New Look
The Regional Transportation Plan

2035 Regional Transportation Plan Update

Background Paper:

A Profile of Regional Roadway System in the Portland Metropolitan Region

Prepared by:

METRO
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DISCUSSION DRAFT
December 21, 2006

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Clean air and clean water do not stop at city limits or county lines. Neither does the need for jobs, a thriving economy and good transportation choices for people and businesses in our region. Voters have asked Metro to help with the challenges that cross those lines and affect the 25 cities and three counties in the Portland metropolitan area.

A regional approach simply makes sense when it comes to protecting open space, caring for parks, planning for the best use of land, managing garbage disposal and increasing recycling. Metro oversees world-class facilities such as the Oregon Zoo, which contributes to conservation and education, and the Oregon Convention Center, which benefits the region's economy.

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2035 Regional Transportation Plan Update

A Profile of Regional Roadway System in the Portland Metropolitan Region

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I. INTRODUCTION

Roadways are the bedrock of transportation systems. They carry people and goods so that the economic and social fabric of metropolitan areas can be sustained. They provide access to recreational and scenic destinations. In some communities a street may be as much a destination as a route while in others a route connects places miles and miles apart.

In the Portland metropolitan region of today, some parts of the roadway system were completed so long ago that the challenge is to replace them without disrupting travel too badly. In other parts, where new land is being brought into the urban growth boundary, new roads must be built to link new to old.

The combined pressure to build the new and repair the old exerts itself at the policy-making table where limited resources must be distributed to achieve maximum benefit. The purpose of this roadway system profile is to understand what infrastructure exists, what condition it is in, and how well it is functioning.

II. BACKGROUND

Given the way that roads are woven into the fabric of our communities, it is unsurprising that they are relevant to all six of the 2040 fundamentals in the Regional Transportation Plan.

Often, we think of roads first and foremost as linked to the region's *economic vitality*. Roads carry a majority of commuters to their jobs and, since the construction of the interstate highways, an increasing share of freight has moved by truck rather than train. Traffic congestion is a perennial source of public anxiety because it imposes delay on people getting to work and goods getting to market.

Yet roads are necessary not only for economic activity but for the general quality of life. *Vibrant Communities* depend on roads so that people can access favorite destinations, from shopping, to recreational activities, to social engagement. However, the mere presence of infrastructure is not enough because the system must be safe for people to want to use it. The ability to walk around a shopping district is vital for the retail community, for example.

Additionally, the roadway system is an essential ingredient in the provision of *transportation choices* around the region. Quality sidewalks and bike facilities encourage walking and cycling and the roads themselves enable our region's bus transit service.

Two of the remaining 2040 fundamentals are sometimes threatened by the roadways system and its users. The pollution generated by motor vehicles and the impacts of infrastructure on ground water and habitats mean roads can pose danger to *Environmental Health*. In addition, highways have a legacy of being built in the communities least able to resist them, among other threats to *Equity* in the region.

Finally, roads are tightly connected with *fiscal stewardship*, largely because they often represent one of the largest (re: most valuable) assets possessed by local governments. As discussed below, the aging of this infrastructure challenges these jurisdictions in terms of maintenance and safety.

III. TRENDS AND RESEARCH

Growing Congestion

It is said that travel speeds in the central business district of Philadelphia, Pennsylvania are the same as they were when the liberty bell rang 230 years ago: 17 miles per hour. Here, it sometimes seems our ancestors on the Oregon Trail had it better than us, from the Sunset Corridor to the Banfield or the Interstate Bridge. According to research done for the Oregon Transportation Plan, Vehicle Miles traveled increased 80% between 1980 and 2002, with a growing population counteracting a decline in per capita driving.

"Rush hour" traffic tends to get worse in three ways. First, peak periods last longer – more hours of the day are marked by congestion on the roadway system. Second, peak conditions affect a greater portion of the network. Third, the severity of the congestion during the peak is greater. In and around Portland, each of these trends is documented, although the one that generates the most ire is the first, that the peaks are "spreading" into more hours of the day. Congestion on I-5 northbound to the Columbia River often starts to form by three o'clock in the afternoon and sometimes even earlier. According to the Cost of Congestion study, completed by Metro, the Port of Portland and the Portland Business Alliance in 2005, the average household in the metropolitan region will spend an extra 50 hours a year stuck in traffic.[1]

Recently, the transportation profession has shifted its focus from speed and time to reliability[2]. The concept of reliability recognizes that whether a trip is short or long, a traveler is aggravated by not knowing how long it is going to take from one day to another. This is related to "non-recurring" congestion which, in contrast to chronic bottlenecks, occurs as a result of incidents (breakdowns, crashes, etc.), construction, weather, and others.

The emphasis on travel time reliability instead of simply travel time means that there are more tools at the disposal of transportation planners and traffic managers, including solutions that do not involve major capital investments and capacity expansion. These tools include mitigation strategies for incidents and construction zones as well as communication tools that keep travelers informed about traffic conditions.

Aging Infrastructure

The Interstate Bridge is approaching its 90th birthday. The Marquam Bridge 10 miles south is merely 40 years old. Like any major demographic trend, American roadways are approaching the end of their useful life and the maintenance costs are on the rise. The MLK viaduct in inner southeast Portland, for example, was built in 1936, supplemented

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[1] The Cost of Congestion study is online: *www.metro-region.org/article.cfm?ArticleID=1667*3

[2] FHWA, 2006. Travel Time Reliability: Making it there on time, every time.

by Grand Avenue in 1965, and is now being replaced at a cost of approximately $50 million. From pavements to bridges, an increasing share of transportation funding is going to operations and maintenance because an increasing share of the infrastructure is reaching retirement age.

