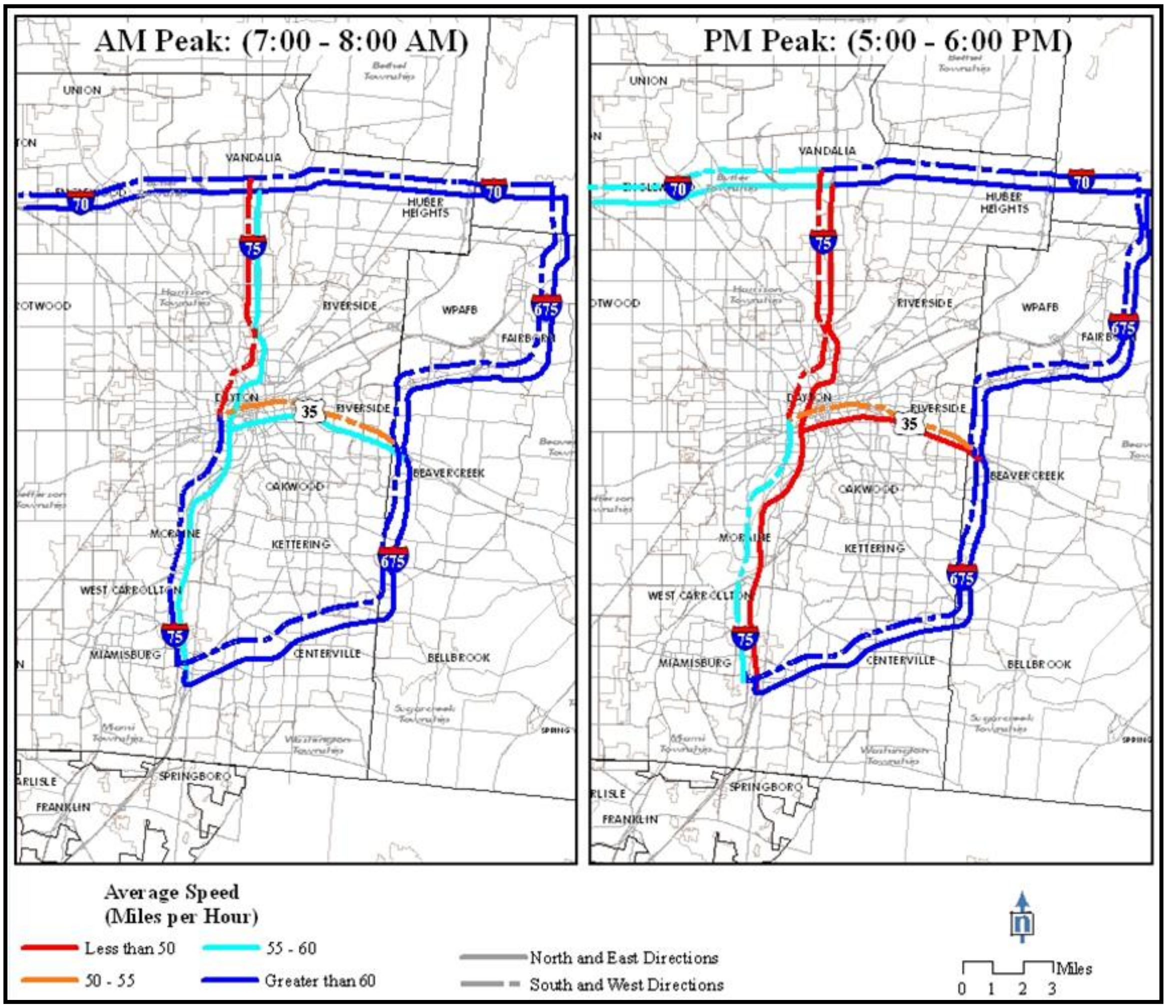


Figure 2-7: Average Speed Distribution During Peak Hours

Figures 2-8 and 2-9 show the average speed distribution by month and days of the week, respectively. No discernable variation exists between different months, but the average speeds tend to be lower on weekdays and much higher on weekends except in certain construction zones.

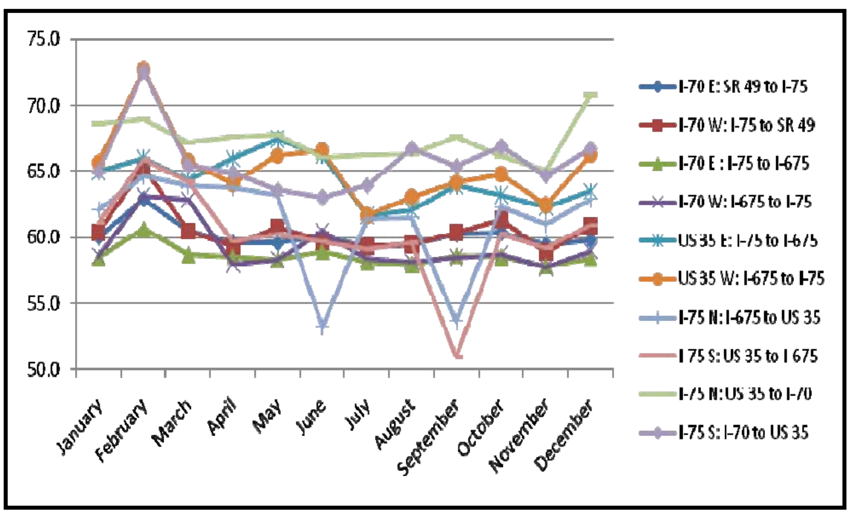


Figure 2-8: Segments with Average Speed Distribution by Month

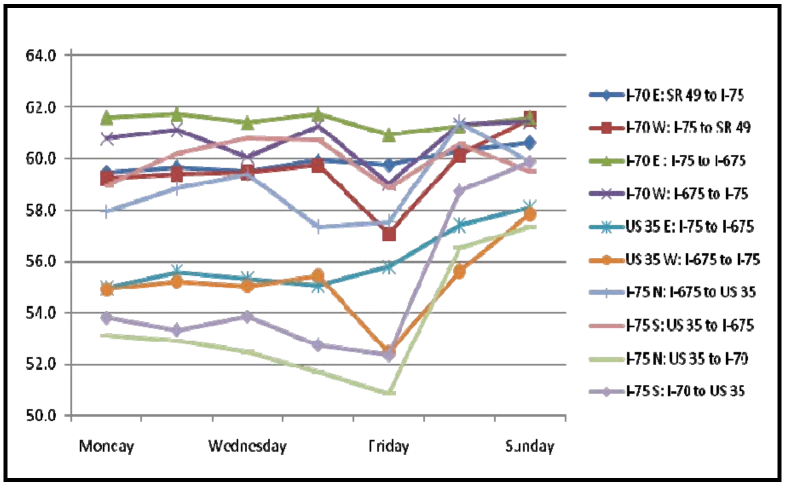


Figure 2-9: Segments with Average Speed Distribution by Weekday

The ten corridor segments were ranked according to buffer time index and travel time index during the AM and PM peak hours with 1 being the least reliable and 10 being the most reliable segment. I-75 between US 35 and I-70 has the lowest ranking for travel and buffer time indices while the I-70 corridor has the highest rankings (See Figure 2-10).

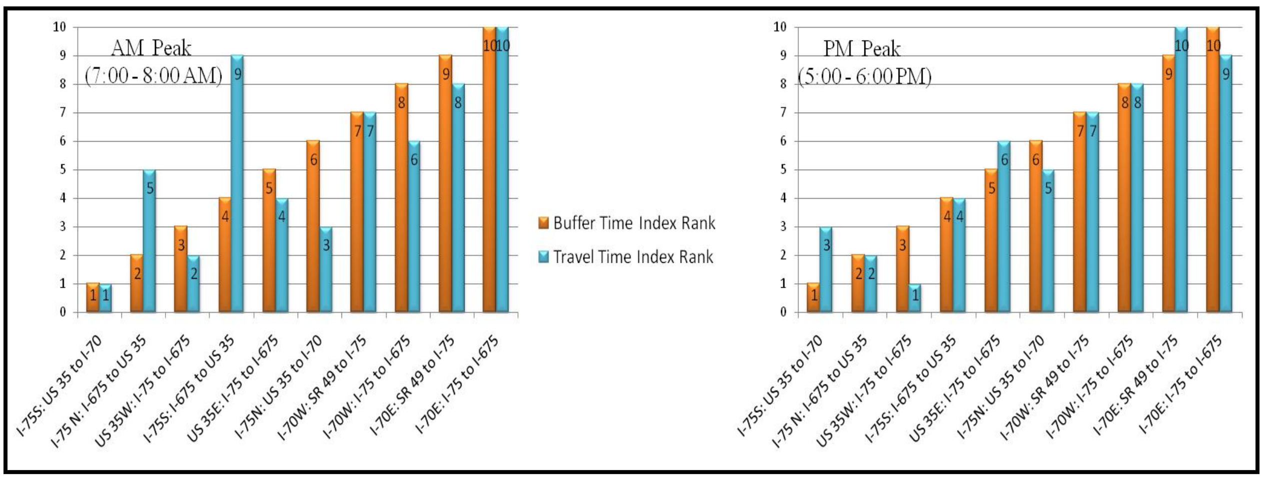


Figure 2-10: Ranking of Segments by Buffer Time and Travel Time Indices

Travel time reliability in Dayton was compared with other cities based on FHWA's 2010 quarterly Urban Congestion Report. Congested hours is the average number of hours during specified time periods in which instrumented road sections are congested (speeds less than 45 mph). For this measure, congestion is defined to occur when link speeds are less than 45 mph. This measure is reported for weekdays (6am-10pm). Dayton's most congested corridor, I-75, had approximately 2 congested hours on the freeway with a travel time index of 1.15 which is lower than several of the large metropolitan cities in the country.

Table 2.6: Comparison of Travel Time Reliability in Dayton

City	Congested Hours	Travel Time Index	Planning Time Index
Chicago, IL	9:39	1.39	1.74
Los Angeles, CA	6:28	1.29	1.59
Seattle, WA	5:22	1.29	1.72
Philadelphia, PA	6:14	1.28	1.66
Boston, MA	5:26	1.27	1.63
Houston, TX	3:31	1.24	1.51
Portland, OR	1:39	1.23	1.62
Atlanta, GA	4:13	1.22	1.58
Detroit, MI	3:20	1.2	1.5
Pittsburgh, PA	7:53	1.2	1.43
Minneapolis-St. Paul, MN	4:18	1.19	1.48
Orange County, CA	3:34	1.19	1.46
Dayton, OH	2:00[12]	1.15	1.5
San Francisco, CA	2:53	1.13	1.32
Riverside – San Bernardino, CA	2:58	1.1	1.25
St. Louis, MO	1:44	1.1	1.27
San Diego, CA	2:14	1.1	1.29
Providence, RI	2:14	1.08	1.24
Sacramento, CA	1:55	1.08	1.21
Tampa, FL	2:21	1.08	1.21
Oklahoma City, OK	1:37	1.06	1.19
Salt Lake City, UT	3:15	1.05	1.16

Misery Index represents the negative aspect of trip reliability that is examined by the average number of minutes that the worst trips exceed the average. Misery Index seeks to measure the length of delay of only the worst trips. This is calculated by taking data from the worst 20 percent of the days and finding the average travel rate for just those trips. Comparing that to the average travel rate for all trips would give a measure of “how bad are the worst days?” This translates to the following formula:

$$Misery\ Index = \frac{Mean\ (Highest\ \ 20\%)Travel\ Times}{Mean\ Travel\ Time\ for\ All\ Trips} - 1$$

A misery index of 0.5 implies that the slowest trips are 50% longer than the average trip. Table 2.7 shows the calculated Misery Index values for I-70, I-75, and US 35.

[12] Value represents congested hours on southbound I-75 during the evening peak hour.

Table 2.7: Misery Index Values for Analyzed Corridors

Corridors	Misery Index
I-75: Between US 35 and I-70	0.43
I-75: Between I-675 and US 35	0.34
I-70: Between SR49 and I-75	0.26
I-70: Between I-75 and I-675	0.32
US 35: Between I-75 and I-675	0.29

The primary challenge for executing this analysis was obtaining continuous error-free travel time data from the freeway management system. The analysis of such a huge volume of data also requires appropriate computer hardware and software to store and process large databases.

Travel time reliability measures are currently under-utilized in regional transportation planning. This analysis exhibits how reliability can vary across roadway segments and how important this variation is in prioritizing corridors for improvements. MVRPC plans to continue updating the freeway management system database with new data from ODOT. This would enable making hourly, monthly and annual comparisons to determine travel time reliability as well as determining project impacts on travel times by comparing pre- and post construction data. The results will be documented in the future updates of this report.

2.7 Recurring Congestion and Regional Freight Movement[13]

To minimize costs, the trucking industry requires a highly efficient and reliable freeway network for delivery of raw materials to manufacturers and goods to market. The combination of industry deregulation and investment in the highway system led to a growth in the cost-saving 'just-in-time' delivery system in the late 1980s and early 1990s. Just-in-time delivery relies on accurate information and a reliable transportation system to deliver raw materials and finished goods on an as needed basis, relieving the costs associated with on-site storage. The manufacturing and retailing industries have adapted to this tightly integrated and highly efficient transport system, generating vast savings for businesses, expanding the choices of available goods and services for consumers, and allowing U.S. businesses to compete in the global marketplace. However, roadway congestion can easily disrupt the delicate balance between productivity and transportation by increasing transport times, reducing delivery reliability, and raising transportation costs. These costs are inevitably passed along to shippers and consumers. Estimates produced by the Federal Highway Administration (FHWA) indicate that increases in travel times costs shippers and carriers an additional $25 to $200 per hour depending on the commodity.

[13] Sources: "An Initial Assessment of Freight Bottlenecks on Highways" *FHWA* (2005) and "Miami Valley Freight Movement Study" *MVRPC* (2006).

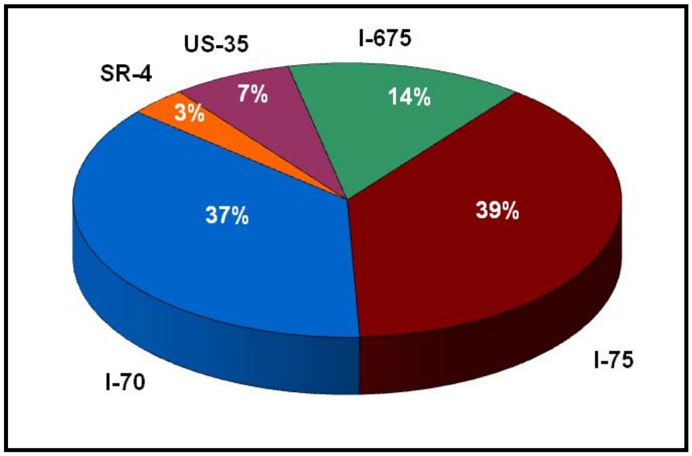


Figure 2-11: Percent of Total Regional Truck Volume by Route, Dayton Region, 2004-2006 ***(Source: MVRPC)***

Though truck volume patterns are heavily influenced by local economic activity, the presence — or absence — of large through-freight movements has a considerable effect on local recurring congestion. In the Dayton Region, I-70 and I-75 serve as the main transportation routes for interstate commerce. For example, from 2004-2006, I-70 and I-75 carried 76% of the total truck volume on the Region's interstates and freeways, as illustrated in Figure 2-11.[14] Furthermore, for inbound and outbound trips, trucks carried 95% of freight tonnage and 84% of freight value, with the majority traveling on I-70 and I-75. On average, trucks accounted for 39% of all traffic on I-75 and 37% of all traffic on I-70, considerably higher than the state average of 17% for truck volumes on interstates. See Figure 2-12 for additional information.

However, as evidenced in Table 2.5, roadway congestion may be severely impacting regional freight movement. Both I-70 and I-75 experienced heavy congestion in 2005, with 48% of lane miles on I-70 and 54% of lanes miles on I-75 identified as congested during the AM peak periods. The AM and PM peak periods will see a significant increase in the percentage of congested lane miles on I-75, escalating to 73 and 87 percent respectively. The percentage of congested lanes miles will fall dramatically during the AM and PM peak periods on I-70, while marginally increase compared to the 2005 level of congested lanes miles on I-75, by implementing the full compliment of LRTP projects (2030 Plan).

In association with the Miami Valley Freight Movement Study, MVRPC conducted a freight movement workshop for representatives of regional public and private stakeholders in the freight movement industry. As identified by the participants, several roadway segments in need of capacity improvements were noted as significant obstacles to the efficient movement of goods within the Region, including I-75 through downtown Dayton and US-35 in western Greene County.

In 2005, FHWA published a national report to identify and quantify highway bottlenecks that delay trucks and increase costs to businesses and consumers. Titled "An Initial Assessment of Freight Bottlenecks on Highways," the report used multiple methodologies and databases to estimate freight flows, traffic volumes, and roadway congestion. Using these measurements, FHWA was able to identify a list of 227 freeway-to-freeway and freeway-to-arterial interchanges that act as 'bottlenecks' on the national freeway system.[15] Nationally, these bottlenecks accounted for approximately 243 million hours of delay, with a direct user cost of $7.8 billion.

