Appendix PIT – Pittsburgh, Pennsylvania
2003 Annual Report on Freeway Mobility and Reliability

This report is a supplement to: *Monitoring Urban Freeways in 2003: Current Conditions and Trends from Archived Operations Data*. Texas Transportation Institute and Cambridge Systematics, Inc., Report No. FHWA-HOP-05-018, December 2004, available at http://mobility.tamu.edu/mmp.

Exhibit PIT-1: Current Measures and Trends

Measures	Current Year	Last Year		Two Years Ago	
	2003	2002	Change	2001	Change
Performance Measures					
Travel Time Index	1.18	1.23	-5% ↓	1.16	+2% ↑
Planning Time Index	1.39	1.47	-8% ↓	1.31	+8% ↑
Buffer Index	15%	16%	-1% ↓	10%	+5% ↑
% Congested Travel	52%	50%	+2% ↑	49%	+3% ↑
Total Delay (veh-hours) per 1000 VMT	1.18	1.23	-4% ↓	1.16	+1% ↑
Explanatory Measures					
Peak Period VMT (000)	1,410	1,460	-3% ↓	1,500	-6% ↓
Avg. Annual DVMT (000)	4,770	4,900	-3% ↓	5,010	-5% ↓
Data Quality Measures					
% complete	93%	87%	+6% ↑	94%	-1% ↓
% valid	99%	99%	0% —	96%	+3% ↑
% of VMT covered	54%	42%	+12% ↑	44%	+10% ↑
% of freeway miles	27%	27%	0% —	28%	-1% ↓

* See pages 7 and 8 for maps of freeway coverage, measure definitions, and further documentation.

Exhibit PIT-2: 2000 to 2003 Annual Trends

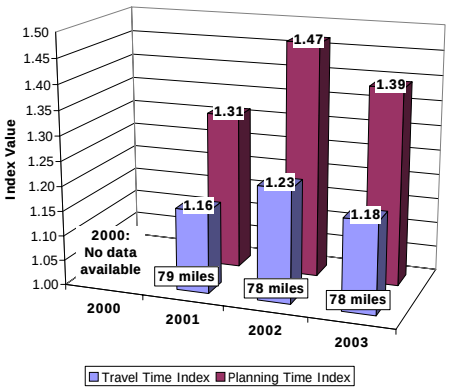
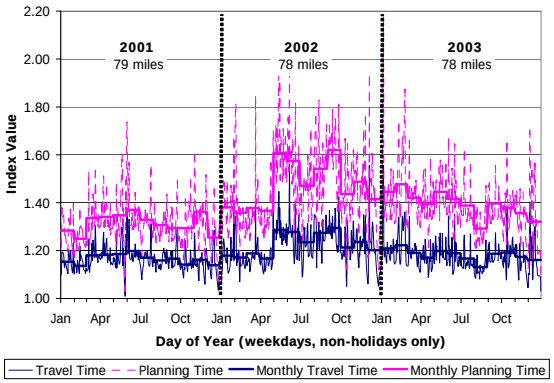