The challenge for Portland is that at the same time the region is facing an unprecedented rate of population growth. That growth means that new infrastructure is needed to support development in parts of the region such as Damascus and Pleasant Valley. Transportation infrastructure is often one of the largest assets owned by cities, towns and counties, which means these jurisdictions face financial as well as engineering challenges.

Innovative Finance

From many directions come hints that the way transportation infrastructure is financed will be changing. A premise of the 2035 RTP is that the federal role in funding transportation is on the decline. Long gone are the days of federal funding for 90% of construction and 80% of maintenance of highways. SAFETEA-LU, the latest federal authorizing legislation for transportation included thousands of earmarks, in contrast to hundreds in the previous round and dozens in the round before that.

The two most recent rounds of federal transportation legislation, TEA-21 and SAFETEA-LU, indicate the federal government is favoring public-private partnerships more and more. At both the federal and state level, there is a conspicuous lack of interest in raising the gas tax. ODOT has recently begun experiments with alternatives. In one, drivers would pay by the miles they drive instead of the amount of fuel they consume. In another, private companies would assume a role in financing, building and operating highways, a scenario that would include tolls or other user fees.

Among other things, “unconventional” funding sources may force a change in the way that transportation is planned. To date, funding decisions are determined by public agencies and in Oregon these decisions are structured by consistency requirements in state law. A growing private role in financing could undermine public policy that depends on the reliance on public finance for infrastructure.

Older Drivers

In addition to the infrastructure, our drivers are getting older. Besides social security and other issues, the baby boomer generation is already affecting public safety on the roads. Boomers drove more than earlier generations throughout their lives and are expected to continue driving into their later years.

What it takes to ensure safety for older drives is not new but the extent of that accommodation is unprecedented. From the visibility of road signs to stopping distances and reaction times, the needs are well known. Furthermore, other modes are also addressing these issues, from ensuring compliance with ADA on sidewalks to considering transit service attributes.

Increasing Emphasis on Management (Demand and System)

In response to the mounting congestion described above, the national trend is toward greater reliance on strategies that make existing infrastructure more productive or effective, in contrast to simply making more infrastructure. In the 1990's, the emphasis was placed directly on the much-touted ability of technology, also referred to as Intelligent Transportation Systems or ITS, to solve traffic problems, from congestion to safety and air quality. While these benefits are possible, the prevailing attitude today is that the technologies should be applied in support of management strategies.

For example, a broken-down vehicle on a highway represents a loss of capacity. As the table below shows, if the vehicle is blocking one of three lanes of traffic, 51% of the built capacity is being sacrificed.[3] A system management strategy might focus on detecting the incident more quickly so that a response – ambulance, tow truck, etc. – can be dispatched. In this example, technology can play a valuable role.

Exhibit A: Impact of Incidents on Highway Capacity (% built capacity lost)

Number of Lanes	Shoulder Blocked	One Lane Blocked	Two Lanes Blocked	Three Lanes Blocked
2	19%	65%	100%	N/A
3	17%	51%	83%	100%
4	15%	42%	75%	87%

The prevailing trend therefore encompasses at least two sub-trends. In the first place, transportation operating agencies (mainly DOTs and transit properties) are increasingly relying on these management strategies as an alternative or complement to capital investments. In the second place, the emphasis has shifted from technology for its own sake to technology in the service of management strategies and performance goals.

Homeland Security

SAFETEA-LU separated "safety and security" – a single planning factor under TEA-21 into separate factors. USDOT and its modal agencies as well as the Department of Homeland Security and its Transportation Security Administration have been working on an array of programs to improve the security of transportation infrastructure. While the overwhelming emphasis has been on aviation security and, to a lesser extent, maritime port security, these agencies have been pushing for security to be considered in all areas, including highway.

For the most part, this has become a matter of assessing vulnerability, which in the context of roadways mainly means identifying critical infrastructure. Infrastructure may be a potential target either because of its significance in the system or because of some symbolic value. Nevertheless, transportation agencies, in the near term at least, have to remain attentive to the security potential of its critical assets.

[3] Highway Capacity Manual, 2000.

IV. POLICY AND REGULATORY FRAMEWORK

Federal

The primary driver from the federal is the six-year authorizing legislation. SAFETEA-LU, passed in August 2005, is the law currently in place, preceded by TEA-21 (1998) and ISTEA (1991). The next legislation is due in 2009. In contrast to previous rounds, there was little in the way of new policy direction in this legislation. Some feel that language regarding public-private financing and high-occupancy toll lanes are major changes. The most notable trend about the legislation overall was that it shifted even more from formula funding to earmarked allocations. The Oregon delegation did fairly well in getting earmarks but the rational planning process generally benefits from more formula funding, not less.

Aside from the legislation, roadway planning is influenced by the metropolitan planning regulation that was proposed in mid-2006 and is expected to be finalized in early 2007. Again, without major changes in the law, the main changes codified in the regulation were ones that reflected evolutionary changes that had occurred since the last regulation was adopted more than ten years ago. There are some changes to the environmental review process but not that have a large impact on the infrastructure that results or how it is managed. The rulemaking does add emphasis to the management of congestion and the promotion of non-expansion solutions.

Finally, there is guidance that accompanies the law and the regulation. With regard to roadways, USDOT is expected to issue guidance with respect to the Congestion Management Process and Transportation System Management/Operations Strategies requirements. Both of these are likely to influence the ways that MPOs and DOTs plan, priorities and implement projects.

State

The 2006 update of the Oregon Transportation Plan has seven goals. The first ("Mobility and Accessibility") speaks to the need to maintain existing infrastructure and build more where it is needed. The second ("Management of the Transportation System") speaks to the importance of maximizing the value of the investment made to date by optimizing the performance of existing infrastructure. Combined with the sixth goal ("Funding the Transportation System") these two establish the basic topography of the roadway system profile for both the state and the region.