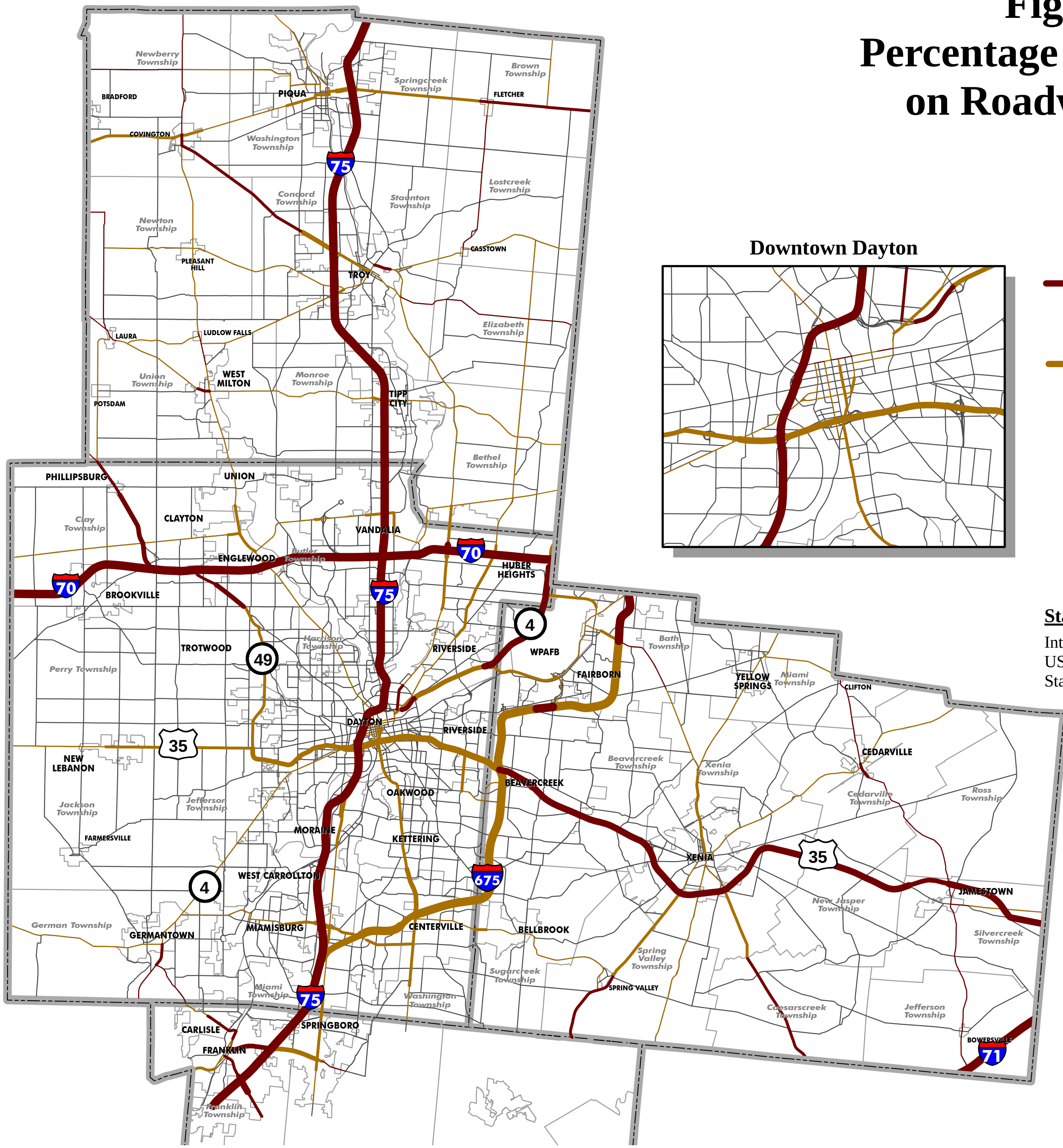
[14] Regional freeway network includes I-75, I-70, I-675, US-35, and SR4. Source: MVRPC.
[15] Refer to Chapter 3 of the FHWA report for an explanation of truck bottleneck typology.

mvrpc

Congestion Management Process

Technical Report, May 2011

Figure 2-12
Percentage of Truck Traffic on Roadway Segments



Downtown Dayton

Roadway segments with above average state truck volume percentage, by road type

Roadway segments with below average state truck volume percentage, by road type

Truck Volume on Road Segments

- 0 - 500
- 500 - 1,000
- 1,000 - 2,500
- 2,500 - 5,000
- 5,000 - 21,000

State Averages - Percent Truck Volume

Interstates:	17.11%
US Routes:	10.48%
State Routes:	6.14%

Source: ODOT and MVRPC

Date: May 2011

0 2 4 6 8 Miles

Miami Valley
Regional Planning Commission
One Dayton Centre
One South Main Street Suite 260
Dayton, OH 45402
Phone - (937) 223 - 6323
Fax - (937) 223-9750
Web - www.mvrpc.org

For the Dayton Region, only one intersection appeared on this list: I-75 at US-35 in downtown Dayton. Of the studied interchanges, the I-75/US-35 interchange ranked as the 43rd worst interchange by annual hours of delay for all trucks in 2004. According to FHWA calculations, traffic conditions on I-75 at US-35 result in approximately 923,000 hours of recurring congestion-related delay annually for all trucks.[16] Using a delay cost estimate of $32.15 per hour[17], recurring congestion on I-75 at US-35 costs the commercial shipping industry roughly $29.6 million per year. The interchange proved to be an even greater obstacle to long distance truck transport, ranking 17th worse by annual hours of delay for large trucks making trips longer than 500 miles.[18] The modernization and reconstruction of I-75 through downtown Dayton, which is currently in progress, is projected to minimize the economic impact of roadway congestion along this major transportation artery.

The economic health of both the Region and the nation depends on the regional transportation system to function properly and move people efficiently into and out of the Dayton Region. Since the Region's roadways carry a high volume of international trade and connect many high-profile industries, the importance of the interstate to commerce, and especially to trucking, cannot be overstated.

2.8 Recurring Congestion and Roadway Safety[19]

Recurring roadway congestion can have a significant impact on regional roadway safety. It is a simple matter of exposure. The more tightly packed vehicles on the road, the more likely they are to come into contact with one another.

Furthermore, roadway congestion may cause some motorists to become more aggressive, showing behaviors such as speeding, tailgating, and sudden or frequent lane changes to maneuver around slower traffic. These behaviors often lead to severe, and occasionally fatal, traffic crashes. The more severe the crash, the longer it will take for emergency crews to clear the incident. If a crash takes place during periods of recurring congestion (peak period), the resulting traffic queue can grow to a great distance and last for a considerably longer period of time. Therefore, it is important to understand traffic crash patterns related to recurring congestion.

Based upon regional freeway crash data obtained from ODOT, a total of 2,777 weekday crashes were reported on the most congested freeway sections identified with levels of service D-F from year 2005 to 2007, accounting for 48.8% of the total number of weekday freeway crashes region-wide (5,696). However, the most congested freeway sections accounted for just 43 linear miles (30%) of the total mileage on the regional freeway network (145 linear miles). A closer examination of the data revealed that 1,026 of these crashes (37%) occurred during the morning and evening peak travel periods, a timeframe of only four hours.[20] The remaining 20

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[16] Highway bottlenecks were located by scanning the FHWA Highway Performance Monitoring System database for highway sections that were highly congested and had a high percentage of trucks.

[17] This is the conservative value used by FHWA's Highway Economic Requirements System model for estimating national highway costs and benefits.

[18] Although the study brings to light the potential congestion impact of the interchange, more detailed analysis would be needed to quantify the impact of all legs of the interchange. Cost estimates and rankings are based on an initial estimate of congestion delay. Absolute costs and rankings may vary.

[19] Crash data was collected for the years 2005-2007 and compared to 2005 levels of service. The conclusions presented in this section assume that roadway congestion did not significantly change from 2005-2007. Crash statistics do not include crashes on weekends, within construction zones, or the following crash types: animal, falling to/from/in vehicle, not stated, pedalcycles, pedestrian, or train.

[20] Defined as 7-9am and 4-6pm

hours have 1,751 (63%) of crashes occurring within the congested freeway sections. It means there were an average of 257 crashes per hour during the four hour peak period compared to an average 88 crashes per hour for the remaining 20 hour period. This finding implies that recurring roadway congestion had an impact in traffic crashes. Table 2.8 below summarizes the crash statistics (2005-2007) for the most congested sections of the regional freeway network. The relevant ODOT Highway Safety Program (HSP) and Hot Spot Location rankings (as of year 2009), and 2030 LRTP project numbers are also provided.[21]

The full impact of roadway congestion on motorist safety can be further understood by observing geographic and crash attribute patterns in peak period crashes. Part of the peak period crash analysis involved an evaluation to determine which segments of the regional freeway network experienced significantly more crashes during the peak period than the mid-day period. Each freeway segment was analyzed based on the total number of peak crashes and the percent difference between the total number of peak and mid-day period crashes.

Table 2.8: Weekday Crash Statistics for Congested Highway Segments, 2005-2007

Co.	Road	Location	LOS (2005)	Fatal Crashes	Injury Crashes	PDO[22] Crashes	Total Crashes	2030 LRTP Proj. #	HSP Rank	Hot Spot Rank
MOT	I-75	Dryden/SR-741 Ramps	D	1	68	168	237	692, 147E	387,509	66
MOT	I-75	Keowee to Stanley	F	0	76	135	211	147(A,B)	-	8
MOT	I-75	Miamisburg-Centerville to Dixie	D	0	40	110	150	147E	472	-
MOT	I-75	Dixie to Dryden	D	2	45	97	144	692,147E	387,472	66
MOT	I-75	S. Edwin C. Moses to Third	F	0	51	70	121	147(C,D)	114	-
MOT	I-75	Wagner Ford to Neff	E	0	51	65	116	678, 147(A,F)	-	8,38
MOT	I-75	SR-4 to Keowee	E	0	42	74	116	147B	291	8
MOT	I-75	SR-4 Ramps	F	0	31	80	111	147B	284,291	8
WAR/ MOT	I-75	Central to I-675	E	1	36	69	106	388G, 711	527	-
MOT	I-75	US-35 Ramps	F	4	44	43	91	147(C,D)	49,114	-
MOT	I-70	Main to Airport Access	D	1	33	55	89	144A	374,384	-
MOT	I-75	Stanley to Wagner Ford	F	1	33	53	87	147A	291	8
MOT	I-75	Monument to SR-4	F	0	27	53	80	147(B,D)	284	-
MOT	I-75	Needmore to Benchwood	D	0	30	40	70	147F	500	38
WAR	I-75	SR-123 to SR-73	E	0	28	41	69	711	510	-
WAR	I-75	SR-73 Ramps	D	1	17	49	67	711,710 (B,C,D)	180,510	-
MIA	I-75	SR-41 to Main	D	2	20	43	65	89A,533	358	-
WAR	I-75	SR-123 Ramps	D	0	22	40	62	711	488,614	-
MOT	I-75	Edwin C Moses Ramps	F	0	25	30	55	147E,677	387,591	-

[21] Note that the location information is approximate. Also, the sections of roadway ranked by ODOT may only include a portion of the regional roadway segments listed. For more information on ODOT's Highway Safety Programs go to: http://www.dot.state.oh.us/Divisions/TransSysDev/ProgramMgt/CapitalPrograms/Pages/SafetyPrograms.aspx .

[22] Property Damage Only

Co.	Road	Location	LOS (2005)	Fatal Crashes	Injury Crashes	PDO[22] Crashes	Total Crashes	2030 LRTP Proj. #	HSP Rank	Hot Spot Rank
MOT	US 35	Woodman Ramps	E	1	20	32	53	154C-G	65	-
MOT	I-75	I-70 to US-40	E	0	18	34	52	-	-	-
WAR	I-75	Franklin Corp. Boundary to SR-123	E	0	12	36	48	711	614	-
MOT	I-75	Edwin C Moses to US-35	F	1	22	23	46	147C	-	-
MOT	US 35	Smithville Ramps	E	0	18	25	43	154C-G	225,577	-
MOT	I-75	US-35 to SR-4	F	0	19	22	41	147D	114,284	-
MOT	I-70	Airport Access Ramps	D	0	17	23	40	-	384	76
MOT	I-75	US-40 Ramps	D	0	11	27	38	680	-	-
MOT	I-75	Benchwood to I-70	D	0	16	21	37	-	500	-
MOT	I-75	SR-741 to Edwin C Moses	F	0	15	19	34	147E	387	-
MOT	I-75	Neff to Needmore	E	0	12	21	33	147F	291	38
MOT	I-70	I-75 to SR-202	F	1	7	24	32	-	-	76
MOT	US 35	Keowee to Steve Whalen	F	0	7	21	28	-	579	-
MOT	US 35	Steve Whalen Ramps	F	0	9	17	26	154C-G	123	-
MOT	I-70	SR-202 Ramps	D	0	7	14	21	-	231	-
MOT	US 35	Steve Whalen to Smithville	F	0	9	12	21	154C-G	123,225	-
MOT	I-70	SR-201 Ramps	D	0	9	11	20	-	525	-
MOT	I-675	I-75/I-675 Ramps	D	0	10	8	18	-	-	-
MOT	SR 235	I-70 to MOT County Line	F	0	4	13	17	-	-	-
MOT	I-70	SR-201 to SR-235	E	0	3	12	15	-	-	-
MOT	US 35	Linden/MOT County Line Ramps	E	0	9	6	15	154C-G	-	-
MOT	US 35	I-75 to Patterson	F	0	3	11	14	-	-	-
MOT	I-70	SR-202 to SR-201	D	0	2	10	12	-	-	-
MOT	US 35	Woodman to MOT County Line	F	0	7	5	12	154C-G	-	-
MOT	I-70	SR 49 to Salem	D	0	4	6	10	144C	-	-
			Total	**16**	**989**	**1768**	**2773**			

A highway segment with significantly more crashes during the peak period than the mid-day period was determined to have:

- A minimum of 10 total peak period crashes and mid-day crashes, and
- At least 1/3 more peak period crashes than mid-day period crashes

Using the above criteria, 11 segments totaling 9.52 linear miles of the regional freeway network, including 4.64 linear miles of roadway with level of service D, E, and F, experienced significantly more peak period crashes than other freeway segments in the Region (Figure 2-13). The majority of these segments were located along I-75 corridor through downtown Dayton and I-675 corridor in western Greene County area. Furthermore, 8 of 11 segments logged more than twice as many peak period crashes than mid-day crashes. The data may indicate that traffic crashes may not only have been caused by recurring congestion, but may have also added to the recurring congestion already present.

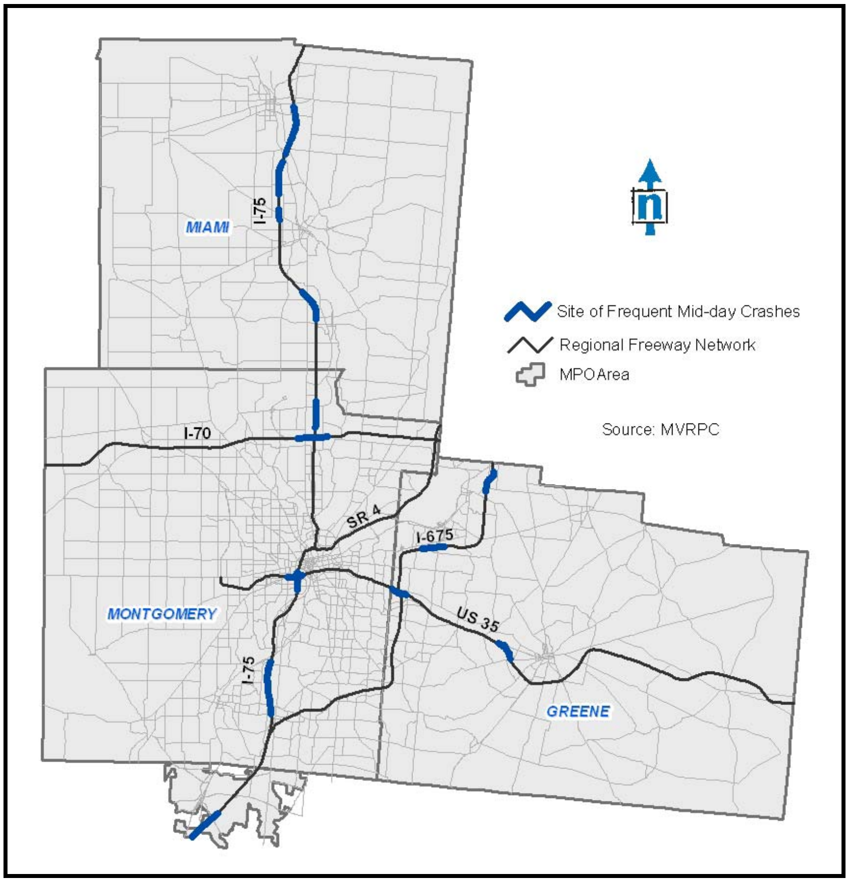

Figure 2-13: Segments with Frequent Peak Period Crashes, 2005-2007

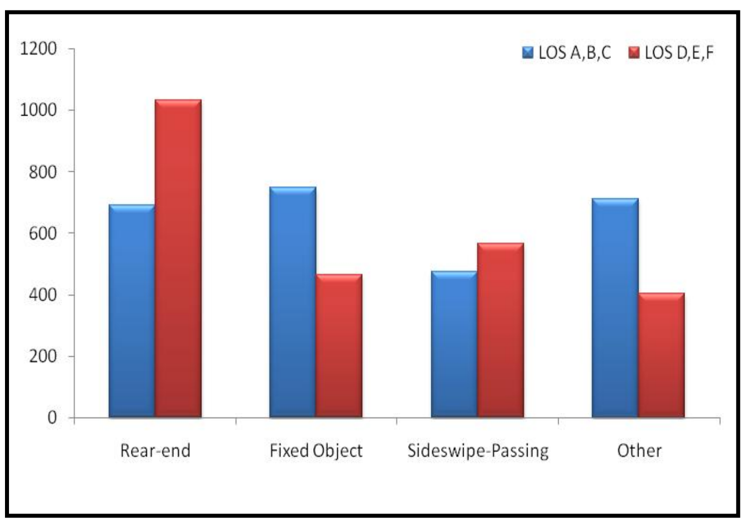

Figure 2-14: Crash Frequency by Crash Type on the Regional Freeway Network,

During the peak period, crashes on all freeway segments with recurring congestion were most often rear-end type crashes, accounting for 48% of the total number of freeway crashes. This pattern is indicative of the congested conditions that motorists experience along these segments. Other frequent crash types on freeway segments with recurring congestion were sideswipe-passing crashes (18%) and fixed object crashes (15%). The other remaining crash types, including angle, head-on, and overturning crashes, accounted for no more than 19% of the total crash frequency.

To illustrate, only 26.4% and 18.1% of the crashes on freeway segments without recurring congestion were rear-end and sideswipe-passing type crashes, respectively. This indicates that congested freeways have higher number of rear-end and sideswipe-passing crashes. High frequency of rear-end and sideswipe-passing type of crashes during congested hour is good indication of more aggressive drivers on freeways. These crash types may demonstrate that recurring congestion on freeways is leading to frustration among drivers. This creates the potential for more frequent crashes on the Region's freeway network. As evidenced, crash totals on freeway segments with recurring congestion increased 11.2% from 2005 to 2007, while crash totals on freeway segments without recurring congestion decreased by -16.6% during the same time period. In time, traffic crashes will only exacerbate the present recurring congestion during the peak travel periods.

No appreciable difference in severity was observed between crashes that occurred on freeway segments with recurring congestion than those without recurring congestion. However, the risk of injury or death in a traffic crash can only increase as driver's exhibit increasingly aggressive behavior on the freeway network due to the frustration caused by recurring roadway congestion.