Exhibit PIT-3: Daily and Monthly Trends



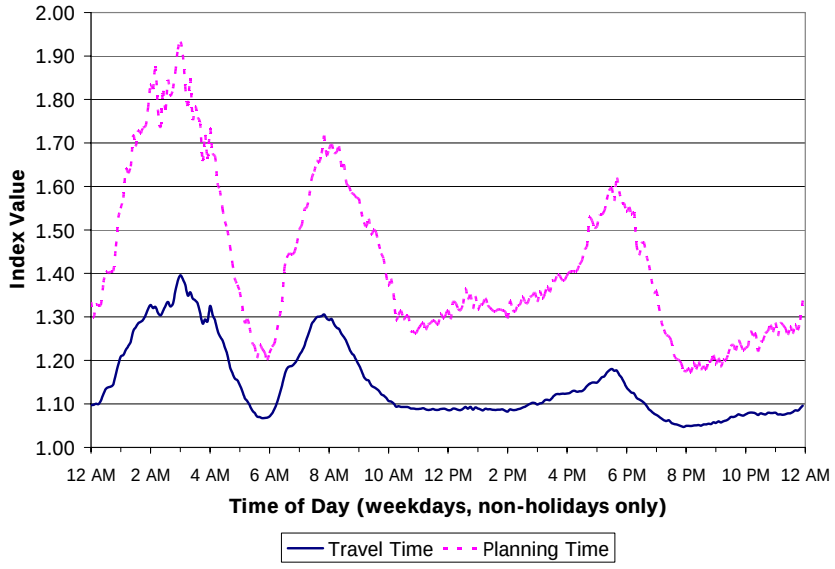
Comments

- 2003 traffic congestion and reliability levels in Pittsburgh have improved over 2002 levels, but are worse than 2001 levels. In comparing 2002 to 2003, the travel time index dropped 5 points and the buffer index dropped 1%.
- Vehicle travel (DVMT) has declined slightly over 2002 levels.

Data Source(s): Mobility Technologies, Inc. (http://www.mobilitytechnologies.com/ and http://traffic.com)
Includes 78 of 292 (27%) total freeway miles in Pittsburgh; collected using microwave and acoustic sensors; see page 7 for additional information on the data source
Data Analysis: Texas Transportation Institute, analysis completed September 2004

Time of Day Patterns and Trends

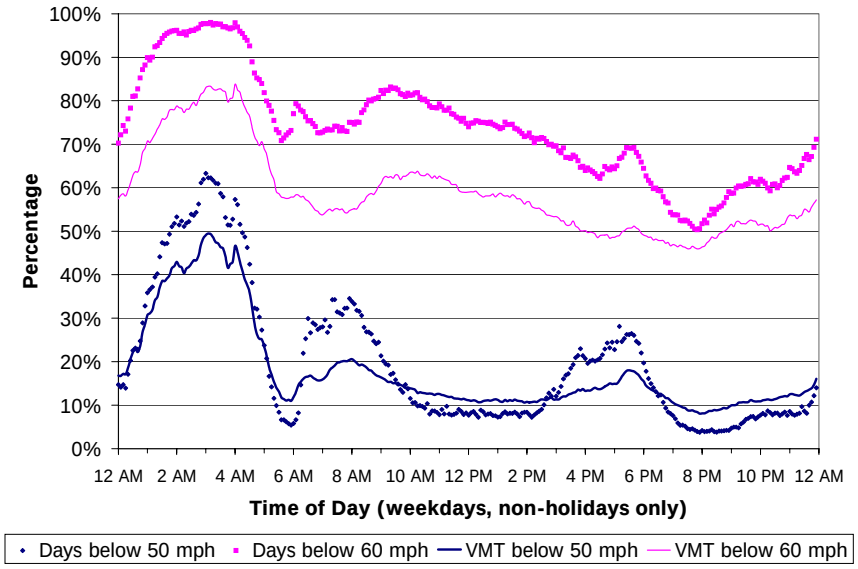
The charts on this page illustrate average weekday (no holidays included) traffic patterns and trends that were measured on the freeway sections instrumented with operations-based traffic sensors.



Comments

- This chart shows areawide congestion and reliability patterns. The difference between the solid line (travel time index) and the dashed line (planning time index) is the additional "buffer" or "time cushion" that travelers must add to average trip times to ensure 95% on-time arrival.
- The morning congestion level is worse than the evening congestion level.
- Slow speeds are evident in the early morning period.

Exhibit PIT-4: Mobility and Reliability by Time of Average Weekday



Comments

- This chart illustrates the difference in using two different speed thresholds (50 and 60 mph) to compute the percent of congested days as well as the percent of congested travel.
- This chart indicates slow speeds (even less than 50 mph) in the early morning hours. The cause of these slow speeds is unknown, but traffic volumes during this time indicate that slow speeds are not being caused by heavy traffic.