In between goals 3, 4 and 5 (Economic Vitality, Sustainability, and Safety and Security) articulate the most important reasons why improving mobility and access are public priorities. And in goal 7 (Coordination, Communication, Cooperation), the OTP addresses both the importance of interagency collaboration and the need for an effective stakeholder process with respect to planning and implementing all kinds of transportation projects.

The aim of the first goal (Mobility and Accessibility) is to "To enhance Oregon's quality of life and economic vitality by providing a balanced, efficient, cost effective and integrated multimodal transportation system that ensures appropriate access to all areas of the state, the nation and the world, with connectivity among modes and places." The OTP identifies three policies to help achieve this goal:

1. Development of an Integrated Multimodal System
2. Equity, Efficiency and Travel Choices
3. Relationship of Interurban and urban mobility

The aim of the second goal (Management of the System) is to "improve the efficiency of the transportation system by optimizing the existing transportation infrastructure capacity with improved operations and management." The document notes that "demand and system management can enhance capacity at generally less cost than adding new infrastructure." In particular, the OTP identifies two supportive policies:

1. Capacity and Operational Efficiency
2. Management of Assets

The newly-adopted OTP has many profound affects on regional transportation planning, in no small part because the state's Transportation Planning Rule (TPR) requires consistency between state, metropolitan and local plans. The main policy feature of the OTP that influences the roadway system is the second goal, which regards management of the system. As noted above in the trend section, transportation agencies are increasingly attentive to the strategies they can use to make existing infrastructure work better.

Regional

Metro Charter

In 1979, the voters in this region created Metro, the only directly elected regional government in the nation. In 1991, Metro adopted Regional Urban Growth Goals and Objectives (RUGGOs) in response to state planning requirements. In 1992, the voters of the Portland metropolitan area approved a home-rule charter for Metro. The charter identifies specific responsibilities of Metro and gives the agency broad powers to regulate land-use planning throughout the three-county region and to address what the charter identifies as "issues of regional concern." Among these responsibilities, the charter directs Metro to provide transportation and land-use planning services. The charter also directed Metro to develop the 1997 Regional Framework Plan that integrates land-use, transportation and other regional planning mandates.

Regional Framework Plan

Updated in 1995 and acknowledged by the Land Conservation Development Commission in 1996, the RUGGOs establish a process for coordinating planning in the metropolitan region in an effort to preserve regional livability. The 1995 RUGGOs, including the 2040 Growth Concept, were incorporated into the 1997 Regional Framework Plan to provide the policy framework for guiding Metro's regional planning program, including development of functional plans and management of the region's urban growth boundary. The Regional Framework Plan is a comprehensive set of policies that integrate land-use, transportation, water, parks and open spaces and other important regional issues consistent with the 2040 Growth Concept. The Framework Plan is the regional policy basis for Metro's planning to accommodate future population and employment growth and achieve the 2040 Growth Concept.

2040 Growth Concept

The 2040 Growth Concept text and map identify the desired outcome for the compact urban form to be achieved in 2040. It envisions more efficient land use and a diverse and balanced transportation system closely coordinate with land use plans. The 2040 Growth Concept has been acknowledged to comply with statewide land use goals by the Land Conservation and Development Commission (LCDC). It is the foundation of Metro's 1997 Regional Framework Plan.

2004 Regional Transportation Plan

The RTP implements the goals and policies in 1995 RUGGOs and the 1997 Regional Framework Plan, including the 2040 Growth Concept. The region's planning and investment in the regional public transportation system are directed by current RTP policies and objectives for the regional public transportation system. The current update of the Regional Transportation Plan (2004) articulates its policies in Chapter 1. Of the 20 policies included in the RTP, some deal directly with roads while others establish context and other influences. Some of the most direct policies are:

Exhibit B: Road-Related Policies from the 2004 RTP

- **Policy 4: Consistency Between Land-Use and Transportation Planning.**
- **Policy 11: Regional Street Design.**
- **Policy 12: Local Street Design.**
- **Policy 13: Regional Motor Vehicle System.**
- **Policy 18: Transportation System Management.**
- **Policy 20.2: Transportation System Maintenance and Preservation.**

Other policies in the RTP bear a strong relationship to the road system such as Transportation Safety and Education ("Improve the safety of the transportation system"), Regional Public Transportation Performance ("Provide transit service that is fast, reliable…"), Regional Freight System ("Provide efficient, cost-effective and safe movement of freight…") and Peak Period Pricing ("manage and optimize the use of highways in the region to reduce congestion, improve mobility and maintain accessibility…").

These policies all bear the stamp of the State of Oregon's policy framework, namely the emphasis on consistency among plans and the integration of transportation with land use. In light of the priorities established in SAFETEA-LU and the OTP, the regional policies that appear most pressing include the regional motor vehicle system (13), transportation system management (18), and transportation system maintenance and preservation (20.2). Below, the descriptions and objectives spelled out in the 2004 RTP are reproduced.

Exhibit C: RTP Policy 13.0 Regional Motor Vehicle System

Provide a regional motor vehicle system of arterials and collectors that connect the central city, regional centers, industrial facilities, and other regional destinations, and provide mobility within and through the region.