3 Non-Recurring Congestion Trends

Non-recurring congestion is the result of random occurrences or unplanned special events that temporarily reduce roadway capacity and reliability to the point that motorists experience sudden significant and unexpected delay. Though non-recurring congestion can occur at any time, it is most observable during the off-peak travel periods. Off-peak predominantly refers to the daytime hours between the peak morning and evening travel periods. Non-recurring congestion may be more observable during the mid-day travel period because traffic volumes are still significant enough that any unforeseen event could inhibit the normal flow of traffic. However, non-recurring congestion can impact overnight travel as well, particularly on freeways with significant truck traffic.

Though categorically different than recurring congestion, non-recurring congestion can have the same adverse effects on personal and commercial travel. Unfortunately, it is difficult to assess the impacts non-recurring congestion can have on the region's freeway network simply because its distribution is random and often difficult to measure.

3.1 What Causes Non-Recurring Congestion?

The sources of non-recurring congestion include a wide range of possibilities:

- Roadway Debris
- Disabled Vehicles
- Roadway Construction
- Law Enforcement Activities
- Inclement Weather
- Heavy Merging Traffic
- Sudden, Unexpected Increases in Traffic Volume
- Unplanned Special Events
- Traffic Crashes

These, and other, unforeseen events which cause normal, free-flowing traffic to suddenly slow — or cease all together — are collectively known as "traffic incidents." The impact of traffic incidents on the normal flow of travel can be measured by at least three factors: (1) the number of affected travel lanes, (2) the severity of the incident, and/or (3) the degree to which the incident captures the interest of passing motorists. For example, the presence of a disabled vehicle on the roadway shoulder would not be expected to significantly disturb the normal flow of traffic because it does not significantly block any lanes of travel nor provides enough of a 'wow-factor' to catch a passing driver's attention. However, a major traffic crash involving multiple, severely damaged vehicles would most certainly both block one or more lanes of travel and cause passing motorist to engage in significant 'rubbernecking'.

It should be understood that these two scenarios would qualify as the end points of a non-recurring congestion continuum; from causing little, if any, travel delay to triggering a substantial traffic queue of many miles in length that lasts for several hours, resulting in thousands of dollars in lost time and productivity. Therefore, the potential impact of non-recurring roadway congestion warrants an analysis of where congestion has occurred in the past and where it is most likely to occur in the future.

3.2 Methodology

At this point, transportation agencies within the Region have limited ability to monitor the regional roadway network in real-time to detect traffic incidents. Non-recurring congestion can be observed and noted by deploying a region-wide freeway management system (FMS) that integrates technologies at strategic locations along the freeway network to remotely monitor traffic conditions. Such a network typically includes a series of closed-circuit television (CCTV) cameras that could be used to monitor traffic conditions and verify the location and severity of traffic incidents. The Dayton Regional Freeway Management System, currently partially deployed in the Region, is scheduled for full deployment in 2011. Data obtained during the partial deployment has helped assess travel time reliability in the Region on selected freeway segments in the Region (see Chapter 2). Full deployment of the freeway management system will result in a greater ability to detect and assess non-recurring congestion on the regional freeway network. In the interim, alternative methods of analyzing non-recurring congestion must be explored.

According to FHWA, 50% of non-recurring congestion can be attributed to traffic incidents, inclement weather, or roadway construction.[23] Using data on traffic crashes and construction obtained from the Ohio Department of Transportation, MVRPC can track where off-peak traffic crashes and construction activity may have caused non-recurring congestion in the past.[24] Furthermore, an analysis of annual average daily traffic (AADT) volumes can identify freeway sections where travel demand is at its greatest, potentially increasing travel delay in the event of non-recurring congestion.

Using Geographic Information Systems (GIS), MVRPC and ODOT staffs were able to pinpoint the location of a significant percentage (95-99%) of the reported traffic crashes that occurred on the regional freeway network between 2005 and 2007. In addition, a survey of internal and external databases was conducted to determine the location of freeway construction projects, measure regional travel demand, and analyze reports of congestion and disabled vehicles during the same time periods. The following sections include summaries of a series of analyses conducted using these relevant datasets.

3.3 Non-Recurring Congestion and Mid-Day Crashes

As previously noted, the mid-day period[25] may be more prone to non-recurring congestion than the late evening to overnight periods simply because travel demand is typically higher during the mid-day period than the late evening to early morning hours. Using this assumption, an analysis was conducted using ODOT crash data to understand where mid-day crashes occurred on the regional freeway network between 2005 and 2007. The analysis is intended to provide a better picture of

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[23] "Reducing Non-Recurring Congestion" (*FHWA*) Accessed on January 25, 2007. http://ops.fhwa.dot.gov/program_areas/reduce-non-cong.htm

[24] For the purposes of this report, it is assumed traffic crashes that occurred during the peak travel periods were influenced by the existing, or recurring, roadway congestion. Therefore, any resulting travel delay would be categorized as existing recurring congestion.

[25] Defined as 9 AM to 4 PM

where non-recurring congestion may have occurred in the past as a result of traffic crashes alone.

During year 2005 and 2007, there were 5,696 weekday crashes on the regional freeway network. 2,001 (35.1%) crashes occurred during the mid-day period. Of these, 723 involved injuries, while nine resulted in a fatality. The most common crash types among mid-day period crashes were rear-end (32.9%), sideswipe-passing (22.2%), and fixed object (20.8%).

The bulk of the investigation was an evaluation to determine which segments of the regional freeway network experienced significantly more crashes during the mid-day period than the peak period. To accomplish this task, each freeway segment was analyzed based on the total number of mid-day crashes and the percent difference between the total number of mid-day and peak period crashes. A potential site of significant non-recurring congestion from traffic crashes was determined to have:

- A minimum of 10 total mid-day crashes and peak period crashes, and
- At least 1/3 more mid-day period crashes than peak period crashes

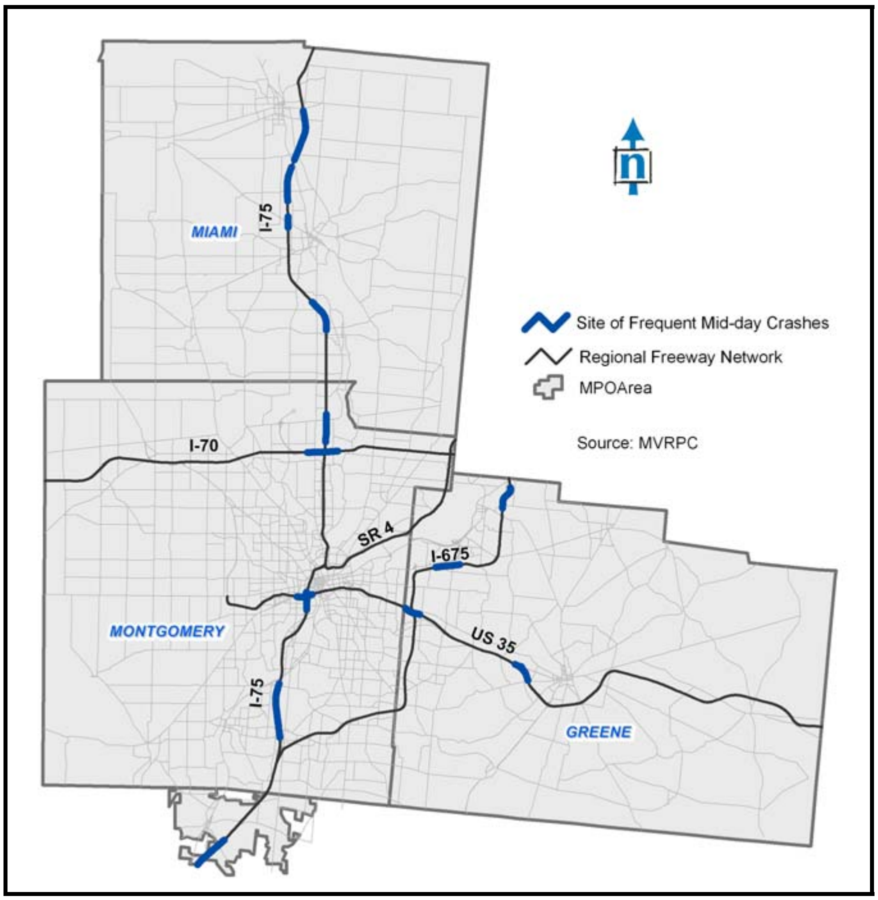


Figure 3-1: Freeway Segments with Frequent Mid-Day Crashes, 2005-2007

Using the above benchmark, 19 segments, totaling 22.53 linear miles, (15.5%) of the regional freeway network may have had significant non-recurring congestion as a result of traffic crashes between 2005 and 2007 (Figure 3-1). The majority of these segments are located outside of the downtown sections of freeway. Overall, mid-day crashes accounted for 42.7% of all crashes on these 19 segments, while peak period crashes comprised only 25.4%.

The data indicates that sizeable portions of the regional freeway network may have experienced significant travel delay due to non-recurring congestion resulting from mid-day traffic crashes between 2005 and 2007. [26]

3.4 Non-Recurring Congestion and Construction

Roadway construction and maintenance is a necessary activity to provide the best possible facilities for personal and commercial traffic. Many of the nation's freeway systems are in need of considerable repair and improvement to meet today's travel demand. Unfortunately, this can lead to an increase in non-recurring congestion as traffic volumes continue to grow and work zones become more common on the freeway network. Regional freeways with high volumes of truck traffic are particularly vulnerable to non-recurring congestion in construction zones.

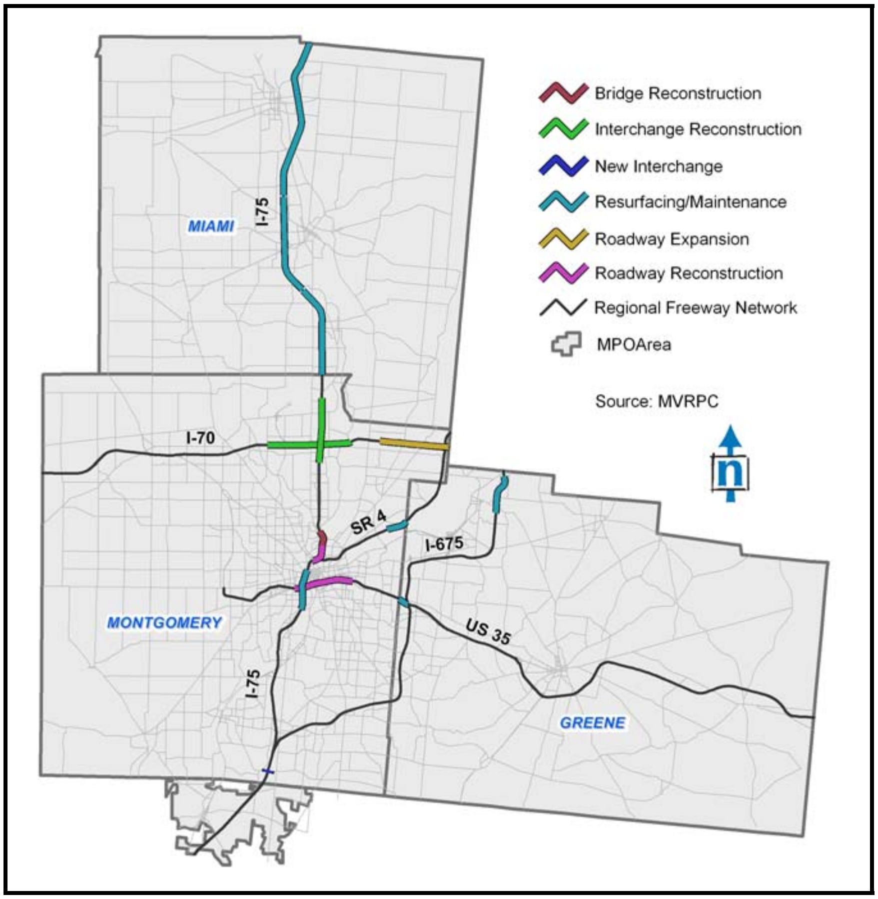


Figure 3-2: Freeway Construction Projects by Type of Work, 2007-2010

[26] These segments may or may not continue to experience significant non-recurring congestion today, due to the random nature of traffic crashes. However, confirmation of these results based on more recent crash data were beyond the scope of this report.

Since 2007, a number of major and minor construction projects have been initiated on the Region's freeway network (Figure 3-2). Minor projects, such as roadway resurfacing and maintenance, may require only a short-term (3 months or less) construction zone to perform the necessary road work, limiting the potential for extensive non-recurring congestion. However, more significant projects can require a considerable alteration to normal lane and/or ramp configurations, increasing the likelihood for non-recurring congestion as motorists adjust to new traffic patterns. The combination of temporary lane shifts and/or ramp alterations and high traffic volumes within the project area can lead to substantial non-recurring congestion during the peak travel periods. In addition, travel delay can be exacerbated by traffic incidents (i.e. disabled vehicles and traffic crashes) if they occur within a construction zone because of a reduced ability to remove the incident from the travel lanes. By providing advanced warning to approaching motorists and utilizing effective work zone management practices, transportation officials can reduce non-recurring congestion in these areas.

There have been statewide efforts to prevent traffic crashes within a construction zone. ODOT has urged drivers to look up, hang up cell phones, and go "slow for the cone zone" during a heavy construction season. In Ohio, 5,197 reported crashes occurred within roadway construction zones in 2008, resulting in 1,780 injuries and 15 fatalities. This number represents one construction zone crash every two hours.

An analysis of construction zone crashes from 2001-2005 revealed that the most common cause of construction zone crashes statewide was due to motorists 'following too close'.[27] This pattern holds true for construction zone crashes within the Region as well. From 2005-2007, there were 837 reported weekday construction zone crashes on the regional freeway network, resulting in 201 injuries and three fatalities. Similar to statewide construction zone crash trends, the majority of crashes in the Dayton Region was caused by drivers 'following too close' (34.2%). Other common contributing factors included 'improper lane change' (14.5%) and 'failure to control' (10.4%). Notably, 630 construction zone crashes (75.3%) occurred during the daytime travel period (6:00 AM to 7:00 PM). The data shows that significant number of non-recurring congestion may have appeared as a result of these crashes.

Operational roadway improvements through better work zone management and increased traffic enforcement may lead to less frequent non-recurring congestion near construction zones.

3.5 Non-Recurring Congestion and Travel Demand

As noted in Chapter 2, many sections of the regional freeway network currently provide a level of service (LOS) D or worse during the peak period. Many of these same freeway segments also carry high traffic volumes and, while LOS is typically only calculated for the peak travel period, traffic counts (AADT=Annual Average Daily Traffic) represent an average day of the year. Heavily traveled corridors can be more susceptible to non-recurring congestion, even during off-peak travel periods. A small change in roadway capacity or travel speed can wreak havoc on an already burdened freeway network at any time of day.

[27] "Drivers Share Responsibility for Work Zone Safety" (*ODOT*) April 2006.

According to regional freeway traffic volume obtained from ODOT, much of I-75 corridor through Montgomery County has the highest traffic volumes of any freeway corridor in the Region. Many segments along I-75 logged average annual daily traffic volumes of greater than 80,000 vehicles (High Demand), as illustrated in Figure 3-3. In fact, approximately 9 miles of I-75 from Needmore to S. Dixie registered an AADT of over 100,000 vehicles. As noted in Chapter 2, I-75 is also a major thoroughfare for commercial truck traffic wanting to access the more urbanized areas of the Region. Therefore, any disruption in the normal flow of traffic can result in moderate non-recurring congestion on I-75, as well as adjacent freeways and surface streets.

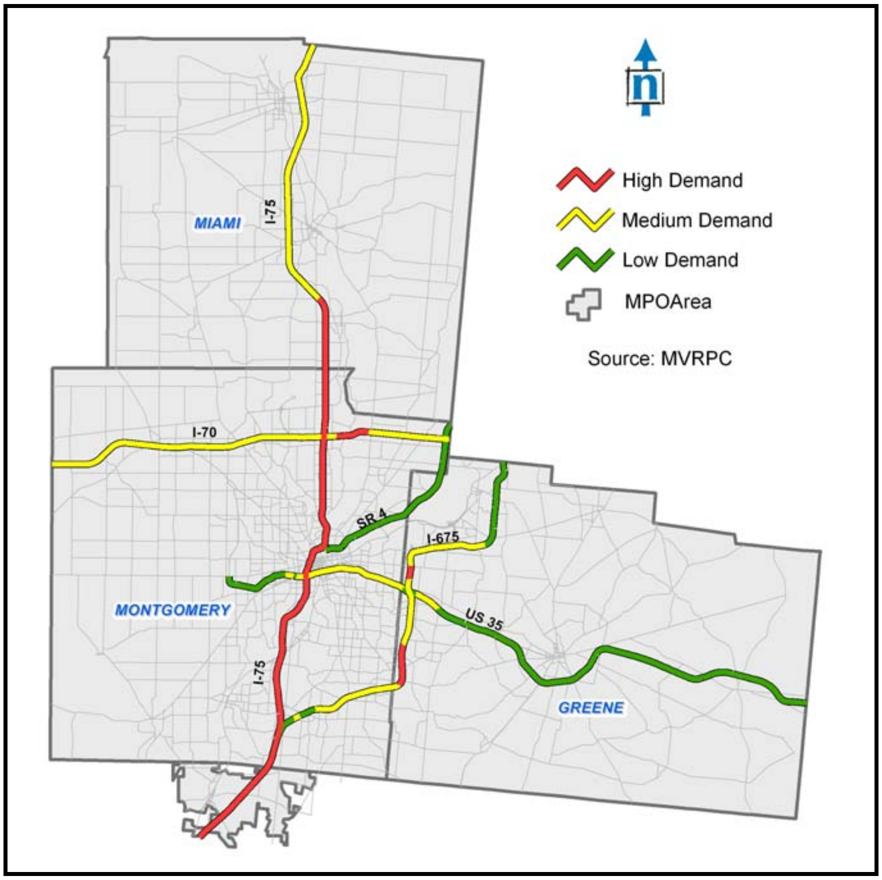


Figure 3-3: Travel Demand on Regional Freeway Segments

Medium levels of demand (AADT 40,000 to 80,000) occur mostly on freeway segments along the fringes of the region's urbanized core, such as I-70 through the northern suburbs, I-675 through the southern and eastern suburbs, and I-75 from Piqua to Tipp City. These facilities are used primarily as routes for inter-regional/interstate traffic and traffic attempting to access the core areas via I-75, thus AADT can be expected to be higher than in more rural areas but not as high as in the urbanized core. US-35 in eastern Montgomery County facilitates the ingress and egress of traffic between the urbanized core area and the suburban fringe. Though AADT volumes along these corridors do not reach the level of those found on I-75 corridor, they are still significant enough to where even a moderate traffic incident can cause significant non-recurring congestion. This is particularly evident on I-70, which carries a very high volume of truck traffic. Rural freeway segments, such as US-35 and northern sections of I-675 in Greene County, carry significant amounts of inter-regional and interstate traffic, but typically experience less traffic than freeways closer to the urban core or suburban fringe.[28] Because they provide access to sparsely populated areas, low demand corridors (AADT<40,000) carry less traffic relative to the freeways in more urbanized areas of the Region. These areas include most of US-35 through Greene County and SR-4. Though current non-recurring congestion along these corridors is relatively infrequent and causes limited impact on traffic conditions when it does occur, traffic volumes are expected to increase in the future, increasing the likelihood of more frequent and more severe roadway congestion. Though categorized in the low demand range, much of US-35 in western Greene County is not a controlled-access facility and is more prone to non-recurring congestion resulting from high travel demand for its functional classification and frequent crashes.