Exhibit PIT-5: Frequency and Percentage of Congested Travel by Time of Average Weekday

Time Period of the Day Patterns and Trends

The charts on this page illustrate average weekday (no holidays included) traffic patterns and trends that were measured on the freeway sections instrumented with operations-based traffic sensors. The time periods are defined uniformly for all cities to facilitate trend analysis over time and between cities. The time periods are defined as follows:

- Early AM: 12 to 6 am
- AM Peak: 6 to 9 am
- Mid-day: 9 am to 4 pm
- PM Peak: 4 to 7 pm
- Late PM: 7 pm to 12 am

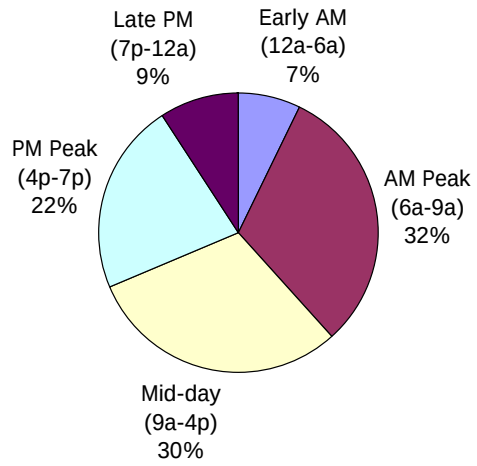


Exhibit PIT-6: Percent of Delay by Time Period

Comments

- This chart shows the percent of delay that occurred during different time periods of an average weekday. Note that the AM and PM peak periods are the same duration, but that the other time periods have different lengths.
- The delay in the morning peak period is greater than during the evening peak period.
- Delay during the mid-day period is almost as much as during the morning peak period.

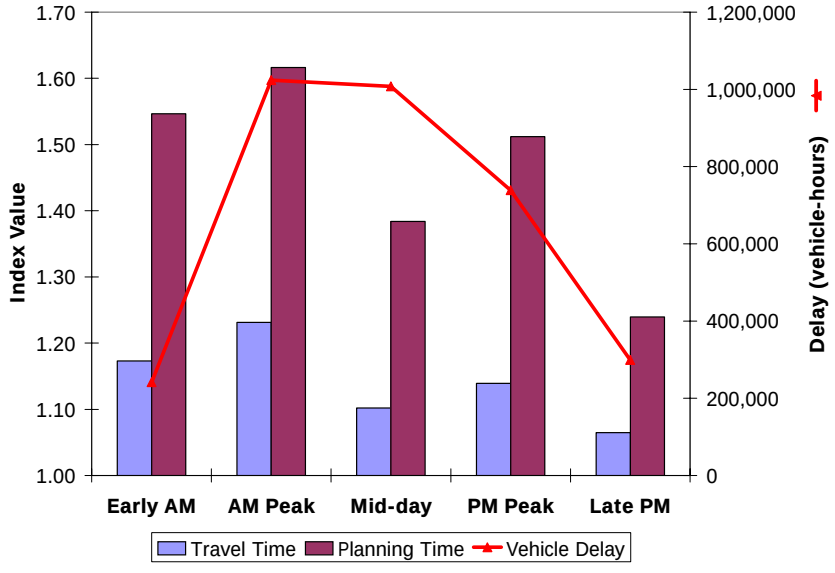


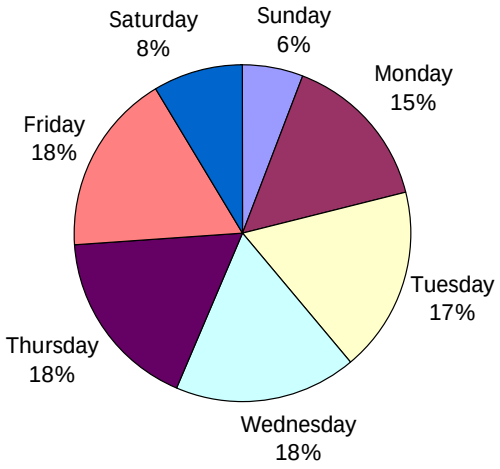
Exhibit PIT-7: Mobility, Reliability, and Delay by Time Period