1. Objective: Provide for statewide, national and international connections to and from the region, consistent with the Oregon Transportation Plan
2. Objective: Provide a system of principal arterials for long distance, high speed, interstate, inter-region and intra-region travel.
3. Objective: Provide an adequate system of arterials that supports local and regional travel.
4. Objective: Provide an adequate system of local streets that supports localized travel, thereby reducing dependence on the regional system for local travel.
5. Objective: Maintain an acceptable level of service on the regional motor vehicle system during peak and off-peak periods of demand, as defined in Table 1.2.
6. Objective: Minimize the effect of improved regional access outside the urban area.
7. Objective: Minimize the impact of urban travel on rural land uses. Limit access to and minimize urban development pressure on rural land uses and resource lands by maintaining appropriate levels of access to support rural activities, while discouraging urban traffic.
8. Objective: Implement a congestion management system to identify and evaluate low cost strategies to mitigate and limit congestion in the region.

Exhibit D: RTP Policy 18.0 Transportation System Management

Use transportation system management techniques to optimize performance of the region's transportation systems. Mobility will be emphasized on corridor segments between 2040 Growth Concept primary land-use components. Access and livability will be emphasized within such designations. Selection of appropriate transportation system techniques will be according to the functional classification of corridor segments.

1. Objective: Provide for through travel on major routes that connect central city, regional centers, industrial areas and intermodal facilities.
2. Objective: Implement an integrated, regional advanced traffic management system that addresses freeway management, arterial signal coordination, transit operation, multi-modal traveler information.
3. Objective: Work with local, regional and state jurisdictions to develop access management plans for urban areas that are consistent with regional street design concepts. For rural areas, access management should be consistent with rural reserve and green corridor land-use objectives.
4. Objective: Integrate traffic calming elements into new street design as appropriate consistent with regional street design guidelines, and as a method to optimize regional street system operation without creating excessive local travel on the regional system.
5. Objective: Continue to restripe and/or fund minor reconstruction of existing transportation facilities consistent with regional street design concepts to address roadway safety and operations.

Exhibit E: Policy 20.2 Transportation System Maintenance and Preservation

Emphasize the maintenance, preservation and effective use of transportation infrastructure in the selection of the RTP projects and programs. 1. Objective: Place the highest priority on projects and programs that preserve or maintain the region's transportation infrastructure and retrofit or remove culverts identified in the region's fish passage program. 2. Objective: Place a high priority on projects and programs that preserve or maintain the region's transportation infrastructure 3. Objective: Place less priority on projects and programs that modernize or expand the region's transportation infrastructure.

V. ROADWAY SYSTEM PROFILE

Introduction

Although the roadway system is designed to be seamless, this profile distinguishes the limited-access highways from the rest of the system (arterials, boulevards, local streets, etc.). The reason for this is that a new analytical tool as emerged that allows the freeways to be examined in a way that the rest of the road network cannot: empirically.

In the first portion of this profile, extensive use is made of data that were generated by sensors installed by ODOT in the pavement of the region's freeways. A laboratory at Portland State University has been archiving these data. The lab has also created a set of online tools for accessing and analyzing the data. This kind of information is not yet available beyond the freeways and so the second portion of the profile analysis is based on outputs of the regional travel demand model.

Finally, given the growing emphasis on asset management, this profile includes the data that could be collected regarding the condition of pavements, bridges and operational aspects of the region's transportation infrastructure.

A note about performance measures
Historically, roadway congestion has been described in terms of volume-to-capacity ratio (V/C) and Level of Service (LOS). In recent years, FHWA and others have pushed to transition from these "engineering" measures to metrics that are more intuitive, especially for the general public. In this profile, preference is given to measures such as speed and travel time, concepts that resonate with users of the system and their day-to-day experience of congestion and delay. Attention is also paid to the concept of travel time reliability. Whereas most speed and time values are averages, experience is rarely "normal" and the reliability concept reflects how often average travel conditions are disrupted.

Part One: The Highway System

1. Overall System Function

The archived data at PSU allow snap shots of traffic levels to be taken. For example, in exhibit 1, below, a map of the region's highways illustrates travel speeds for the morning rush hour, averaged for weekdays in the month of May 2006. May makes for a good snapshot because the weather is stable, school is still in session and there is only one major anomaly (Memorial Day).

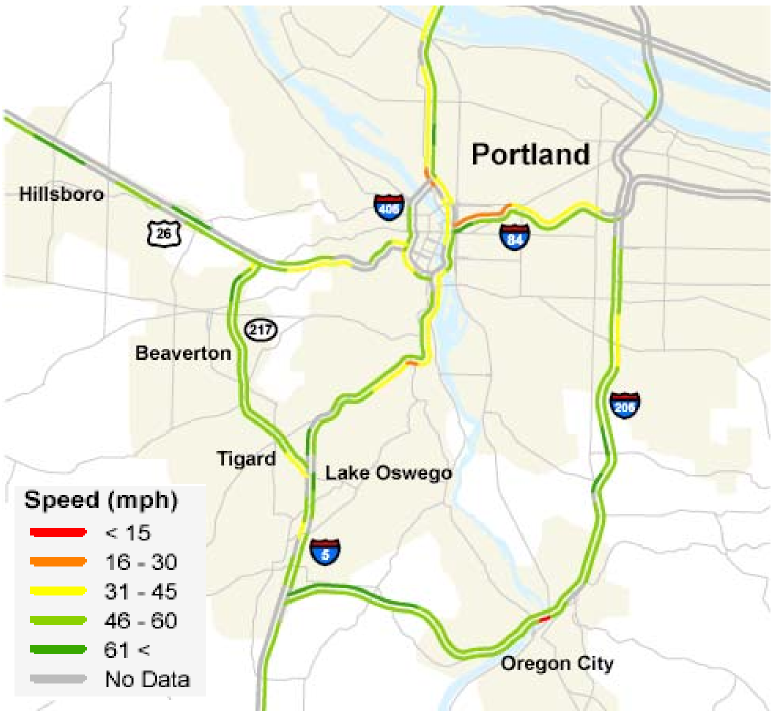


Exhibit 1: Regional Map of Speed from May 2006 AM Peak

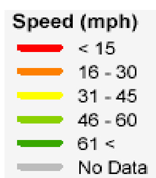
For contrast, exhibit 2, on the following page, demonstrates the profound effect of bad (i.e., rainy) weather on traffic. This plot compares November and May of 2006, using the evening rush hour. This shows that in many parts of the system, travel is slower (shades of red) in the fall than in the spring, which makes sense considering the number of days with heavy rain (greater than half an inch) in November 2006 (9 days) relative to May (2 days).