In contrast, US-35 in Jefferson Township and SR-4 in Montgomery and Greene Counties experience low travel demand, though they sit within both urbanized and suburban areas. However, these routes primarily serve commuting and access needs of adjacent residential and commercial developments rather than inter-regional or interstate traffic.

To summarize, the data indicates that the Region's principal freeways, I-75, I-70, I-675, and US-35, are particularly prone to major traffic delays as a result of non-recurring congestion due to the high volumes of daily traffic that occur on these routes. On average, these corridors handle significantly more personal and commercial traffic than the rural freeway network, and are rapidly approaching or exceeding their designed travel demand capacities. In addition, portions of I-75 and US-35 in Montgomery County are burdened by poor geometrics, the results of outdated (1950's & 1960's) standards of freeway design. An ODOT and MVRPC transportation study resulted in the reconstruction of I-75, which was one of the highest priorities in Ohio. Phase 1 of the reconstruction began in 2007 and is expected to be complete in 2011. Due to high traffic volumes, little to no additional available capacity, and outdated design, an incident along high and medium demand corridors — whether natural or man-made — often results in lengthy traffic queues, long travel delays, and significant economic and personal costs to travelers.

3.6 Ohio Freeway Incident Response Service Team (FIRST) Program

In 2005, the Ohio Department of Transportation (ODOT) extended their incident management program (FIRST) to the Dayton area. The goal of an incident management program is to maintain the safe and effective flow of traffic during incidents and emergencies while protecting the public and incident responders from further damage.

In the Dayton Area, FIRST is operated by ODOT District 7, on weekdays, between 5 am and 8 pm. One driver is available from 5 am to 1 pm and 2 drivers are available from 1 to 8 pm.

Using the records provided by District 7 MVRPC analyzed the 2007-2009 incidents. After a few deletions for errors the database contained 14,364 records, about equally

[28] Recall that I-70 carries a high volume of truck traffic. Using calculations from the Highway Capacity Manual, the capacity of I-70 is roughly 87% of what would be expected under ideal (no trucks) conditions. Thus, observed AADT volumes on I-70 are typically lower than on freeways with less truck traffic.

distributed by day of the week with approximately 54% of incidents recorded between 1 and 7 pm. Table 3.1 shows the frequency and percentage of incidents by activity type. Five activity types (abandoned motor vehicle, debris on roadway, motor vehicle accident, safety coverage, and stopped motor vehicle) comprised 75% of incidents.

Table 3.1: Reported Incidents by Activity Type, 2007-2009

Activity Type Description	Total	Percent
Abandoned Motor Vehicle	2,654	18.5%
Brush Fire	8	0.1%
Cell Phone Call	79	0.5%
Coolant (water or antifreeze)	37	0.3%
Debris on the Roadway	3,205	22.3%
Flat Tire	909	6.3%
Gasoline/Diesel	717	5.0%
Hazardous Material (HAZMAT)	6	0.0%
Jumpstart	112	0.8%
Lost Motorist	122	0.8%
Medical Emergency	284	2.0%
Minor Repair	117	0.8%
Motor Vehicle Accident	1,373	9.6%
Oil	6	0.0%
Others	95	0.7%
Pedestrians on Highway	187	1.3%
Push Vehicle	611	4.3%
Safety Coverage	1,312	9.1%
Stopped Motor Vehicle	2,184	15.2%
Towing	346	2.4%
Grand Total	**14,364**	**100.00%**

The database also includes information about the duration of the incident response. Table 3.2 shows the duration of the top 5 activity types. Responses to abandoned motor vehicles, debris on the roadway, and stopped motor vehicles have short duration times with over 80% of responses being 5 minutes or less while responses to accidents and providing safety coverage last longer. Sixty-five percent of accident responses last between 10 and 60 minutes and 65% of safety coverage responses last between 5 and 30 minutes.

Analyzing incident responses by location for the most frequent and intense (longer) responses shows that 75% of responses are clustered on the I-75 corridor, followed by 17% on the I-70 corridor and 7% on the US 35 corridor. Figure 3-4 shows the location of accident and safety coverage responses.

Table 3.2: Duration by Activity Type

Activity Type Description	Duration (Min)	Total	Percent
Abandoned Motor Vehicle	**0-4**	2,499	94.2%
	5-9	126	4.7%
	10-29	21	0.8%
	30-59	6	0.2%
	>60	2	0.1%
Abandoned Motor Vehicle Total		**2,654**	**24.7%**
Debris on the Roadway	**0-4**	2,816	87.9%
	5-9	316	9.9%
	10-29	62	1.9%
	30-59	3	0.1%
	>60	7	0.2%
Debris on the Roadway Total		**3,204**	**29.9%**
Motor Vehicle Accident	**0-4**	101	7.4%
	5-9	230	16.8%
	10-29	573	41.8%
	30-59	319	23.3%
	>60	149	10.9%
Motor Vehicle Accident Total		**1,372**	**12.8%**
Safety Coverage	**0-4**	342	26.1%
	5-9	424	32.3%
	10-29	434	33.1%
	30-59	90	6.9%
	>60	22	1.7%
Safety Coverage Total		**1,312**	**12.2%**
Stopped Motor Vehicle	**0-4**	1799	82.4%
	5-9	299	13.7%
	10-29	80	3.7%
	30-59	3	0.1%
	>60	3	0.1%
Stopped Motor Vehicle Total		**2,184**	**20.4%**
	Grand Total	**10,726**	**100.0%**

The FIRST data appears to corroborate the previous analyses of non-recurring congestion. The I-75 corridor from Needmore Road to Springboro Pike (SR741) had the most reports of either crashes or safety coverage responses (Figure 3-4). The stretch of I-70 between Union Road and SR201 also had a comparatively high frequency of incidents with US 35 between Longworth Street and Smithville Road being the only other segment with a high concentration. Though the FIRST database does not account for every incident on the regional roadway network, it does give a good indication of non-recurring incidents and not surprisingly high incident locations are also top locations for crashes, construction events, high traffic volumes, and recurring congestion.

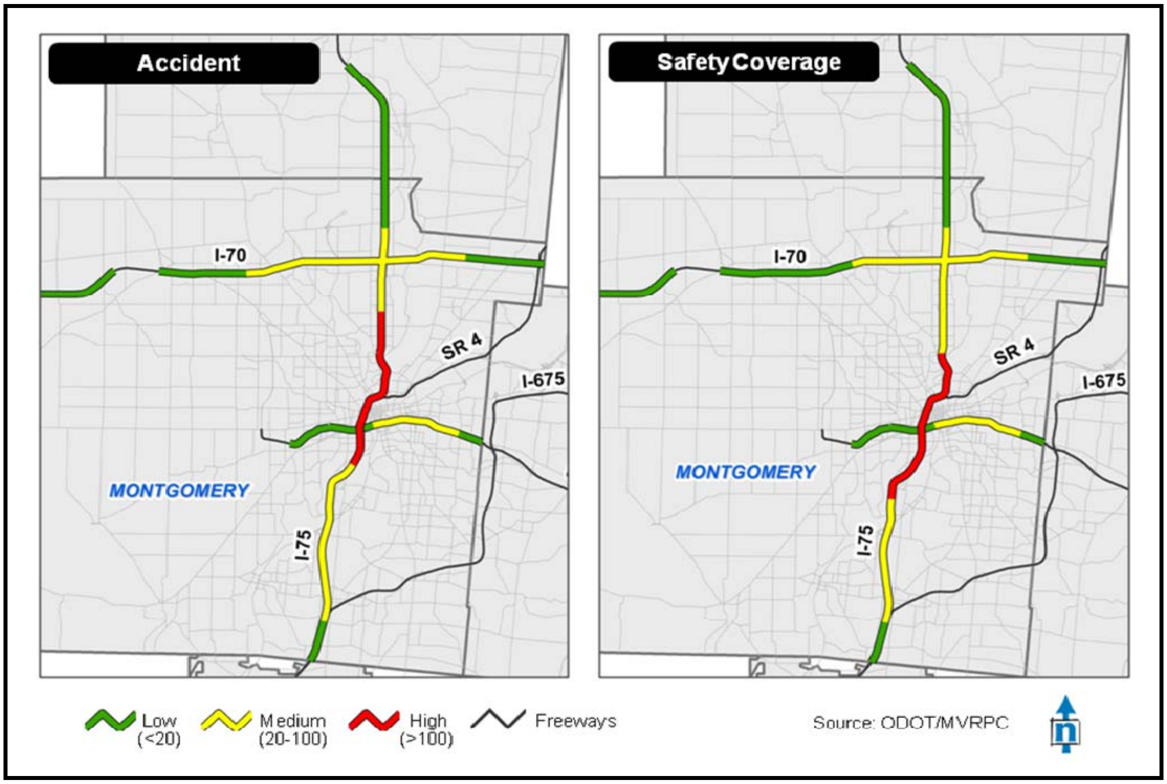


Figure 3-4: FIRST Accident and Safety Coverage Responses, 2007-2009

Overall, many of the region's freeways may be experiencing significant travel delay as a result of non-recurring congestion caused by natural and man-made incidents, construction, and high traffic volumes. Though up to 50% of roadway congestion in general can be attributed to non-recurring congestion, it is often difficult to assess the impacts of and provide solutions to non-recurring congestion. Expanding roadway capacity to reduce non-recurring congestion through physical improvements or operational strategies may have the highest potential to minimize frustration and improve efficiency while enhancing the safety and reliability of the entire regional freeway network. In addition, motorists can help to lessen the impacts of non-recurring congestion by exercising patience when traveling on congested roadways.

4 Public Transportation Demand

An important tool for managing recurring and non-recurring congestion is the regional public transportation system. Everyday, thousands of citizens in the Dayton Region use public transportation to access employment centers, commercial areas, recreation facilities, entertainments venues, and public institutions. By doing so, transit riders reduce the travel demand on the Region's roadways while moderating congestion and pollution, particularly during the peak travel periods.

Since 1998, MVRPC has coordinated with the Greater Dayton Regional Transit Authority (GDRTA) to collect ridership data on GDRTA's fixed routes. It is important to note that, with the exception of a limited portion of Greene County (Wright State University and Wright Patterson AFB, and two new Greene CATS flex-routes), Montgomery County is the only county in the Dayton Region that is served by regularly scheduled fixed transit routes. Therefore, the following subsections focus primarely on transit services in Montgomery County. Miami and Greene Counties have demand-responsive transit services that are open to the general public and provide inter-county connections with GDRTA at various locations. Figure 4-1 shows major transit hubs, park and ride lots, inter-county connections, and fixed transit routes in Montgomery County.

The analysis presented below is based upon the 2007 GDRTA routes, schedules, and ridership statistics. In January 2007, GDRTA implemented a complete re-design of the fixed route system within Montgomery County making comparisons with previous (2003) routes difficult.

4.1 Methodology

Ridership data was obtained from GDRTA for 2003 and 2007, categorized by type of route and time period. Ridership was then aggregated into the following periods by time of day for 2003/2007 respectively.

- Morning Peak (4:30am to 9:30am)/(6:30am to 9:00 am)
- Afternoon Peak (2:30pm to 6:30pm)/(3:00pm to 6:30pm)/
- Off Peak (9:30am to 2:30pm and 6:30pm to 1:00am)/(4:00am to 6:30am, 9:00am to 3:00pm, and 6:30pm to 2:00am)

Headway and route characteristics, such as run times, were also collected along with operating characteristics on the vehicle used on a particular route and the seating and standing capacity of each vehicle.

4.2 Load Factor Analysis

Based on the above data, MVRPC and GDRTA calculated the average load factor for each route by time period. Average load factors were not calculated for routes that were not available in a particular period or did not run more than three times a day. The results of the analysis are presented in Table 4.1. Load factor is a measure of ridership compared to the seating capacity of a route for a given time period. Similar to level of service on roadways, the relative comfort that a passenger may experience while seated on a transit vehicle (load factor) is given a level of service label of A through F (See Table 4.2).

Table 4.1: Maximum Load Factor by Route, GDRTA, 2007[29]

Route Name & Number		AM Peak	PM Peak	Off Peak	Avg. Daily Load Factor
		6:30AM–9:00AM	3:00PM–6:30PM	4:00AM–6:30AM 9:00AM–3:00PM 6:30PM-2:00AM	
Vandalia	17N	1.34	0.93	1.12	0.51
Huber Heights	18N	0.90	1.03	1.31	0.48
WPAFB	X1A	0.52	0.40	-	0.46
Union	16N	0.88	0.74	1.21	0.45
Moraine-W.Carrollton-Msbg.	18S	0.83	1.14	1.03	0.45
South Hub	17S	0.97	0.90	1.03	0.44
Greenwich Village	9N	0.88	1.26	1.35	0.44
N. Main St.	7N	1.05	1.17	1.12	0.42
Kettering-Whipp & Bigger	16S	0.76	0.79	1.00	0.41
Miami Chapel	9S	1.06	1.06	1.44	0.41
Five Oaks	12N	1.31	1.72	1.38	0.40
Keowee-Northridge-Poe Av.	22N	0.90	0.90	1.24	0.40
Trotwood	14N	1.24	1.07	1.52	0.39
W. Third-Drexel	1W	0.49	1.17	0.66	0.39
South Hub	X5	0.66	1.03	0.72	0.38
Kettering Medical Center	11S	1.44	1.04	1.12	0.37
Otterbein-Lexington-Turner	2W	0.76	0.88	0.61	0.36
Wright State	13	0.62	0.66	1.41	0.35
Centerville	14S	0.72	0.90	1.38	0.35
Watervliet	7S	0.66	0.98	1.05	0.35
Moraine-South Hub	19S	0.79	0.76	1.55	0.34
Linden Ave.-Eastown Hub	2E	0.56	0.66	0.73	0.34
Salem Ave.-Northwest Hub	8N	1.41	1.85	0.80	0.34
Huber Heights	19N	0.62	1.07	1.41	0.33
Northwest Hub-South Hub	24	0.41	0.59	0.83	0.32
South Hub-Eastown Hub	23	0.52	0.66	0.52	0.30
E. Third-Mount Crest	1E	0.66	0.90	0.66	0.30
W. Third-Townview	3W	0.56	0.93	0.95	0.30
NW Hub-Consumer Sq.	20N	0.97	0.69	0.79	0.29
Nicholas-Westown Hub	8S	1.00	1.68	0.83	0.28
Wayne Ave.-Eastown Hub	3E	0.44	0.56	0.68	0.27
Hoover-Delphos	4W	NA	0.76	0.68	0.26
WPAFB	X1B	0.38	0.14	-	0.26
WPAFB-USAF Museum	11N	1.04	0.68	0.48	0.25
Derby/Birdland	22W	0.72	0.62	0.69	0.25
Englewood-Downtown	X15	0.52	0.48	2.00	0.24
New Lebanon	41	0.41	0.21	0.14	0.21
Xenia-Linden-Eastown	4E	0.37	0.54	0.46	0.21
Dora Tate Center-Job Center	63	0.30	0.65	0.74	0.20
Madden Hills-MVCTC	20S	0.93	0.28	0.66	0.20
Brookville-Clayton-Ph'burg	40	0.28	0.36	0.24	0.19
Forrer Blvd.	12S	0.48	0.69	0.76	0.18
Miamisburg-South Hub	60	0.35	0.43	0.30	0.15
Valley St.	5N	0.39	0.68	0.59	0.15
Far Hills	5S	0.61	0.76	0.15	0.15
Englewood-NW Hub	15	0.38	0.41	0.31	0.14
Germantown-Farmersville	42	0.16	-	0.16	0.05
Huber Heights-WPAFB	X3	0.10	-	-	0.05
Avg. Maximum Load Factor		**0.71**	**0.82**	**0.88**	
				Avg. System-wide Daily Load Factor	**0.33**

[29] Represents highest value in either the inbound or outbound direction.

Figure 4-1: Multi-Modal Passenger Facilities

Back of Figure 4-1

Table 4.2: Transit Vehicle LOS and Load Factor[30]

LOS	LOAD FACTOR (PEOPLE/SEAT)	PASSENGER CONDITIONS
A	0.00-0.50	No passenger needs to sit next to another
B	0.51-0.75	Some passengers may need to sit together, but not all
C	0.76-1.00	All passengers may sit together, limited seat choice
D	1.01-1.25	Some passengers will need to stand
E	1.26-1.50	Full transit vehicle, spacing between passengers at maximum level of tolerability
F	>1.50	Crush load, extremely intolerable

The results of the analysis indicates that, based on the average daily load factor, routes offered a very good level of service with only few routes operating near or beyond the seating capacity in 2007. For example, the route with the highest passenger density, Vandalia (17N), logged an average daily load factor of only 0.51. This illustrates that transit vehicles were running at less than half full during the majority of their daily service time. However, some routes did experience passenger congestion (load factor ≥1.0) during at least one inbound or outbound trip in the morning, evening, or off peak period.