Comments

- This chart shows congestion and reliability (shown as bars) as well as delay (shown as a line) during different time periods of an average weekday.
- The trends in this chart follow closely those shown in Exhibit 6.
- The travel time index for the mid-day period is moderate, but the delay is relatively high because of the length of this time period (7 hours).

Day of Week Patterns and Trends

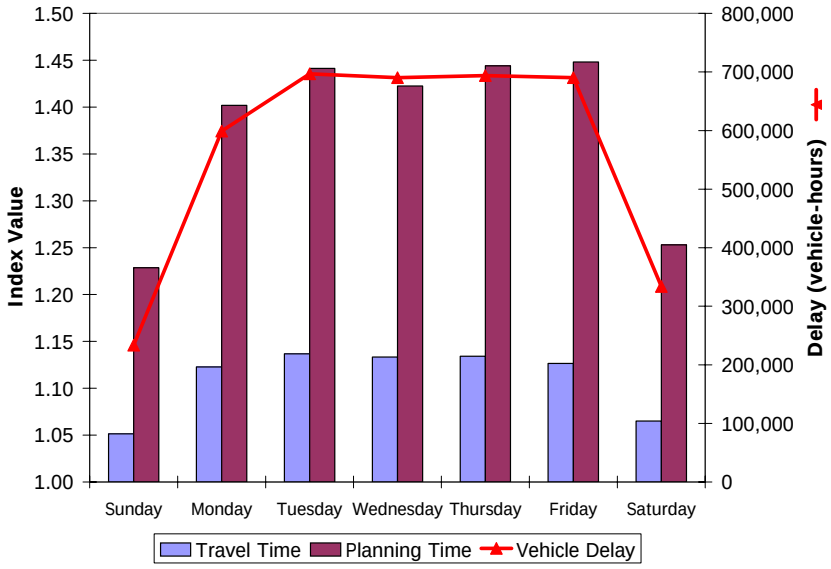
The charts on this page illustrate average traffic patterns and trends that were measured on the freeway sections instrumented with operations-based traffic sensors. Because of different peak period times and lengths on weekdays and weekends, the statistics presented on this page are 24-hour daily totals or averages.



Comments

- This chart shows the percent of total daily delay that occurred during each day of the week.
- Monday has the least delay of all weekdays. All other weekdays have about the same share of delay
- Each weekend day has about half of the delay of a typical weekday.

Exhibit PIT-8: Percent of Daily Vehicle Delay by Day of Week



Comments

- This chart shows average daily congestion and reliability (shown as bars) as well as total daily delay (shown as a line) during each day of the week.
- The trends in this chart follow closely those shown in Exhibit 8.
- All weekdays except Monday have comparable congestion and reliability levels.

Exhibit PIT-9: Mobility, Reliability, and Delay by Day of Week

Other Traffic Data Patterns and Trends

The chart on this page illustrates average traffic patterns and trends that were measured on the freeway sections instrumented with operations-based traffic sensors.