To elaborate on this comparison, the data from ODOT and PSU provide some interesting comparisons. Drivers spend 4.3 million hours drive 210 million miles on the freeways in November (average speed: 49.34 mph) whereas in May, they spent 4.2 million hours driving 225.5 million miles (average speed 53.44). In May, there was congestion on the system 12.5% of the time while in November the occurrence was 18.72%.

Finally, regarding reliability, the data for May and November 2006 suggest that if your daily commute takes an average of 30 minutes but you absolutely had to be on time, you would need to give yourself about 45 minutes in May and nearly 60 minutes in November.

In the next illustration, the comparison is based on the same month in two different years. Specifically, the map shows the change from May 2005 to May 2006. There is a combination of speeds increasing (green) as well as decreasing (red) during the year. Combined, the average speed for the entire system rose from 53.27 miles per hour in’05 to 53.44 in ’06. The amount of time in which some of the system was congested increased from 11.97% in the ‘05 to 12.5% in ‘06. In terms of reliability, the relationship between average travel time and the safe travel time was negligible.

Exhibit 2: Regional Map of Speed Comparing May and November 2006



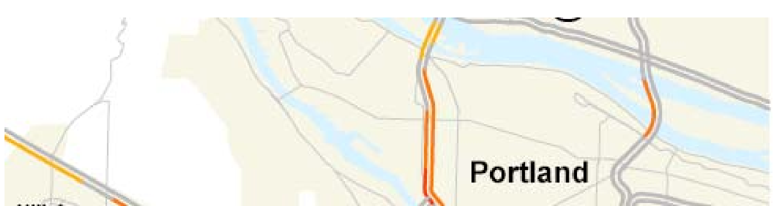
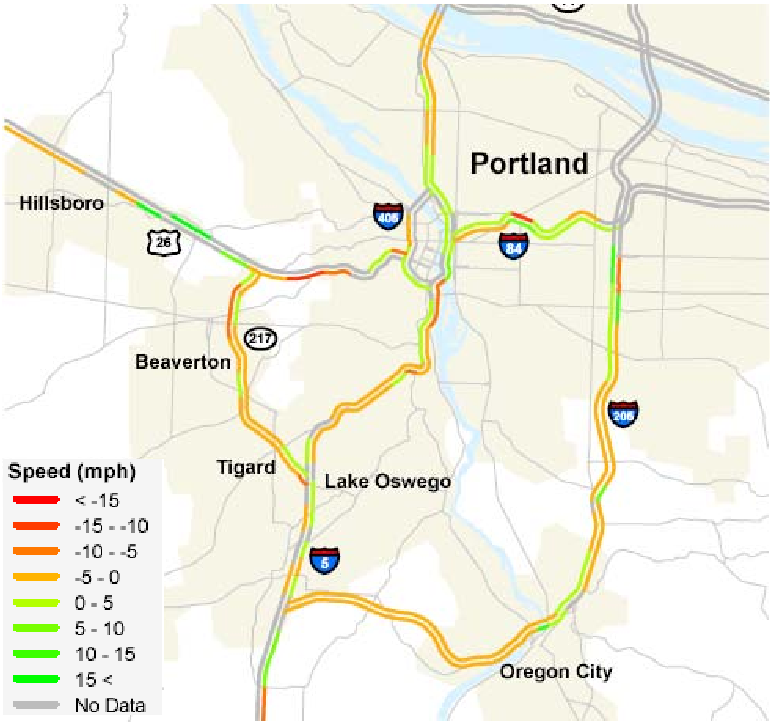


Exhibit 3: Regional Map of Speed Illustrating May 2006 versus May 2005



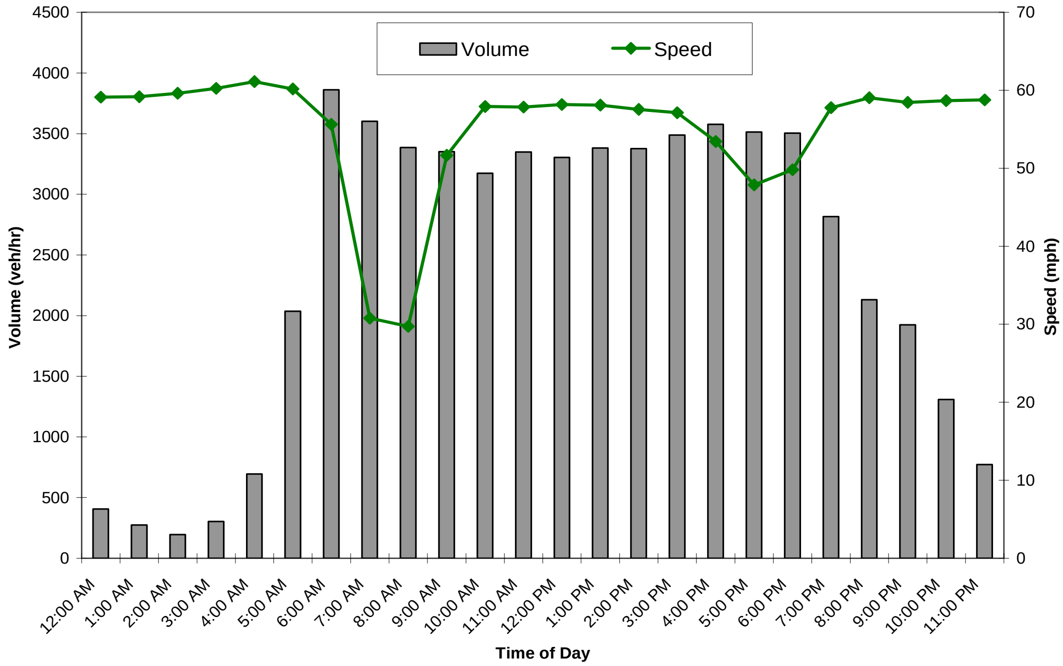
2. Cross Sectional Analysis

Eight locations were chosen – not because they have the best or the worst traffic but because they are good indicators of the overall system:

- I-5 Northbound at Portland Boulevard
- I-84 Westbound at 82nd Avenue
- I-205 Northbound at Powell Boulevard
- I-205 Southbound at Stafford Road
- I-5 Northbound at Stafford Road
- OR-217 Southbound at Beaverton-Hillsdale Highway
- I-5 Southbound at Capitol
- US-26 Eastbound at Canyon Road

For each of these locations, annual averages of volume (vehicles per hour, vph) and speed (miles per hour, mph) were calculated from the PSU data for each hour of the day, based on midweek days (Tuesday through Thursday). This allows the production of volume-speed plots, as shown below in exhibit 4.

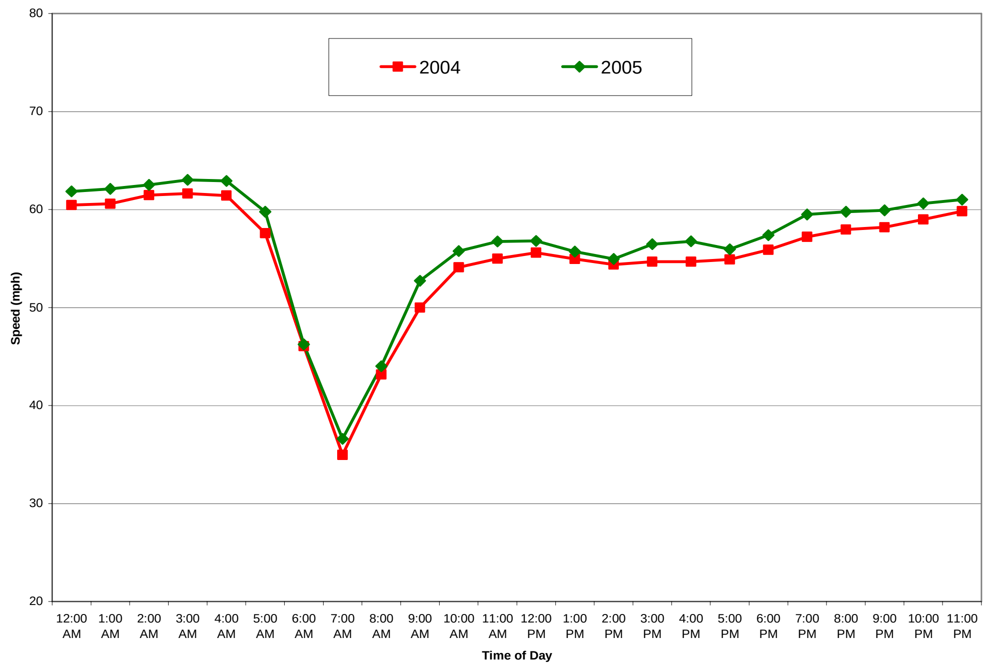
Exhibit 4: Traffic Volume and Speed on US26 Eastbound at Canyon Road in 2005



This kind of graph is very helpful in understanding how the Sunset Highway is used for the traditional commute into the City of Portland and how it is also being used for the "reverse" commute from Portland to jobs in Washington County. The graph helps show this by comparing the morning and evening periods of congestion. The traditional commuters produce the decline in speed in the morning while the reverse commuters produce the congestion in the evening as they return to Portland.

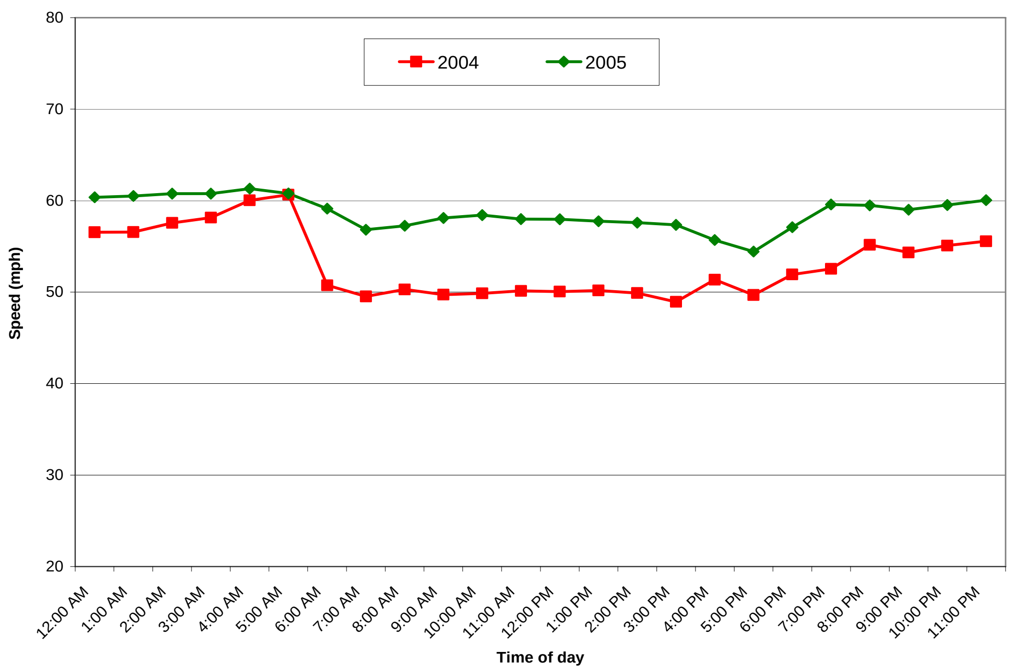
In addition to relating volume and speed in a single year, it is also possible to see how speed changes from one year to the next. At I-84 westbound near 82nd avenue, for example, the following graph shows that the speed profile has remained essentially constant over the last three years. In each year, the same tell-tale decline in speed occurs each morning and free-flow conditions are not achieved until well into the evening.