For the morning peak period, the routes with a load factor of 1.0 or greater were:

- Kettering Medical Center (11S) — 1.44
- Salem Ave.-Northwest Hub (8N) — 1.41
- Vandalia (17N) — 1.34
- Five Oaks (12N) — 1.31
- Trotwood (14N) — 1.24
- Miami Chapel (9S) — 1.06
- N. Main St. (7N) — 1.05
- WPAFB-USAF Museum (11N) — 1.04
- Nicholas-Westown Hub (8S) — 1.00

For the evening peak period, the routes with a load factor of 1.0 or greater were:

- Salem Ave.-Northwest Hub (8N) — 1.85
- Five Oaks (12N) — 1.72
- Nicholas-Westown Hub (8S) — 1.68
- Greenwich Village (9N) — 1.26
- N. Main St. (7N) — 1.17
- W. Third-Drexel (1W) — 1.17
- Moraine-W.Carrollton-Msbg. (18S) — 1.14
- Trotwood (14N) — 1.07
- Huber Heights (19N) — 1.07
- Miami Chapel (9S) — 1.06
- Kettering Medical Center (11S) — 1.04

[30] "TCRP Report 100: Transit Capacity and Level of Service Manual" (*TCRP)* 2003

- Huber Heights (18N) — 1.03
- South Hub (X5) — 1.03

For the off-peak periods, the routes with a load factor of 1.0 or greater were:

- Englewood-Downtown (X15) — 2.00
- Moraine-South Hub (19S) — 1.55
- Trotwood (14N) — 1.52
- Miami Chapel (9S) — 1.44
- Huber Heights (19N) — 1.41
- Wright State (13) — 1.41
- Five Oaks (12N) — 1.38
- Centerville (14S) — 1.38
- Greenwich Village (9N) — 1.35
- Huber Heights (18N) — 1.31
- Keowee-Northridge-Poe Ave. (22N) — 1.24
- Union (16N) — 1.21
- N. Main St. (7N) — 1.12
- Kettering Medical Center (11S) — 1.12
- Vandalia (17N) — 1.12
- Watervliet (7S) — 1.05
- Moraine-W.Carrollton-Msbg. (18S) — 1.03
- South Hub (17S) — 1.03
- Kettering-Whipp & Bigger (16S) — 1.00

Some of the highest load factors were found in the off-peak periods of midday and late evening because fewer buses were in operation, causing longer headways between vehicles. The off peak period also had the greatest number of routes (19) with load factors above 1.0. A few routes (7N, 9S, 12N, 14N, and 11S) consistently had load factors above 1.0 for all periods with three of these routes (7N, 9S, and 12N) also ranking in the top 10 based on daily ridership (See Table 4.3).

Based on 2007 ridership levels and load factor measurements, the regional public transportation system in Montgomery County was underutilized by the Region's population. Those with personal forms of transportation were much more likely to take a private vehicle to work than a transit vehicle, as illustrated by the latest journey-to-work statistics from the 2030 LRTP. In 2000, over 83% of workers in Montgomery County drove alone to work; while a mere 2.7% used the public transportation system. However, those that use public transportation will, in general, rarely experience delay or discomfort due to over-filled transit vehicles.

4.3 Ridership Statistics

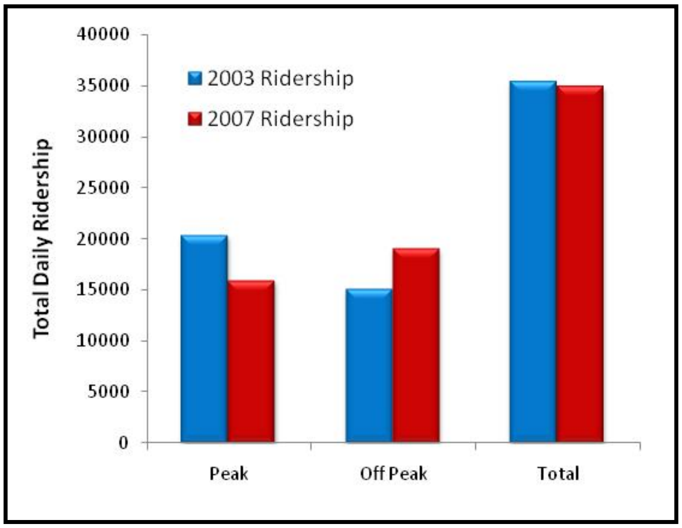


Figure 4-2: GDRTA Average Daily Ridership
(Source: GDRTA)

Overall, ridership figures on GDRTA's system remained stable between 2003 and 2007 (See Figure 4-2). The increases/ decreases between the peak and off peak periods can be explained by the differences in the peak/off peak period definitions between 2003 and 2007.

In summary, about half the routes show an increase in ridership while the other half show a decrease but given the changes in route alignment and operational characteristics is difficult to make further comparisons.

To respond to new challenges such as on-going suburbanization and declining budgets, GDRTA implemented a complete transit system overhaul in January 2007. Many routes were either significantly altered to serve new centers of population and commercial activity, or abolished all together to better manage resources and improve service quality. An Origin and Destination Study conducted by the GDRTA in 2005 identified the Top 10 Trip Destinations in the Dayton Region[31]:

1. Dayton Central Business District (Sinclair Community College)
2. Dayton Mall
3. The Montgomery County Job Center
4. Miami Valley Hospital
5. Good Samaritan Hospital
6. Wright State University
7. Westown Shopping Center
8. Grandview Hospital
9. University of Dayton (Including Brown Street commercial district)
10. Salem Mall/Consumer Square

New or existing routes were changed to improve transit service to these, and other, destinations with the hopes that ridership levels would increase as a result. Planned improvements in service quality were also of high priority. By modernizing its operations to match the changing residential and commercial landscape, GDRTA hopes to boost ridership and provide better service to county residents.

[31] "RTA Rounding Corner, Gaining Speed" (*Dayton Daily News*) 3 November 2006.

Table 4.3: Average Daily Ridership by Route, GDRTA

Route Name and Number		2003 Peak	2003 Off Pk	2003 Total	2007 Peak	2007 Off Pk	2007 Total	Percent Diff. (Total)
South Hub-Eastown Hub	23	-	-	-	131	180	311	NA
Air Force Museum	23N	40	28	68	-	-	-	NA
Dayton Mall-South Hub	23S	269	248	517	-	-	-	NA
NW Hub-South Hub	24	-	-	-	198	236	434	NA
Friendship Vil.-NW Hub	24N	174	107	281	-	-	-	NA
South Hub	24S	250	180	430	-	-	-	NA
Englewood-Downtown	X15	-	-	-	56	56	112	NA
Trotwood	14N	181	0	181	333	342	675	273%
Madden Hills-MVCTC	20S	69	25	94	229	94	323	244%
Centerville	14S	206	0	206	287	315	602	192%
Germantown-Farmersville	42	3	1	4	4	6	10	150%
New Lebanon	41	21	4	25	21	20	41	64%
Vandalia	17N	326	261	587	347	512	859	46%
South Hub	17S	333	233	566	356	385	741	31%
Union	16N	424	313	737	371	532	903	23%
Wayne Ave.-Eastown Hub	3E	357	260	617	313	430	743	20%
Brookv-Clayton-Ph'burg	40	16	14	30	17	18	35	17%
Miami Chapel	9S	700	623	1323	581	939	1520	15%
Greenwich Village	9N	861	552	1413	672	935	1607	14%
Huber Heights	18N	535	297	832	398	541	939	13%
Kettering Medical Center	11S	190	209	399	158	291	449	13%
Moraine-W.Carrollt-Msbg.	18S	503	237	740	326	500	826	12%
Huber Heights	19N	324	200	524	252	301	553	6%
Watervliet	7S	929	728	1657	756	944	1700	3%
Xenia-Linden-Eastown	4E	403	371	774	322	471	793	2%
Kettering-Whipp & Bigger	16S	487	320	807	396	422	818	1%
Forrer Blvd.	12S	329	239	568	187	387	574	1%
Wright State	13	273	132	405	212	197	409	1%
Hoover-Delphos	4W	517	464	981	385	593	978	0%
E. Third-Mount Crest	1E	502	573	1075	425	632	1057	-2%
South Hub	X5	365	197	562	350	200	550	-2%
N. Main St.	7N	1171	955	2126	937	1138	2075	-2%
Nicholas-Westown Hub	8S	1234	942	2176	1003	1057	2060	-5%
WPAFB-USAF Museum	11N	146	144	290	109	165	274	-6%
Keowee-Northridge-Poe	22N	748	546	1294	476	732	1208	-7%
NW Hub-Consumer Sq.	20N	315	190	505	292	178	470	-7%
Otterbein-Lexingt-Turner	2W	658	449	1107	545	484	1029	-7%
W. Third-Drexel	1W	697	740	1437	528	758	1286	-11%
Five Oaks	12N	861	560	1421	587	681	1268	-11%
Moraine-South Hub	19S	437	261	698	241	347	588	-16%
Derby/Birdland	22W	572	322	894	329	405	734	-18%
Salem Ave.-NW Hub	8N	1684	1447	3131	1370	1171	2541	-19%
Linden Ave.-Eastown Hub	2E	733	533	1266	462	558	1020	-19%
W. Third-Townview	3W	728	522	1250	441	539	980	-22%
Dora Tate Ctr-Job Ctr	63	61	83	144	40	71	111	-23%
Valley St.	5N	170	148	318	175	64	239	-25%
WPAFB	X1B	22	0	22	15	0	15	-32%
Miamisburg-South Hub	60	118	97	215	68	75	143	-33%
Englewood-NW Hub	15	135	67	202	55	72	127	-37%
WPAFB	X1A	38	0	38	23	0	23	-39%
Huber Heights-WPAFB	X3	7	0	7	3	0	3	-57%
Far Hills	5S	276	273	549	185	50	235	-57%
Total Average Daily Ridership		**20398**	**15095**	**35493**	**15967**	**19024**	**34991**	**-1.4%**
Ave. Daily Ridership per Route		**416**	**308**	**724**	**333**	**397**	**730**	**0.6%**

Further in the summer 2009, GDRTA implemented a new downtown transit hub. The hub offers a covered platform and customer waiting area for convenience and ease of transfer between routes. What effect these changes will have on roadway congestion is yet to be determined.

4.4 Greene County Transit Board (Greene CATS) – Flex Route Expansion

In 2009, Greene CATS implemented its first Flex Route Service to locally serve the Cities of Fairborn and Xenia and to provide a connection between the two cities (see Figure 4.1). A flex route operates with a specified route and timepoints but also allows for up to ¾ mile deviations from the route to serve passengers with disabilities. The Fairborn-Xenia route operates on a 90 minute headway, 6:00am to 6pm, Monday to Friday. Average daily ridership is 101 with 30 and 71 passengers for the peak and off-peak periods respectively. In January 2011 Greene CATs started operating service between Xenia and Downtown Dayton and an additional flex route, Fairborn-Beavercreek, is planned for implementation later in the year. Approximately 14/22 percent of the population in Greene County lives within ¼ and ½ mile of a currently operating route.

4.5 Accessibility Analysis

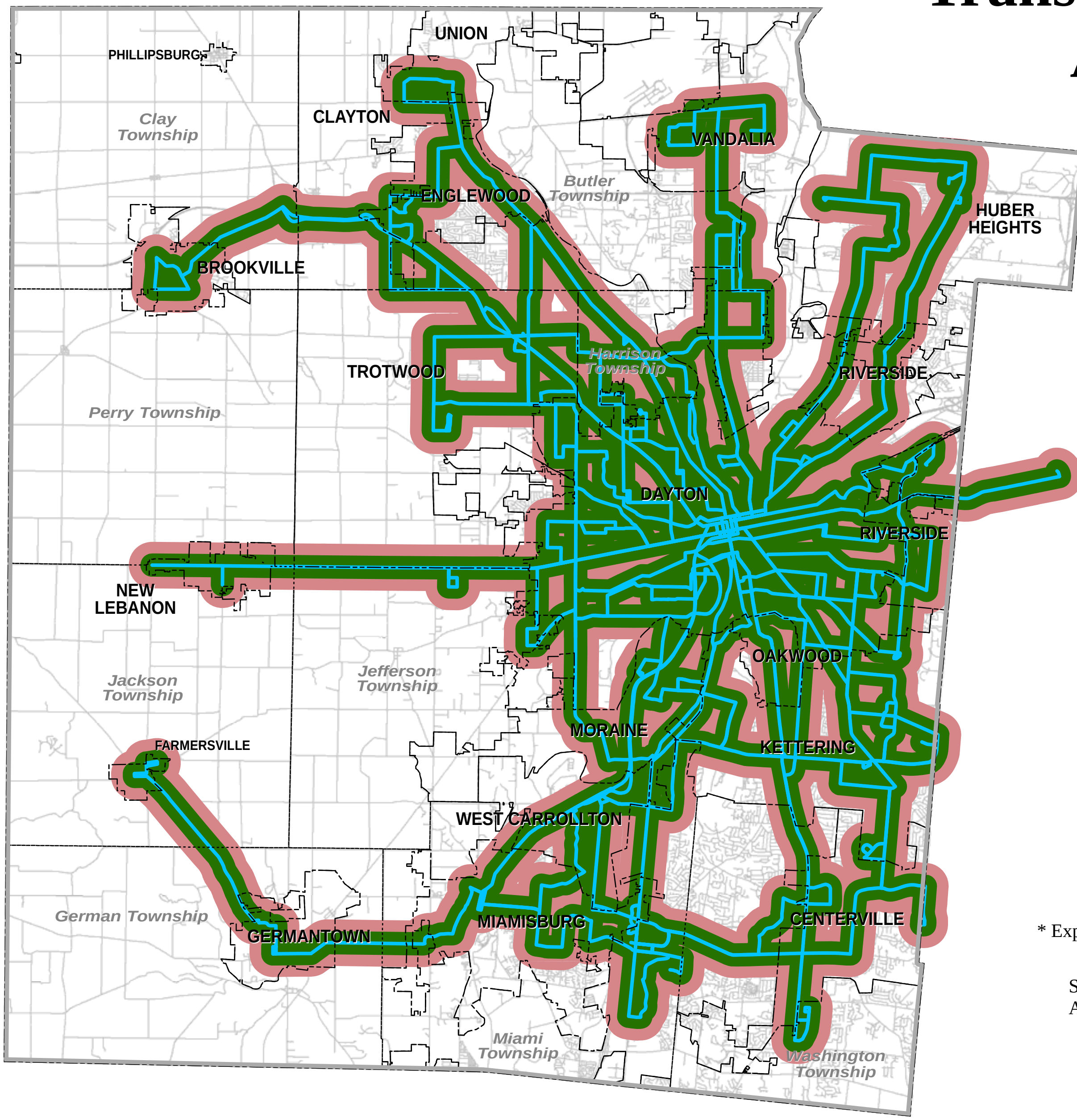
According to the 1990 Nationwide Personal Transportation Survey (NPTS), 10.3% of persons living within ¼ mile of a transit stop are likely to use transit to commute to work. If the distance is increased to 2 miles, the percentage of persons that are willing to use transit declines to 3.8%. Many transit and pedestrian studies also note that most people are willing to walk ¼ to ½ mile to access transit.

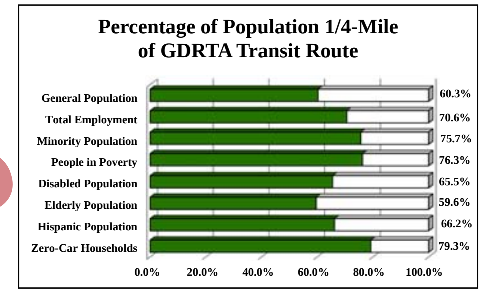
Using ¼ and ½ mile buffers from 2010 GDRTA fixed transit lines, the accessibility of transit was measured with respect to the location of population and employment in Montgomery County using GIS (Figure 4-3). Transit lines were used as the basis of the analysis because it was determined that bus stops were spaced frequently (closer than ¼ mile) throughout the routes.

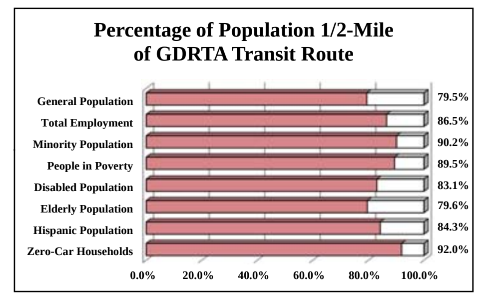
The transit buffers were superimposed onto the Traffic Analysis Zones (TAZ) demographic data compiled by MVRPC to determine the area covered by a buffer using the assumption that population and employment are evenly distributed throughout the TAZs. The percentages of population and employment covered by the buffers were then calculated.

Using 2000 Census population figures, the results indicate that approximately 60.5% of the total population in Montgomery County lives and 59% of the County employment is located within ¼ mile of a transit route. By increasing the buffer to ½ mile, the population and workforce percentages increase to 79.9% and 78.9%, respectively.

Figure 4-3
Transit Accessibility Analysis*







* Express Routes and Local School Routes are not included.

Source: 2010 Greater Dayton Regional Transit Authority bus routes, U.S. Census 2000 and MVRPC

Date: May 2011

Miami Valley
Regional Planning Commission
One South Main Street Suite 260
Dayton, OH 45402
Phone - (937) 223 - 6323
Fax - (937) 223-9750
Web - www.mvrpc.org

4.6 Role of Public Transportation in Roadway Congestion Management

Public transportation has the potential to significantly reduce congestion on the regional roadway network, particularly in Montgomery County. According to one source, only 49% of Americans live within ¼ mile of a transit stop.[35] In contrast, MVRPC analyses have shown that up to 58.8% of Montgomery County residents live within ¼ mile of a transit stop. Though regular fixed route service is currently unavailable in Miami and Greene Counties, GDRTA has agreed to extend service to just over the border into Greene County, most notably to 'The Greene', a high-end shopping district in Beavercreek, in addition to its service to Wright State University and Wright-Patterson AFB.

GDRTA also operates three express routes that provide direct service from Downtown Dayton to Wright-Patterson Air Force Base (X1A and X1B) and the South Hub near the Dayton Mall (X5). These routes have the greatest potential to remove vehicles from the regional roadway system because they provide a level of service equivalent to commuting by automobile. In addition, GDRTA's Westown, Eastown, and South Hubs offer ample parking and frequent local service to many regional destination points, including the central business district. This provides suburban commuters with the opportunity to park-and-ride to their destination. Though currently underutilized by the Region's commuters, express routes and park-and-ride facilities may see ridership increase as the personal costs of regional roadway congestion continue to climb.

The role of public transportation in roadway congestion management is to give commuters and shoppers an alternative to the automobile for local trips. After conducting a comprehensive analysis of their service, GDRTA recognized that transit riders wanted access to the region's major employment, commercial, and entertainment centers. To accommodate their needs, GDRTA has increased the quality and frequency of service to several high demand locations, while reducing or cutting service on seldom used routes. The goal of transportation officials looking to reduce roadway congestion is to attract residents that own automobiles (i.e. choice travelers) to public transit as a means to access these centers. Though convincing choice travelers to use public transportation in place of their automobiles is a challenge, doing so may help to better manage congestion on the regional roadway network.