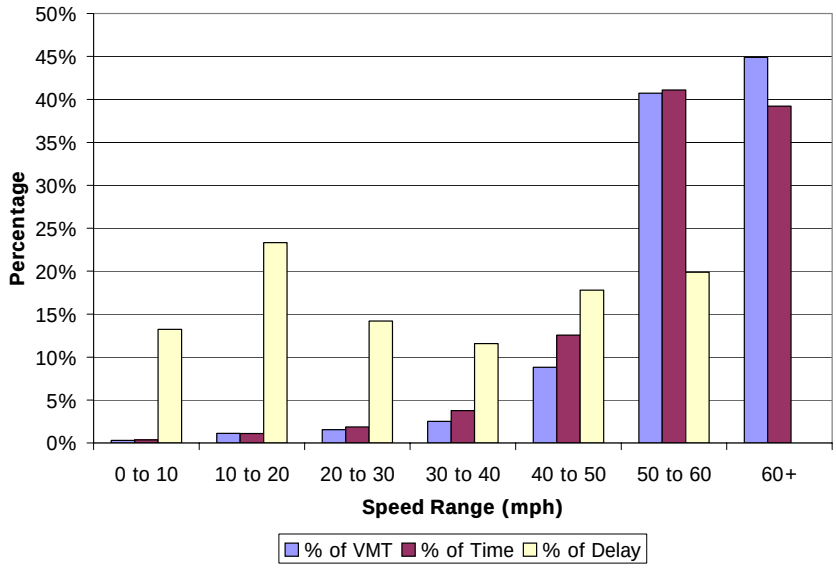


Exhibit PIT-10: Percent of VMT, Delay and Time Periods in Different Speed Ranges

Comments

- This chart shows the percent of VMT, time, and delay in different speed ranges. This chart is useful to determine how much VMT and delay is occurring at different congestion levels.
- Delay is evenly spread across all speed ranges.
- About 38% of the delay is in the 40 to 50 mph and 50 to 60 mph ranges.

Mobility and Reliability Statistics for Specific Freeway Sections

The table in this section illustrates average weekday (no holidays included) statistics from the freeway sections instrumented with operations-based traffic sensors. Where possible, the freeway sections have been defined to begin and end at major interchanges, streets, or other locations where traffic conditions are likely to change. The freeway sections are typically between 5 and 10 miles in length.

Exhibit PIT-11. Mobility and Reliability by Section and Time Period

Freeway Section (sorted from most congested to least congested sections)	Length (mi)	Travel Time Index				Buffer Index			
		Morning Peak (6a-9a)	Midday (9a-4p)	Evening Peak (4p-7p)	Average peak period	Morning Peak (6a-9a)	Midday (9a-4p)	Evening Peak (4p-7p)	Average peak period
I-279 Parkway West NB: I-79 to Ft Pitt Tunnel	6.37	Route-specific information is the property of Mobility Technologies, Inc. Agencies or companies interested in viewing route-specific information should direct their request to Mobility Technologies, Inc. at DataRequests@traffic.com.							
I-376 Parkway East WB: I-76 to Forbes Ave	13.26								
PA-28 NB: I-279 to SR 910	12.83								
PA-60 NB: US 22 to Airport	4.50								
PA-28 SB: SR 910 to I-279	12.83								
PA-60 SB: Airport to US 22	4.50								
I-376 Parkway East EB: Forbes Ave to I-76	13.26								
I-279 Parkway West SB: Ft Pitt Tunnel to I-79	6.37								
I-279 HOV: Perry Highway to E North Ave	3.93								
I-279 Parkway North SB: I-79 to PA-28	12.48								
I-279 Parkway North NB: PA-28 to I-79	13.64								
I-79 NB: Bridgeville to I-279	17.54								
I-79 SB: I-279 to Bridgeville	17.54								
I-79 SB: SR 3018 to I-279	10.10								
I-79 NB: I-279 to SR 3018	10.10								
Average for all Sections		1.23	1.10	1.14	1.18	28%	24%	31%	29%

Comments

- This table shows average weekday congestion (travel time index) and reliability (buffer index) for specific routes for different time periods of the day.

Source and Coverage of Data

This report was produced using data collected by Mobility Technologies, Inc. (http://www.mobilitytechnologies.com/). A map of the freeway routes on which traffic data was collected is shown below.