Exhibit 5: Traffic Speed on I-84 Westbound at NE 82nd Avenue, 2004 vs. 2005



In contrast, the profile of I-5 southbound near the interchange for Capitol Highway shows an increase in speed from 2005 to 2006.

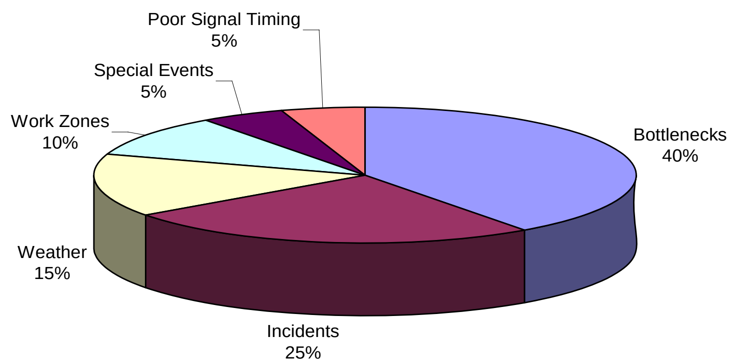
Exhibit 6: Traffic Speed on I-5 Southbound at Capitol Highway, 2004 vs. 2005



3. Sources of Non-Recurring Congestion

National data suggests that 60% of delay can be attributed to so-called "non-recurring" sources of congestion, including incidents (both collisions and breakdowns), construction, weather, special events and poorly-timed traffic signals. This breakdown is shown in the pie chart below.

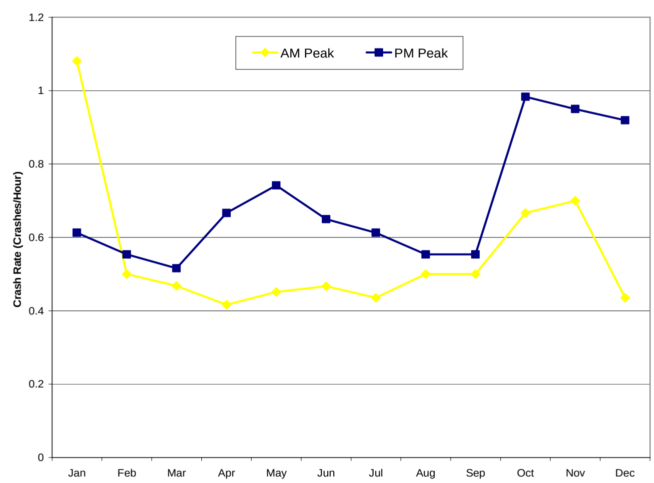
Exhibit 7: Sources of Non-recurring Congestion[4]



On Portland's regional freeways in 2005, there was an average of approximately 1000 incidents per month (808 breakdowns, 249 crashes). According to the Highway Capacity Manual, even a stalled vehicle in the shoulder can reduce capacity of a 3-lane highway by 17%. That loss grows to 51% when a single traffic lane is blocked and to 83% if the incident interferes with 2 of the three lanes.

Exhibit 8, below, shows that crashes are more likely to happen at certain times of day and certain months of the year. Comparing the morning peak (7-9am) with the evening peak (4-6pm), it is interesting to note that except for January, crashes occur more frequently in the evening than in the morning. This may be attributable to end-of-day fatigue or darkness and the spike in morning crashes in January may be attributable to icy conditions. It is also interesting to note how the crash rate increases in the October and November, typically when the heavy rain returns to the region.

Exhibit 8: Traffic Crash Rates by Month and Time of Day



Work zones are another culprit in the realm of non-recurring congestion. Exhibit 9, below, illustrates how travel speed on the eastbound Sunset Highway changed between 2004, when construction was active and 2005, when it was complete. Note that each