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5 Congestion Management Strategies

A number of strategies have been explored and implemented to reduce the cumulative effect of roadway congestion in the Dayton Region. These strategies include both physical and operational improvements to the regional network of interstates, controlled-access freeways, and surface arterials. In addition, MVRPC is involved in a number of transportation planning studies and activities intended to identify current and future roadway congestion trends.

5.1 Congestion Management and Regional Transportation Planning

Stated simply, regional roadway congestion management is a primary component in many of MVRPC's regional transportation planning processes. Though not always explicitly noted, nearly every report, study, or assessment of the region's roadway network either directly or indirectly addresses many of the underlying causes or potential countermeasures to regional roadway congestion. In fact, MVRPC declared that reducing regional roadway congestion to promote positive economic growth was a regional priority as part of its widely endorsed Greater Dayton Compact, which stated that "everyone in the Region should be connected to economic opportunities by a housing and *transportation system that brings jobs and workers together efficiently and safely* (emphasis added)."

Of the multiple MVRPC planning documents that address roadway congestion, the most prominent is the Long Range Transportation Plan. The plan is designed to be a guide for the effective investment of public funds in transportation facilities. It has long been established that investing in the transportation network to reduce congestion on the regional roadway network is a top priority. To meet this challenge, MVPRC staff collects and evaluates a vast array of socio-economic and transportation-related datasets for use in its travel demand forecasting model. This model simulates not only the current travel demand, but also predicts travel demand decades into the future. Using this model, MVRPC staff can identify where recurring congestion is most prevalent and where it is most likely to spread in the future. Using MVRPC data as well as their own evaluations, local jurisdictions are then encouraged to apply for federal funding for roadway, bikeway, pedestrian, or transit projects that, in addition to other benefits, will help to reduce travel demand and/or manage the growth of congestion on the regional roadway network.

Prior to gaining eligibility for inclusion in the Long Range Transportation Plan, these projects are evaluated using the MVRPC Project Evaluation System (PES), which scores each project on a 70-point scale based upon its impact on the regional transportation network. Only projects that adequately serve regional transportation needs are recommended for funding. In evaluating roadway projects, several congestion management-related criteria are considered, including inter-modal connectivity, level of service, intelligent transportation systems, economic development, air quality, operational efficiency, and system preservation/expansion. Once the evaluation and prioritization process has been completed, key regional projects are incorporated into the Long Range Transportation Plan and become eligible for funding through the Transportation Improvement Program (TIP). The TIP is a state and federally mandated document that shows planned projects for which one or more project phases will begin within the four year timeframe of the document.

Finally, every opportunity is given to allow the public to participate in and evaluate regional transportation reports, studies, and plans. All comments, suggestions, and recommendations received through the public participation process are thoroughly considered for their value to the overall transportation system, shared with the MVRPC MPO Board of Directors, and incorporated into the regional transportation planning process wherever possible.

5.2 Congestion Management Regional Transportation Investments

The most perceptible roadway congestion mitigating countermeasures are capital projects that increase the capacity, safety, and/or efficiency of the roadway network. Capital infrastructure improvements can also reduce the geographic and temporal extent of roadway congestion. Listed in Table 5.1, and illustrated in Figure 5-1, are projects of regional significance for congestion management from the 2030 Long Range Transportation Plan (LRTP), representing a total investment of $1.33 billion. These projects are intended to manage the growth of congestion on the regional roadway network. Though each project in Table 5.1 is considered regionally significant for congestion mitigation, not all have received funding in the MVRPC SFY 2008-2011 TIP. Multiple local and state operational strategies and countermeasures are also being implemented to compliment these infrastructure improvements.

Figure 5-1: Projects of Regional Significance

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Table 5.1: 2030 LRTP Regionally Significant Congestion Management Projects

CO	LRTP Project Number	Location	Project Description	LRTP Timeframe	08-11 TIP Funding	Cost (Million)
GRE	5	I-675	Add full movements at Grange Hall Road interchange.	2021-2025	None	$24.37
GRE	9A	US 35	Build full access interchanges at Factory Road and Trebein/Valley Road.	2016-2020	Partial	$76.35
MIA	89A	I-75	Widen from 4 to 6 lanes from 1.13 miles north of SR 41 to 0.42 miles north of CR 15 (Piqua-Troy Road).	2016-2020	None	$41.15
MIA	89B	I-75	Rehabilitate and widen from 4 to 6 lanes from 0.42 miles north of CR 15 (Piqua Troy Road) to US 36.	2016-2020	None	$37.75
MIA	98	SR 48	Widen from 3 to 5 lanes from Emerick Road to the Montgomery County line;	2021-2025	None	$12.64
MIA	524	I-75	Upgrade ramps at Exit 69 on I-75 to improve capacity and access management.	2011-2015	None	$4.95
MIA	528	I-75	Interchange modification to improve capacity of existing ramps.	2011-2015	None	$1.61
MOT	144A	I-70	Widen from 4 to 6 lanes from SR 48 to Airport Access Road.	2016-2020	None	$49.51
MOT	144C	I-70	Widen from 4 to 6 lanes from Arlington Road to SR 48I; Interchange modifications at Brookville-Salem Road, SR 49-North, SR 49-South, and Hoke Road.	2021-2025	None	$53.31
MOT	147A	I-75	Widening from 3 to 4 lanes from Leo to Wagner Ford.	2021-2025	None	$76.16
MOT	147D	I-75 (Phase 2)	Upgrade and modernization of I-75 from US 35 to SR 48.	2011-2015	Partial	$261.38
MOT	147E	I-75	Widen from 6 to 8 lanes from I-675 to Edwin C. Moses Boulevard.	2026-2030	None	$225.43
MOT	147F	I-75	Widening from 6 to 8 lanes Wagner Ford Road to Benchwood Wyse Road.	2026-2030	None	$79.21
MOT	154C-G	US 35	Widen from 4 to 6 lanes from Steve Whalen Boulevard to I-675; Interchange improvements at Smithville Road and Woodman Drive.	2016-2020	Partial	$98.24
MOT	161B	SR 4 / SR 444 / Valley St	Interchange modification - Add missing movements (EBValley Street to SB SR 4 and NB SR 4 to WB Valley Street).	2026-2030	None	$15.23
MOT	184B	SR 725 (Phase 2)	Widen from 2 to 5 lanes from Bigger Road to Wilmington Pike.	2011-2015	None	$6.93
MOT	338G	I-75	Widen from 6 to 8 lanes from approximately Pennyroyal Lane to I-675.	2026-2030	None	$22.18
MOT	656	Smithville Road	Widen from 2/4 to 3/5 lanes from US 35 to Fourth Street.	2011-2015	None	$6.81
MOT	676	I-75	Interchange modification at Needmore Rd; Widen Needmore Road bridge over I-75 to 8 lanes.	2021-2025	None	$31.99
MOT	677	I-75	Interchange improvements at Edwin C. Moses Boulevard.	2016-2020	None	$19.80
MOT	678	I-75	Interchange modification at Wagner Ford Road.	2016-2020	None	$54.46
MOT	679	I-75	Interchange modification to improve capacity of existing ramps at SR 725.	2026-2030	None	$40.36
MOT	680	I-75	Interchange modifications to reduce weaving movements at US 40 and Northwoods Boulevard.	2026-2030	None	$38.08

CO	LRTP Project Number	Location	Project Description	LRTP Timeframe	08-11 TIP Funding	Cost (Million)
MOT	819	SR 725	Widen roadway to 24 feet from SR 4 to Soldiers Home Road.	2021-2025	None	$9.95
MOT	823	I-675	Interchange modification at Wilmington Pike.	2011-2015	None	$7.43
WAR	710B	SR 73/I-75 (Phase 2)	Build Ramp C and collector-distributor lane.	2011-2015	None	$2.48
WAR	710C	SR 73/I-75 Phase 3)	Reconstruct SR 73 with overlay and widening for approximately 4,000 feet	2011-2015	None	$2.97
WAR	710D	SR 73/I-75 (Phase 4)	Reconstruct Ramp D as a two-lane exit ramp from SR 73 south.	2011-2015	None	$4.08
					Total	$1,329.31
					Percent of All Transportation Projects in 2030 LRTP	47.5%

For a complete list of Long Range Transportation Plan projects, navigate to http://www.mvrpc.org/transportation/long-range.

5.3 MVRPC Investment Profile

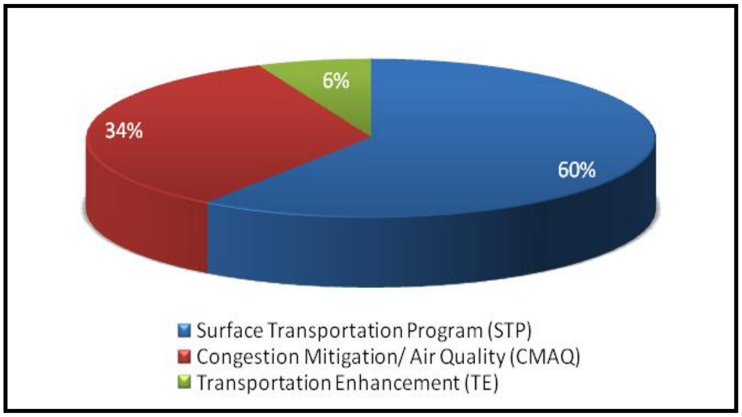

Figure 5-2: MVRPC Planned Allocation of Funds for SFY 2010-2015 by Funding Program

MVRPC's most direct contribution to addressing congestion is by its allocation of regionally controlled STP, CMAQ, & TE funds. In 2003, MVRPC embarked on a regional visioning process that resulted in a new Project Evaluation System (PES). MVRPC started using the new PES to allocate funds in 2005, roughly corresponding with projects scheduled for construction in SFY 2010-2015. MVRPC plans to allocate $112 million of STP, CMAQ, and TE funds towards numerous multimodal transportation projects and improvements. A little over $67 million will be funded to the Surface Transportation Program, $37.9 million by CMAQ, and $7.3 million by TE. Figure 5-2 displays a breakdown of the three MVRPC controlled funds planned for SFY 2010-2015.

MVRPC controlled funds are not large enough to fund costly freeway reconstruction or expansion projects (see section 5.3). However, they are a major funding source toward the improvement of the regional arterial and collector system, as well as bike/ pedestrian and enhancement type projects. A breakdown of the programs shows that a majority of the investment is targeted towards Highway Operational, Maintenance and Capacity improvements. Table 5.2 details the investment profile for each program. Roughly $85 million or 75.6% of all investment will go towards improving or maintaining the regional roadway system.

Investment towards alternative transportation improvements is also identified, including $14.4 million in bikeway and pedestrian oriented investments. However, 80% of roadway specific projects do have bikeway or pedestrian improvements accompanying the project. Additionally, $5.85 million has been identified for MVRPC's commuter match RIDESHARE program as well as various planning studies including: *Going Places* regional land-use planning initiative, air quality program, and safety studies. Transportation enhancements which fund integration of transportation facilities into their surrounding communities and the natural environment are also identified for $4.25 million.

Table 5.2: MVRPC Investment Profile for SFY 2010-2015

FUNDING PROGRAM SFY 2010-2015	PERCENT	TOTAL
SURFACE TRANSPORTATION PROGRAM (STP)		
Highway Operational / Intersection Improvement	34%	$22,998,015
Highway Capacity	35%	$23,708,216
Highway Maintenance/ Reconstruction	27%	$18,135,583
Plannning/Studies	3%	$2,200,025
	STP TOTAL:	**$67,041,839**
CONGESTION MITIGATION/ AIR QUALITY (CMAQ)		
Highway Operational/ Intersection Improvement	48%	$18,051,398
Highway Capacity*	4%	$1,406,818
Transit	8%	$2,906,793
Bike/Pedestrian	31%	$11,920,817
Railroad/Rideshare	5%	$2,035,472
Planning/Studies	4%	$1,619,247
	CMAQ TOTAL:	**$37,940,545**
TRANSPORTATION ENHANCEMENT (TE)		
Highway Capacity*	8%	$609,694
Bike/Pedestrian	34%	$2,480,469
Enhancement	58%	$4,249,798
	TE TOTAL:	**$7,339,961**
	GRAND TOTAL:	**$112,322,346**

*The addition of Highway capacity is not eligible for CMAQ or TE funds. The amounts summarized in this category represent CMAQ or TE funded amounts (e.g. sidewalks) in a larger capacity project funded primarily by STP funds.

As described in MVRPC's Basic Project Evaluation System (PES), several indicators from categories including Regional-Context/Cooperation, Transportation-Choices, Transportation System Management, Land Use, Economic Development and Environment are assessed in each project to ensure all investments advance transportation projects that are consistent with regional transportation priorities and the Long Range Transportation Plan. Ensuring that investments made into the Region's transportation grid improve livability, support economic development, and include alternative modes of transportation, are important to each project's merit and the Region's goals.

As shown in Figure 5-3, roughly 80% of MVRPC's future investment will create, improve or enhance connectivity among different transportation modes or improve alternative modes of transportation including pedestrian and bikeway improvements. Improving livability is another factor evaluated in advancing the Region's transportation priorities. Sixty-two percent of all transportation investments will aim to reduce and minimize sprawl-oriented development; revitalize or preserve an urban center; have a positive environmental impact within a concentrated minority and/ or poverty area; and be compatible with a local jurisdiction's comprehensive land use or thoroughfare plan. And lastly, economic development is also assessed in the Project Evaluation System for the Region's future investments. 62% will contribute directly to the creation of new jobs, retention of existing jobs, or improve access to employment centers.

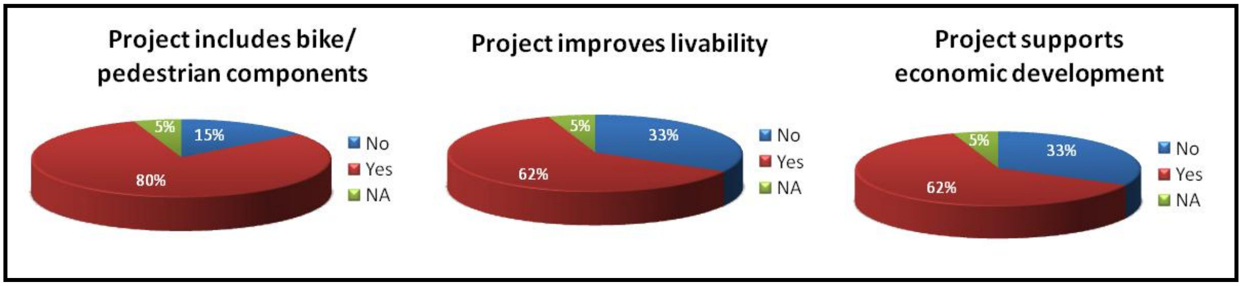

Figure 5-3: Breakdown of Projects Supporting Regional Transportation Priorities

5.4 Public Transportation

In the Dayton Region, public transportation is provided by three carriers: Miami County Transit, Greene Coordinated Agency Transportation System (Greene County), and the Greater Dayton Regional Transit Authority (Montgomery County).

Because they serve predominantly rural areas, Miami County Transit and Greene CATS do not currently operate fixed route service. However, starting in 2009 Greene CATS began operating Flex Routes (see Section 4.4) that serve the elderly and disabled populations in their respective counties, providing pre-scheduled and demand-responsive transit trips.

The GDRTA provides both fixed-route and demand-responsive services in urban Montgomery County. Operating over 30 fixed routes seven days a week, the GDRTA provides more than 11 million passenger trips annually. In addition, 79.8% percent of Montgomery County residents live less than ½ mile from one of 6,400 countywide bus stops. Because many fixed routes pass near major employment centers, GDRTA provides ample opportunity for commuters to use public transportation. The GDRTA also maintains a number of park-and-ride locations throughout the county, with one currently served by a dedicated express route to downtown Dayton (South Hub). For added convenience, many GDRTA buses are equipped with bike racks. Consult Chapter 4 of this report or the GDRTA website (www.greaterdaytonrta.org) for more detailed information on public transportation use.

5.5 MVRPC Sustainable Growth Initiative

MVRPC is focusing on intelligent and well-planned strategies through research, consensus building, public education, and public policy to improve the quality of life within the Dayton Region. The term "Sustainable Growth" is used to describe the on-going efforts by communities across the country to manage and direct growth in a way that builds viable communities without damaging the environment. As part of this initiative, MVRPC implemented a comprehensive outreach campaign to promote the use of alternative modes of transportation through general advertising, financial assistance, and promotional events.

Presented below is a list of MVRPC Sustainable Growth Initiative programs and action items that can help to reduce congestion on the regional roadway network:

- RIDESHARE - A free computer-matching service available to anyone who lives or works in Montgomery, Greene, Miami, and Clinton Counties that helps link people together who are interested in carpooling/vanpooling to work or college. Currently, there are approximately 2000 people enrolled in the RIDESHARE program. In SFY 2011, MVRPC implemented a "one trip module" software update to allow users to request sporadic/one time trips, expanding the RIDESHARE program beyond its traditional commuting origins. Additionally, MVRPC also provides subsidies to encourage the formation of new vanpools.
- Alternative Transportation Outreach – A coordinated effort with GDRTA to promote transit through discounted bus passes and/or special promotions, promotion of the "Bike on Bus" program to emphasize the availability of bike racks on buses, and encouragement of displaced transit riders to use RIDESHARE as an alternative commuting option. Free bus passes are also given away as part of the "Caught Ya Doin' Good" promotion.
- Miami Valley Recreational Trails Map – Currently disseminated to local cycling affiliations and parks and recreation departments, and promoted at various local cycling events.
- Comprehensive Regional Bikeway Plan – Completed in 2008, the plan documents existing and planned bikeway facilities, identifies corridors that connect local communities, and provides missing links in the regional bikeway network for jurisdictions to consider when evaluating future investments in their bikeway systems.
- Walkable Communities Handbook – A how-to guide for local jurisdictions on conducting their own Walkable Communities workshops, providing adequate pedestrian facilities, and actively promoting walking among their residents.
- Drive Less Live More – A region-wide promotion to encourage residents to pledge to reduce the amount of single occupant vehicle (SOV) travel they do during a typical month's travel time. More information is available on the campaign's website at http://www.drivelesslivemore.org/.
- Regional Cooperative Effort – Continue educating MVRPC member jurisdictions, the business community, and other key stakeholders about Sustainable Growth principles and strategies that have impacts on the regional transportation system.
- Regional Land Use Planning Initiative – In SFY2008, MVRPC launched an initiative in cooperation with local jurisdictions and regional leaders to develop a shared land-use vision to guide the Region's growth patterns and achieve consistency between transportation investment, infrastructure, and development, while protecting the Region's environmental resources.