Exhibit PIT-12: Freeway Routes with Traffic Sensors in Pittsburgh
(Source of graphic: Mobility Technologies, http://traffic.com)

Exhibit PIT-13: Instrumented Freeway Coverage in Pittsburgh

Coverage Measures	Year	Instrumented Freeway Routes	Total Freeway System[1]	Percent Coverage
Lane-miles	2000	0	1,190	n.a.
	2001	415	1,190	35%
	2002	377	1,215	31%
	2003	541	1,228	44%
Centerline-miles	2000	0	283	n.a.
	2001	79	284	28%
	2002	78	289	27%
	2003	78	292	27%
Average annual daily vehicle-miles of travel (DVMT) (1000)	2000	0	11,130	n.a.
	2001	5,010	11,310	44%
	2002	4,900	11,700	42%
	2003	4,770	11,985	40%

[1]Source is FHWA's Highway Performance Monitoring System and the Texas Transportation Institute's Urban Mobility Study (http://mobility/tamu.edu/ums).

Documentation and Definitions

Performance Measures

- **Travel Time Index:** ratio of the average peak period travel time to an off-peak travel time. For example, a value of 1.20 means that average peak travel times are 20% longer than off-peak travel times. In this report, the morning peak period is from 6 to 9 a.m. and the evening peak period is from 4 to 7 p.m. The off-peak travel time is calculated by assuming a free-flow speed of 60 mph.
- **Planning Time Index:** statistically defined as the 95th percentile Travel Time Index, this measure also represents the extra time most travelers include when planning peak period trips. For example, a value of 1.60 means that travelers plan for an additional 60% travel time above the off-peak travel times to ensure 95% on-time arrival.
- **Buffer Index:** the extra time (or buffer) needed to ensure on-time arrival for most trips. For example, a value of 40% means that a traveler should budget an additional 8 minute buffer for a 20-minute average peak trip time to ensure 95% on-time arrival. In this report, the buffer index is a VMT-weighted average of the buffer index for each route for the morning and evening peak period. The buffer index is calculated for each route and time period as follows: buffer index = (95^{th} percentile travel time – average travel time) / average travel time.
- **% Congested Travel:** the congested peak period vehicle-miles of travel (VMT) divided by total VMT in the peak period. This is a relative measure of the amount of peak period travel affected by congestion.
- **Total Delay per 1000 VMT:** the total vehicle delay (in vehicle-hours) divided by the amount of VMT. This is a relative measure of the total delay and will not be as affected by changes in the level of sensor instrumentation for a particular city.
- **Vehicle Delay:** the delay (in vehicle-hours) experienced by vehicles traveling less than free-flow speeds (assumed to be 60 mph in this report).

Explanatory Measures

- **Peak Period VMT:** the average amount of VMT within the defined peak periods (weekdays from 6 to 9 a.m. and 4 to 7 p.m.) for the year. Peak period VMT is reported by 1000s.
- **Average Annual DVMT (000):** the average annual amount of daily VMT (DVMT) for all days and times for the year. Average annual DVMT is reported by 1000s.

Data Quality Measures

- **% complete:** the number of valid reported data values divided by the number of total expected data values (given the number of active sensors and time periods). In this report, % complete is reported as the lowest value of either traffic volume or speed data.
- **% valid:** the number of reported data values that passed defined acceptance criteria divided by the total number of reported data values. In this report, % valid is reported as the lowest value of either traffic volume or speed data.
- **% of DVMT covered:** the amount of average annual DVMT reported by sensors divided by the areawide average annual DVMT as estimated in FHWA's Highway Performance Monitoring System and TTI's Urban Mobility Study. This measure characterizes the relative amount of areawide travel that has the performance indicated in this report.
- **% coverage of freeway mileage:** the amount of freeway lane-miles containing sensors divided by the areawide freeway lane-miles as estimated in FHWA's Highway Performance Monitoring System and TTI's Urban Mobility Study. This measure characterizes the relative amount of areawide freeways that has the performance indicated in this report.