In total, MVRPC has committed $3.8 million toward the programs and action items noted above between SFY 2008 and 2011. Navigate to the MVRPC website http://www.mvrpc.org for more information.

5.6 Miami Valley Recreational Trails

With over 250 miles of paved, multi-use recreational trails in the Dayton Region, commuters and visitors have abundant opportunities to use non-motorized forms of transportation (See Figure 5-4). Connecting many of the regions urbanized centers and tourist destinations, this network of dedicated trails stretches from Miami County in the north, to Warren County in the south, and from western Montgomery County to eastern portions of Greene and Clark Counties. Many local communities have promoted non-motorized forms of transportation by providing marked routes, paths, and sidewalks that connect and/or guide users to the Miami Valley Recreational Trail system (http://www.mvrpc.org/transportation/bikeways-pedestrians). By using these trails as a primary travel route, or in conjunction with park-and-bike facilities and transit vehicle bike racks, commuters and visitors can reduce congestion on the regional roadway network.

The SFY 2008-20011 TIP includes multiple regional pedestrian and bikeway projects representing a total investment of $15.93 million.

5.7 Dayton/Springfield Freeway Management System

Even with planned construction projects over the next 20 years, the Miami Valley Region will continue to face congestion and suffer problems on key highway corridors. Since the Region is home to two major interstates with high passenger and freight volumes, the impact of this congestion can reach far beyond the borders of the Region and even the State.

The Dayton/Springfield Freeway Management System (http://www.mvrpc.org/transportation/long-range/its), currently partially deployed and in the process of complete deployment by 2011, combines technological and operational solutions to manage congestion growth. It also enhances existing incident and traffic management activities on the regional freeway network and provide timely and accurate traveler information to motorists. The development and implementation of the regional freeway management system will be further addressed in Chapter 6.

5.8 Traffic Incident Management

In cooperation with the Montgomery County Office of Emergency Management (MCOEM), MVRPC has engaged our regional partners in a discussion regarding traffic incident management on Dayton area freeways and expressways (http://www.mvrpc.org/transportation/long-range/its/incident-management). Traffic incident management (TIM) is a multi-jurisdictional operational strategy that promotes a coordinated and planned approach to improve safety and minimize traffic delay due to an incident on the regional highway network. This regional effort has been organized as the Traffic Incident Management Subcommittee of the MCOEM Technical Advisory Committee.

Figure 5-4: Miami Valley Recreational Trails System

Back of Figure 5-2

Many local emergency response agencies have stated that responding to highway incidents pose the greatest danger to responders, victims, and motorists. A coordinated TIM program among local emergency response agencies can significantly reduce these dangers by facilitating the quick and coordinated clearance of traffic incidents. By promoting quick clearance principles, a TIM program can also be an effective strategy to manage non-recurring congestion. In 2005, ODOT extended their incident management program (FIRST) to the Dayton area. Information about the program is available in Section 3.3.

5.9 Dayton Regional Safety Initiative

The Dayton Regional Safety Initiative (DaRSI) began in SFY2006 as a response to the emphasis placed on roadway safety by the 2005 Federal Transportation Bill known as SAFETEA-LU (Safe, Accountable, Flexible, Efficient Transportation Equity Act - A Legacy for Users). In an effort to reduce roadway fatalities and injuries throughout the Miami Valley, the original regional safety analysis was initiated in SFY 2006. The goal of DaRSI is to generate a list of locations in need of safety countermeasures to reduce the frequency or severity of accidents. MVRPC staff collected and analyzed 2002-2004 regional traffic crash data provided by both the Ohio Department of Transportation and the Ohio Department of Public Safety to identify local "high crash locations." After the 2006 Roadway Safety Workshop, MVRPC staff compiled a final list of the top 50 locations based on attendee comments and internal analyses. Ten locations from the list for low-cost, short-term safety improvements were prioritized and presented to ODOT for funding consideration and funding was subsequently approved for further study or project implementation.

The 2009 Dayton Regional Safety Analysis used updated roadway crash data for the years 2005 – 2007 to analyze the regional roadway network and determine high priority crash locations. In addition, the new analysis platform allows comparisons between the SFY2009 update and future iterations of the regional safety analyses. As future analyses are completed, MVRPC can work with our regional partners to identify locations where roadway safety continues to be a public hazard. Pre- and post-implementation data can also be compared using the analysis platform to determine if implemented safety countermeasures are achieving noticeable reductions in crash frequency and/or severity.

More information on the Dayton Regional Safety Initiative and the SFY 2009 safety analysis update is available on MVRPC's website at http://www.mvrpc.org/transportation/long-range/safety.

5.10 Miami Valley Freight Movement Study

Completed in May 2006, the Miami Valley Freight Movement Study was conducted to identify trends in the freight industry, develop a regional freight transportation system profile, and analyze regional freight movement. The Study takes an in-depth look at freight movement in the Region by focusing on existing freight transportation modes (truck, rail, air, pipeline and intermodal connections), using capacity, performance, and usage data. The findings of the Study will be incorporated in MVRPC's next Long Range Transportation Plan update.

Understanding the movement of freight within the Region can have a significant effect on understanding roadway congestion. Due to their lack of mobility and slow acceleration, long-haul trucks can have a significant negative affect on roadway congestion, notably near interstate ramps and interchanges. By identifying the ramps, interchanges and roadways most frequently used by the trucking industry, these facilities may receive special attention in later updates to the LRTP or TIP.

The Miami Valley Freight Movement Study can be accessed by navigating to http://www.mvrpc.org/transportation/long-range/freight-movement.

5.11 Traffic Monitoring Program

MVRPC maintains a regional traffic count database with the assistance of participating jurisdictions as part of MVRPC's Traffic Monitoring Program and the Ohio Department of Transportation. This information provides valuable inputs to the transportation planning process and allows for periodic updates of MVRPC's web-based traffic count database. In 2006, MVRPC implemented an interactive web-based traffic count database system (Traffic Count Viewer) for fast and comprehensive data sharing. MVRPC's Traffic Counting Program utilizes a three-year traffic counting cycle and covers major network roads in Greene, Miami, and Montgomery Counties. MVRPC's counts are available to the public at http://www.mvrpc.org/transportation/long-range/traffic-counts. The database now includes historical traffic volume information between 1997 and 2008.

In addition to maintaining traffic count information for the Region, MVRPC also assists local jurisdictions and ODOT by collecting additional traffic count information as needed with in-house traffic counters. The traffic counts are stored as databases in the Geographic Information System (GIS) and are periodically updated as new counts become available.

Traffic counts shown (AADT=Annual Average Daily Traffic) are based on manual or machine counts that are seasonally adjusted to represent an average day of the year. Traffic counts are classified into two different types of data, program and non-program counts. Program counts on major roads at specific locations are typically updated every three years. Also added during this update are non-program counts, which are received from participating jurisdictions or taken as a result of studies at locations not regularly updated.

Collecting traffic count data is essential to prepare for and mitigate roadway congestion before it occurs. Using a three-year-cycle, engineers and planners can gauge where traffic is on the rise. Furthermore, traffic counts are the primary tool to guide the validation of the current regional travel demand model. The model is used to predict future traffic patterns using a number of land use and transportation variables. Once they are identified, locations of current or future congestion can then be considered for capacity and/or operational improvements in future updates to the LRTP or TIP.

6 Intelligent Transportation System Development and Implementation Program

MVRPC has been involved in providing a more reliable transportation system using an integrated set of technologies known as an Intelligent Transportation System (ITS) since the ISTEA legislation of 1991. Planning for this system began with the development of the *Miami Valley Regional ITS Early Deployment Plan (EDP)* in 1997. The EDP represented the Region's first major effort towards developing a regional ITS system and built awareness of the benefits that ITS projects could bring to the Region. Most importantly, the plan gave the Region a vision for ITS deployment:

> The vision for the Miami Valley is one of enhanced transportation productivity, mobility, efficiency and safety within the Region with a reduction in energy use and improvement in the environment through the use of cost effective ITS technologies and systems.

In addition, the EDP provided a list of ITS goals and objectives for the Dayton Region:

- To create a state-of-the-art transportation system
- To enhance productivity
- To improve safety
- To reduce energy consumption and improve the environment
- To enhance mobility and accessibility
- To increase efficiency

Two subsequent documents, the *Dayton/Springfield Freeway Management System: ITS Architecture, Strategic Plan, and Integration Strategy* (2003) and the Miami *Valley Regional ITS Architecture* (2005), defined the manner in which the region's ITS vision and goals would be achieved and provided a program for integration and implementation of a regional ITS system.[32] As a result, ODOT has committed $7.8 million for the design and construction of the region's priority ITS project, the Dayton/Springfield Freeway Management System (D/SFMS), which commenced design work in 2008.

6.1 What is ITS?

Intelligent Transportation Systems (ITS) improve the efficiency and safety of the transportation network by combining electronic, communication, and information technologies to enhance the reliability of the transportation network for all types of users.

A fully functional ITS system can be a significant tool to providing a more reliable transportation network. The combined benefits of an ITS system typically result in an overall reduction in roadway congestion, and may include:

- More Accurate Travel Information

[32] These documents will be introduced in Sections 6.2 and 6.3, respectively.

- Enhanced Traffic Management
- Improved Commercial Operations
- Improved Transit Operations
- Lower Travel Demand
- Enhanced Emergency Management
- Less Pollution
- Improved Inter-governmental Communication

Currently, there are two operational ITS systems in Ohio: The Advanced Regional Traffic Interactive Management and Information System (ARTIMIS) in Cincinnati and the Columbus Metropolitan Freeway Management System (CMFMS). Four other Ohio cities have intelligent transportation systems programmed for completion by 2011: Cleveland, Akron/Canton, Toledo, and Dayton.[33]

In order to properly integrate these systems to provide useful information, the physical components of an ITS system must be coordinated according to a document known as the Regional ITS Architecture. This document identifies the critical operational and functional needs of the system and describes how ITS operations in the Region will perform with respect to data collection, processing, and dissemination. It also guides stakeholders in integrating various project systems and components.

6.2 Dayton/Springfield Freeway Management System

MVRPC completed the *Dayton/Springfield Freeway Management System (D/SFMS)* study in May 2003. The goal of the study was "to develop a plan for implementing a freeway management system in the Miami Valley area that would appropriately meet the needs of the Region while in harmony with ODOT's ITS vision throughout the state."[34] Based upon the vision outlined in the *Miami Valley ITS Early Deployment Plan*, the D/SFMS provides a framework for planning the regional freeway management system (FMS) and describes how technological and operational solutions will be combined to provide congestion relief on the Region's interstates and controlled-access freeways. In addition, the study presents a conceptual system design along with rudimentary cost estimations and implementation schedules.

The ultimate product of the D/SFMS is a conceptual layout of a full-build scenario for the Region, illustrated in Figure 6-1. The conceptual layout incorporates the design criteria used in developing the recommended field components, their approximate locations, and the communications systems for the D/FMS.

As planned in the Operational Concept, the D/SFMS will continuously monitor traffic conditions during the peak travel periods on the regional freeway network. The systems will then collect and distribute traffic information to various regional transportation and emergency agencies that serve this network. It will be owned, operated, and maintained by ODOT in coordination with key regional stakeholders, such as the City of Dayton, the City of Springfield, and the Greater Dayton Regional Transit Authority (GDRTA). These stakeholders, among others, will be required to share transportation information with the D/SFMS and, in turn, the D/SFMS will provide the following user services or functional capabilities:

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[33] Construction dates obtained from the ODOT 2007-2012 Major New Construction Program List (June 2006)

[34] "Dayton/Springfield Freeway Management System: ITS Architecture, Strategic Plan, and Integration Strategy" *MVRPC* (2003)

Figure 6-1: Freeway Management System

Back of Figure 6-1

- Traffic Management
- Maintenance of Traffic
- Incident Management
- Traveler Information
- Multimodal Integration

The interaction and data flow between these services is described in the Draft Project ITS Architecture included in the study, together with a concept of operations describing the manner in which user services will be provided. The concept of operations was planned as follows:

- Freeway Operations Management — The D/SFMS will enhance incident detection, traffic monitoring, maintenance of traffic, and traffic information dissemination for the regional transportation network during the peak travel periods.
- Emergency Management — Through direct visual detection and incident notification from participating public service answering points (PSAP),[35] D/SFMS operators will be able to verify and validate the nature and severity of an incident; this improves the quality of the traffic incident information provided to emergency response agencies.
- Maintenance and Construction Management — During construction, D/SFMS operators will be able to inform motorists of any unexpected restrictions or delays as a result of roadway construction, improving motorist and highway worker safety.
- Traveler Information Operations — Information collected from field devices will be summarized into traveler information packets for distribution using dynamic message signs (DMS) and highway advisory radio (HAR), local media outlets, and a regionally-based traveler information website.
- Regional Transportation Coordination Operations — The D/SFMS will share information with other regional, state, and ODOT traffic management centers to provide through travelers with seamless information, particularly construction and incident information.

In summary, the full-build scenario would include six HAR stations, eight DMS signs, 33 closed circuit television (CCTV) cameras, 10 linear miles of fiber optic cable, and associated hardware and software components, at an approximate cost of $8 million.

As part of the I-75 and US-35 downtown reconstruction projects, 25 cameras have been installed to monitor traffic conditions and manage roadway congestion throughout the construction zones on I-75 and US-35. These cameras are mounted on temporary wooden poles to provide ease of movement in the event of relocation during construction. Fiber optic cable have also been installed during construction. Finally, five (5) permanent DMS signs, and four (4) highway advisory radios (HAR) have been installed to provide travel information to passing motorists. Vehicle travel time data obtained through the Doppler radar sensors have been utilized to determine travel time reliability on the freeway network as discussed in Chapter 2.

[35] Public Service Answering Point (PSAP) – the branch within an emergency response agency's organizational structure responsible for dispatching emergency response personnel.

6.3 Miami Valley Regional ITS Architecture

An ITS architecture functions much the same as a building blueprint. A blueprint illustrates where key structural components of a building must be placed. These structural components give the building stability and provide a framework for the installation of the building's individual subsystems, such as plumbing, communications, and elevators. In a similar fashion, an ITS architecture is the platform around which the various ITS subsystems are integrated, like traveler information systems, vehicle information systems, and incident response systems. As implementation progresses, the ITS architecture defines the subsystems and information exchanges needed to execute the objectives and satisfy the goals of the ITS system. Because the ITS architecture is not technology specific, it does not provide a definitive description of the hardware and software necessary to operate the ITS system. This allows the architecture to remain relevant even as technology evolves, though it must be updated as regional needs change. An ITS architecture defines "what" must be done, not "how" it will be done.[36]

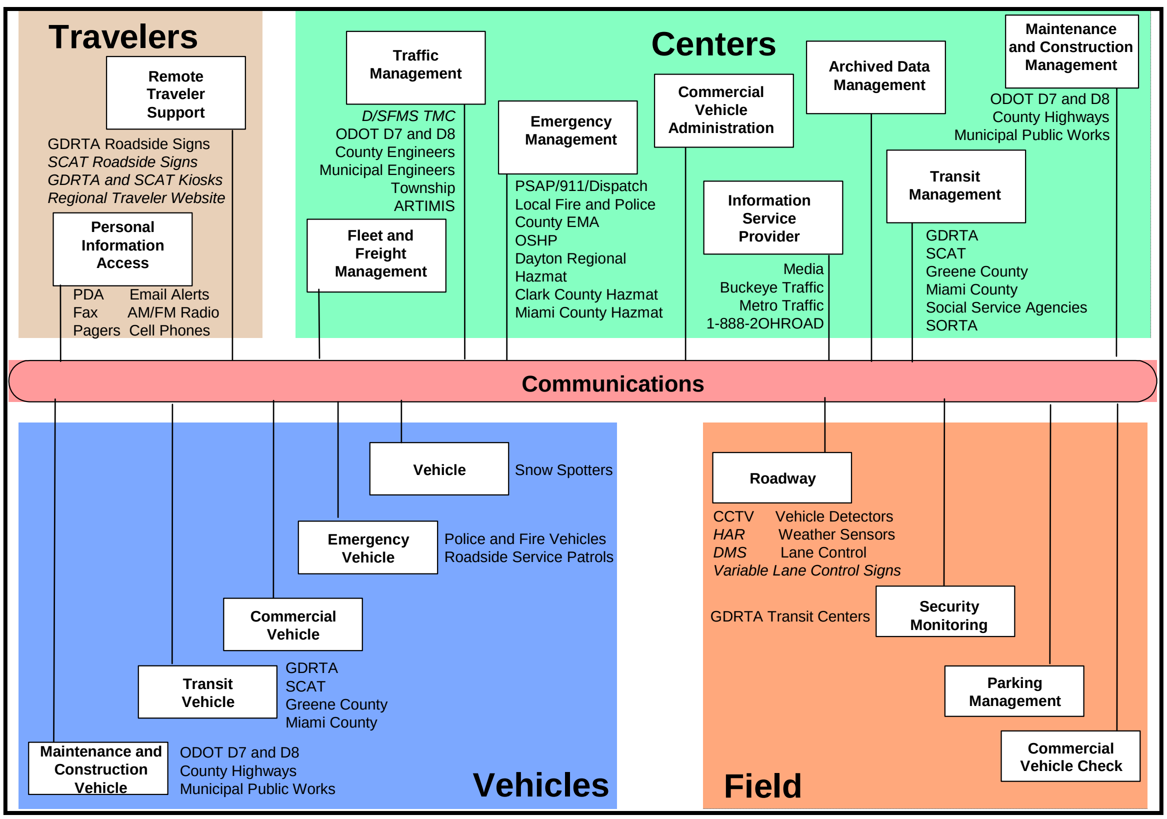

Figure 6-2: Miami Valley Regional ITS Architecture Summary Diagram

MVRPC completed the *Miami Valley Regional ITS Architecture* (http://www.mvrpc.org/transportation/long-range/its/architecture) document in February 2005. This document provides a common framework for the Dayton Region's ITS development and ensures interoperability among the various regional transportation management subsystems. The Architecture addresses ITS deployment on the region's interstates, controlled-access freeways, and surface

[36] "Regional ITS Architecture Guidance" *USDOT, FHWA, FTA* (2006)

arterial roadways. As required for ITS projects funded through the highway trust fund, the regional ITS architecture was developed in accordance with the National ITS Architecture to ensure interoperability among ITS systems in neighboring regions.

When developing a regional ITS architecture, participants are permitted to select the National ITS Architecture subsystems that are most appropriate for their region. Figure 6-2 shows the *Miami Valley Regional ITS Architecture* macro view of all the possible interactions between ITS subsystems and stakeholders in the Dayton Region.

6.4 Existing and Planned Regional ITS Infrastructure Projects

The Dayton Region has invested a considerable amount of fiscal resources into congestion management, including several projects to add or upgrade ITS-related infrastructure. ITS-related projects with funding commitments are programmed in MVRPC's SFY 2008-2011 Transportation Improvement Program (TIP); future ITS projects of regional significance are included in the 2030 Long Range Transportation Plan (LRTP). Many of these projects have been or may be partially funded through the federal government's Congestion Mitigation and Air Quality (CMAQ) Program. Because the Dayton/Springfield Freeway Management System has yet to be constructed, the majority of completed ITS-related projects to date involved upgrading and interconnecting signal systems on regional roadways.

Table 6.1 lists ten local or ODOT-sponsored projects with ITS components that have been completed in the Region since 2006. The table also lists eight committed projects that include ITS-related hardware or software upgrades that could eventually be fed into the regional intelligent transportation system. These projects account for a combined total investment of $23.1 million.

6.5 Statewide ITS Coordination

The Ohio Department of Transportation serves as the primary coordinator of regional ITS efforts statewide. ODOT envisions the state will have "an exemplary ITS program that combines technology and advanced operational concepts to improve transportation decision-making by all partner agencies, while providing unprecedented levels of information to businesses and individual travelers."[37] All six regional intelligent transportation systems in the state will be interconnected and interoperable. This interoperability enables a seamless progression of traveler information from region to region and provides redundancy in the event of a regional system failure. The Ohio Emergency Management Agency will also be able to access the system to broadcast hazard or threat-related information statewide. Finally, ODOT has produced two documents to guide ITS implementation throughout the state: *Best ITS Management Practices and Technologies for Ohio* (2001) and *Ohio Freeway Management System Concept of Operations* (2004).

[37] "Ohio ITS Vision Statement" (*ODOT Office of ITS Program Management*) 2007

Table 6.1: Implemented and Committed ITS-related Projects SFY 2006-2013, Dayton Region

Project Sponsor	Location	Project Description	Construction Date	Cost (000s)
Beavercreek	Various Signalized Intersections	Traffic Signal Upgrade and Interconnect on North Fairfield Rd and Dayton Xenia Road	SFY 2009	$574
Tipp City	SR 571	From the junction of CR25A to Hyatt Street- Installation of Fiber Optic Signal Interconnect System on 8 Signals	SFY 2009	$814
Dayton	Various Signalized Intersections	Signal Upgrade Program Phase 7-8	SFY 2009-2010	$2,720
West Carrollton	S. Alex Rd.	Remove and replace traffic signals systems for 9 intersections. Install master traffic signal computer system at the city building.	2009	$518
Covington	Intersection of US 36 and SR 48	Upgrade traffic signal and Provide advanced vehicle detecting and protected permitted left-turn signal.	SFY 2010	$110
Dayton	Several Arterial Streets	Installation of various types of system sensors to allow traffic responsive operation of the traffic signals.	SFY 2010	$596
ODOT	I-70/I-75 Interchange	Installation of Closed-Circuit Television Cameras to Aid in Traffic Monitoring during I-70/I-75 Interchange Reconstruction	N/A	N/A
Moraine	Dryden Road	Traffic Signal Installation and Interconnect from I-75 to Arbor Rd	SFY 2010	$264
Springboro	SR 73 and SR 741	Traffic Signals Upgrade and Interconnect between Pennyroyal Rd and Lytle Five Points Rd	SFY 2010	$177
ODOT	I-75/I-70 Mainline	Freeway Management System – Early Deployment Project	SFY 2008	$1,615
Dayton	Various Surface Streets	Cable Upgrade Phase II: Replace Old/Damaged Communication Cable with Fiber Optic Cable in Wright/Dunbar area	SFY 2012	$677
Kettering	8 Signalized Intersections	Signal Upgrade and Interconnect	SFY 2011	$1,354
Moraine	Citywide	Upgrade complete traffic system including the City's traffic management center. Provide additional system detection and upgraded equipment for future ITS development.	SFY 2013	$1,344
Tipp City	Main Street	Upgrade Signals on four intersections	SFY 2013	$888
Fairborn	Central Ave	Install and Interconnect six traffic signals	SFY 2013	$265
Dayton	Various Signalized Intersections	Signal Phase 9: Upgrade/Rebuild 10 Intersections with New Poles, Signs, Detectors, and Cable	SFY 2012	$1,475
Beavercreek	Various Signalized Intersections	Installation of fiber optic cable and connection of 17 intersections to the closed-loop system, installation of cameras, and miscellaneous upgrades	SFY 2013	$2,453
ODOT	Clark, Greene, Miami, & Montgomery Counties	Construct components of Dayton/Springfield Freeway Management System	SFY 2011	$7,300
			Total Investment	**$23,144**

7 Federal and State Congestion Management Efforts

Both the Federal and State of Ohio governments have undertaken initiatives to manage roadway congestion. These efforts primarily focus on providing leadership, education, and financial resources through a multitude of guidelines, directives, workshops, programs, grants, and legislation. Regional and local governments can then access these resources to manage roadway congestion at the local level. MVRPC has assimilated many of the state and federal goals, strategies, and programs to manage congestion through its Long Range Transportation Plan (LRTP), Transportation Improvement Program (TIP), and various regional projects, programs, and initiatives. Presented below are just a handful of national and state strategies to relieve roadway congestion.

7.1 Federal Congestion Management Efforts

At the federal level, congestion management typically takes the form of programs and legislation meant to provide guidance and funding to state and local governments. The Federal Highway Administration (FHWA), U.S. Department of Transportation (USDOT), and Federal Transit Administration (FTA) are the primary distributors and administrators of national congestion management guidance and funding. These agencies also maintain extensive websites that provide a wealth of information and resources for both public agencies and private citizens.

A collection of federal programs designed to alleviate roadway congestion was authorized by the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) of 2005. These programs are intended to promote the safe and efficient management and operation of integrated, intermodal surface transportation systems to mitigate the impacts of roadway congestion and improve system reliability. The most prominent of these programs is the Congestion Mitigation and Air Quality Improvement (CMAQ) Program.

Initially created by the Intermodal Surface Transportation Efficiency Act (ISTEA) legislation of 1991, SAFETEA-LU has authorized over $8.6 billion for the CMAQ program throughout the bill's six year lifespan (2004-2009). The purpose of the CMAQ program is to fund transportation projects or programs that will contribute to attainment and maintenance of the national standards for ozone, carbon monoxide (CO), and particulate matter (PM). The CMAQ program supports two goals of the USDOT: improve air quality and relieve congestion. SAFETEA-LU added a provision to the program that established priority consideration for cost-effective emission reduction and congestion mitigation activities when using CMAQ funding.[38]

From 2007-2009, MVRPC allocated approximately $30 million in regionally-controlled CMAQ funds to various regional projects and programs. MVRPC receives approximately $5.5 million of CMAQ funds annually.

In addition to authorizing programs that promote congestion management, SAFETEA-LU approved the use of federal funds for 8 local transportation projects that will, among other objectives, help to manage congestion on the regional

[38] "The Congestion Mitigation and Air Quality (CMAQ) Improvement Program: Final Program Guidance" (*FHWA*) 2008

roadway network. Table 7.1 lists congestion management projects that received funding through SAFETEA-LU, amounting to a total earmark of $28.1 million; while the earmark funds were primarily used for project development and design, many of the projects have been completed, or are under construction.

SAFETEA-LU expired on September 30, 2009 and is currently up for reauthorization. Congress passed an extension act that would continue the funding for surface transportation funding and Highway Trust Fund spending through September 30, 2011. The extension funding maintains the same maximum spending levels for surface transportation programs out of the Trust Fund as were set in the FY 2010 Transportation Appropriations Act.

Table 7.1: Local SAFETEA-LU Earmarks of Interest for Congestion Management

County	Location	Project Description	Project Status	Earmark (Millions)
GRE	US-35	Construct Orchard Lane to Factory Road Connector	Completed	$0.40
MIA	River Corridor	Construct Great Miami River Multi-use Trail	Completed	$1.01
MOT	I-75	Redesign4 “Deficient Partial Access” Interchange at South Dixie/Central (Exit 47) to Provide Full Access to I-75	Under Construction	$2.0
GRE	US-35	Add Partial Movement Interchange at Factory; Full Movement Interchange at Valley; Eliminate at-grade Intersections at Alpha, Shakertown, and Orchard; and Build Parallel Access Roads	Project Development	$3.00
MOT	US-35	Widen from 4 to 6 Lanes from Steve Whalen to I-675; Interchange Modifications at Steve Whalen, Smithville, Woodman, and Spinning	Under Design	$4.00
MOT	I-75	Reconstruction, Widening, and Interchange upgrades between Cincinnati and Dayton	Under Construction	$5.00
MOT	I-75	Construct Austin Pike Interchange; Widen Austin from 2 to 5 Lanes from Wood to SR741	Completed	$7.50
MOT	Riverscape	Riverscape Phase III	Completed	$5.18
			Total	$28.09

Parallel with statutory efforts to curb roadway congestion, the USDOT published its own strategy to reduce roadway congestion. The “National Strategy to Reduce Congestion on America’s Transportation Network” (FHWA, 2006) is a six-point plan to reduce congestion in the short term and build the foundation for successful long term congestion-reducing strategies. The plan to reduce roadway congestion includes:

- Relieving urban congestion
- Unleashing private sector investment resources

- Promoting operational and technological improvements
- Establishing a "Corridors of the Future" competition
- Targeting major freight bottlenecks
- Accelerating major aviation capacity projects

In addition, the USDOT incorporated congestion mitigation into its 2006-2011 Strategic Plan. The Reduced Congestion Strategic Goal aims to "reduce congestion and other impediments to using the nation's transportation system.[39]" Several of the Goal's expected outcomes are reflected in the Transportation Goals and Objectives in the 2030 LRTP, such as system preservation and upgrades, improved access to transportation choices, and ensure the ability of the transportation system to support local land uses and economic development.

7.2 State of Ohio Congestion Management Efforts

At the state level, strategies to manage roadway congestion are spearheaded primarily by the Ohio Department of Transportation (ODOT). ODOT partners with local governments on many transportation projects and programs designed to manage congestion and promote efficiency on the state network of interstates, U.S. highways, and state routes. Congestion management projects and programs include travel demand forecasting and modeling, physical roadway expansions, improved roadway signage, intelligent transportation systems, traffic incident management, and many others. A few examples are outlined below.

Eligible major new statewide or regional projects costing more than $5 million must be approved for ODOT funding through the Transportation Review Advisory Council (TRAC) process. Created in 1997 by the Ohio General Assembly, the Council governs an equitable, numbers driven system that approves state funds for transportation projects. Projects eligible for TRAC funding include those that will increase mobility, provide connectivity, increase the accessibility of a region for economic development, increase the capacity of a transportation facility, or reduce congestion. The TRAC process could be considered ODOT's most influential congestion management policy mechanism since major statewide or regional projects can have a significant impact on roadway congestion. Compiled annually, the current Major New Construction Program List (Years 2010-2014) was approved in May 2014.[40]

The most recent TRAC Program List includes three major projects for construction (Tier I) within the Dayton Region: the I-75 reconstruction project (Phase 2), interchange modification project on I-75 at Central Avenue/Dixie Drive, and the Dayton/Springfield Freeway Management System implementation. Currently, the Council has authorized $296 million for preliminary engineering, project design, right-of-way acquisition, and/or construction for these six projects, enough funding to cover up to 96% of the total cumulative project costs. Among other goals, these projects are expected to reduce roadway congestion on the regional freeway network.[41]

Calling for a new dialogue on how best to determine Ohio's transportation priorities and identify the fairest ways to finance them, ODOT unveiled its 2010-2011 Business Plan, highlighted by a commitment to fully fund the preservation of Ohio's current

[39] "Department of Transportation Strategic Plan: Fiscal Years 2006-2011" (*USDOT*) 2006
[40] "TRAC Policies and Procedures" (*ODOT*) 2010
[41] "2010-2014 Major New Construction Program List" (*ODOT*) May 2010

highways and bridges, New "FAST TRAC" procedures to advance major new transportation projects that are economic drivers, have statewide or regional significance, and have committed public and private sector partners.

The ODOT Business Plan, required every two years under Ohio law, also details the department's new mission which emphasizes a multi-modal approach to modernizing the state's transportation system. ODOT will assemble a statewide Ohio 21st Century Transportation Priorities Task Force to lead a frank discussion on how best to position Ohio's transportation spending to balance the movement of people and freight, promote safety and reduce congestion, create jobs, encourage responsible growth, and help build sustainable communities. As the Task Force determines these priorities, it will also be asked to identify the fairest ways to finance them, including the identification of new tools for state and local governments to partner with the private sector.

The Ohio Department of Transportation has assembled a task force of more than two dozen business and government officials to map out the state's transportation future, on and above the ground. The group's goal was to prioritize how the state balances the movement of people and freight, boosts safety while cutting congestion and encourages growth. The Final Report by the Task Force included examining financing options for the state's transportation system, digging up new funding sources for state and local governments, and boosting private-sector involvement.

In 2009, as a recommendation of Ohio's 21st Century Transportation Priorities Task Force, ODOT launched the Go Ohio Statewide Futures Plan to look at the state's transportation networks and direct investments that support economic development and job creation, while providing more transportation choices, protecting the environment and enhancing the quality of life for all citizens. The Plan includes two phases. The first phase looks at policy issues affecting the efficient movement of people and goods, and the way transportation shapes communities. The second phase is a needs assessment which will identify critical freight and passenger corridors and where there are deficiencies that lead to congestion and additional transportation costs/delays for businesses and commuters. Based on the needs assessment, the Futures Plan will prioritize short-, mid-, and long-term improvement investments.

In addition to providing funding for major new projects or framing Ohio's future transportation needs, ODOT continuously evaluates the state-maintained roadway network to identify sections of roadway where travel demand is approaching or exceeding roadway capacity. This proactive approach provides a readily available list of the Top 200 most congested stretches of Ohio interstates, freeways, and surface roadways. Policy makers can use this list to identify and evaluate future transportation needs. Many of these locations have been selected for current or future operational and capacity projects. Locations are ranked based on their calculated V/C ratio, a figure that compares the volume of traffic with the roadway's capacity (number of lanes). For a more detailed explanation of the V/C ratio, see Chapter 2 of this report.

Last updated in 2009, the Dayton Region is home to 14 of the Top 200 most congested roadway sections in Ohio, including one in the Top 10 and four in the Top 100. Visit the ODOT website to view the complete list, or consult Table 7.2 below for segments in the Dayton Region, including any relevant recommended projects from the 2030 LRTP.

Table 7.2: Dayton Region Roadway Segments on Top 200 ODOT Congested List

County	Road	Location	V/C Ratio	State Rank	Relevant LRTP Project Number(s)
MOT	I-75	Dryden Rd to SR 4	1.30	8	147 (B,C,D,E), 149C, 677, 678, 692
GRE	US 35	Shakertown to Valley Rd	1.23	53	9A
MOT	SR 48	I-675 to 2000' N of Rahn Rd	1.22	56	None
MOT	SR 741	I-675 to SR 725	1.10	91	None
MOT	I-70	SR 48 to E of Airport Access Rd	1.07	97	144A
MOT	US 35	I-75 to Wayne Ave	0.98	127	None
MIA	SR 41	I-75 to 1000' S of Washington Rd	0.96	137	96, 371
MOT	SR 202	I-70 to Executive Blvd	0.96	138	None
MOT	SR 725	SR741 to Prestige Plaza Dr	0.95	140	None
MOT	SR 4	Monument Ave to Valley St	0.95	141	None
WAR	SR 73	Clearcreek-Franklin Rd to 500' E of Parkdale Dr	0.95	142	None
WAR	SR 73	I-75 to Tahlequah Trail	0.95	143	710 (B,C, D)
WAR	I-75	1 Mile S of SR 123 to Austin Pk	0.95	145	711, 338G
MOT	SR 48	Skeeter Ln to Westerly Ln	0.93	156	None

Finally, ODOT is managing non-recurring roadway congestion through a number of statewide low-cost programs and countermeasures, of which four are noted below.

Consult the ODOT website for more information on statewide congestion management strategies and programs.

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8 Conclusions and Next Steps

In summary, the current (2005) temporal length of recurring traffic congestion is primarily contained within the morning and evening peak travel periods, from 7:00AM to 8:00AM and 3:00PM to 6:00PM. Geographically, recurring congestion is concentrated on the regional freeway network and near-by interchanges and surface roadways. Some significant peak period recurring congestion is also evident on surface arterials and collectors away from the freeway system. However, analysis indicates that implementation of the Long Range Transportation Plan can slow the growth of recurring congestion on much of the Region's roadway network. Without LRTP implementation, recurring roadway congestion may continue to expand both temporally and geographically at a much more rapid pace, potentially diminishing personal quality-of-life and inhibiting economic growth in the Region.

Non-recurring congestion analyses focused primarily on the regional freeway network. Using available data sources, it appears that non-recurring roadway congestion within the Region can occur at virtually any point along the freeway network, though some segments appear more prone to non-recurring congestion due to high traffic volumes, mid-day period crashes, or construction.

MVRPC, ODOT, and local jurisdictions have implemented a number of physical and operational improvements intended to manage recurring and non-recurring congestion. Additional improvements are planned and/or funded for implementation within the LRTP plan horizon (2030). Together, public transportation agencies at the national, state, and local level, along with partners in the private sector, are working together to mitigate the strangling effects that roadway congestion is having on the nation's freeway and surface transportation systems.

As part of its congestion management process, MVRPC will continue to gather relevant transportation data; evaluate current and future trends in roadway congestion and transportation science; identify proactive strategies to curb roadway congestion expansion; and partner with our local, state, and federal partners to efficiently implement roadway congestion countermeasures. As stated by Norman Y. Mineta, former U.S. Secretary of Transportation[42]:

> "Congestion is one of the single largest threats to our economic prosperity and way of life. [However] congestion is not a fact of life. It is not a scientific mystery, nor is it an uncontrollable force. Congestion results from poor policy choices and a failure to separate solutions that are effective from those that are not. We must not be afraid to embrace new solutions if we are going to make any meaningful progress…We have the tools, the technology, and the plan to make today's congestion a thing of the past."

[42] "National Strategy to Reduce Congestion on America's Transportation Network" (*USDOT*) 2006

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