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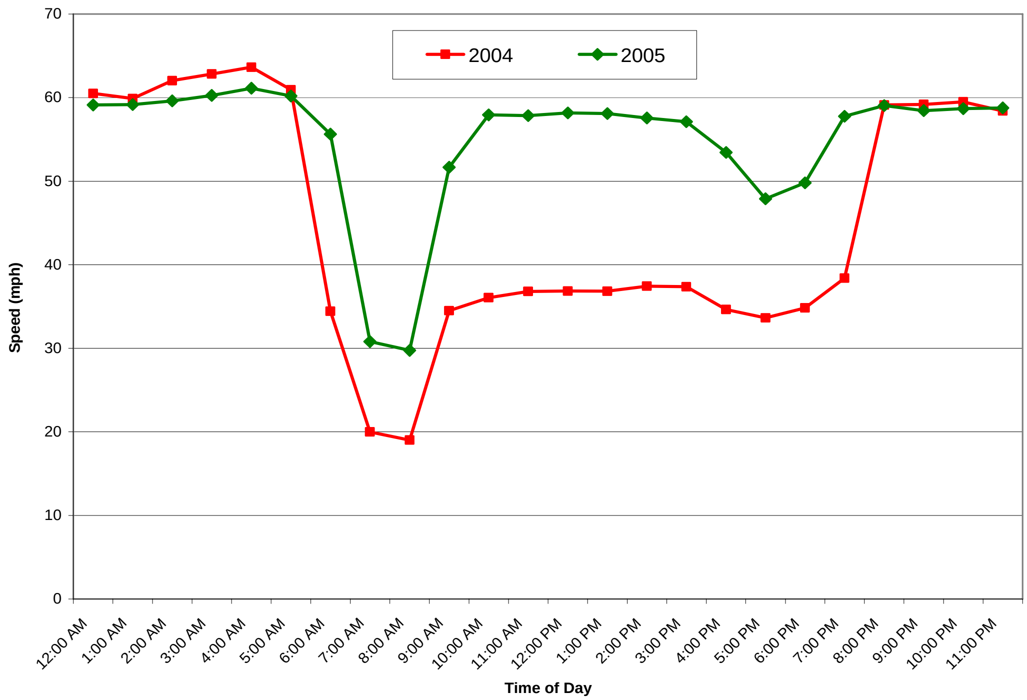
4 Federal Highway Administration, 2005.

speed curve follows the same basic pattern – very slow during the morning peak and slightly slow during the evening peak – but that the speeds are lower in ’04 than they are in ’05 or ’06.

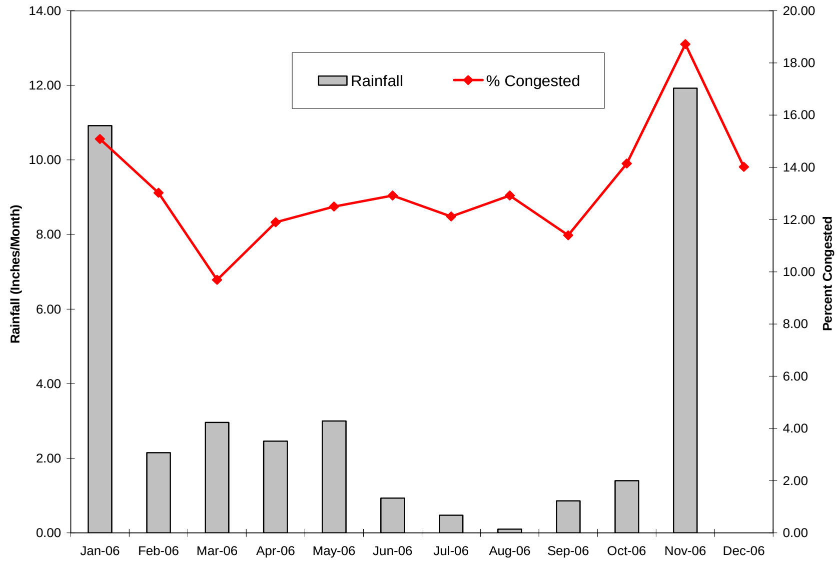
Exhibit 9: Traffic Speed on US26 Eastbound at Canyon Road, 2004 vs. 2005



Despite the region’s reputation for rainy weather, the data also suggest that the wet months witness more congestion than other times of the year. As noted above, the frequency of crashes increases significantly in October and November. There is a well documented trend that the first major rain in a long time leads to frequent crashes, mainly because oils build up on the road and make the road slick when it rains. But bad weather also reduces visibility and creates other hazardous conditions, explaining why the rate seems to peak in November. As shown in Exhibit 10, on the next page, the months with the highest rainfall (in 2006, January and November were notable extremes), also witness the most congestion. In the graph below, the cumulative monthly rainfall is shown in columns while the occurrence of congestion (average amount of time per day when congestion is present) is illustrated by the line.

Finally, special events can disrupt traffic, even though they are often anticipated and efforts are made to mitigate their impacts. Some events, such as a Trailblazers game or concert at the Rose Garden simply overwhelm parts of the system for a short period of time. Other events, such as holiday parades and road races, require the closing of some roads and bridges. The graph below shows the volume of traffic on I-405 northbound on three consecutive Sundays. On the third (shown in COLOR), the volume spikes for several hours because I-5 northbound was closed for a charity bike ride. Because the event was held on a Sunday morning, the impact on traffic was probably limited but that is not always the case.

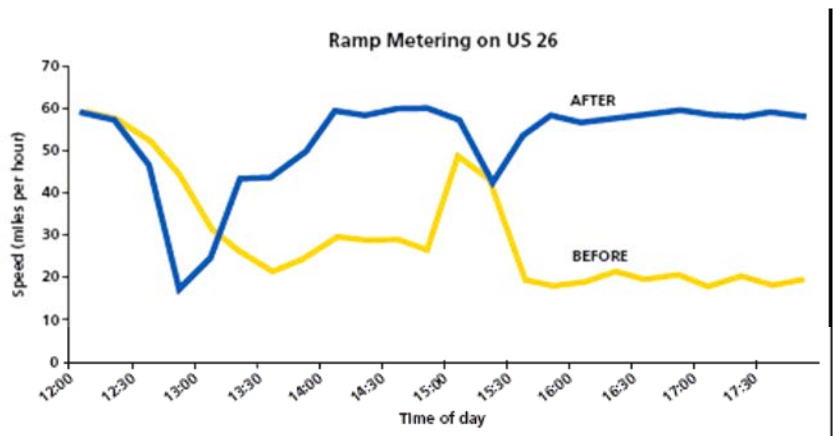
Exhibit 10: Relationship between Rainfall and Traffic Congestion



<u>4. System Management Strategies</u>

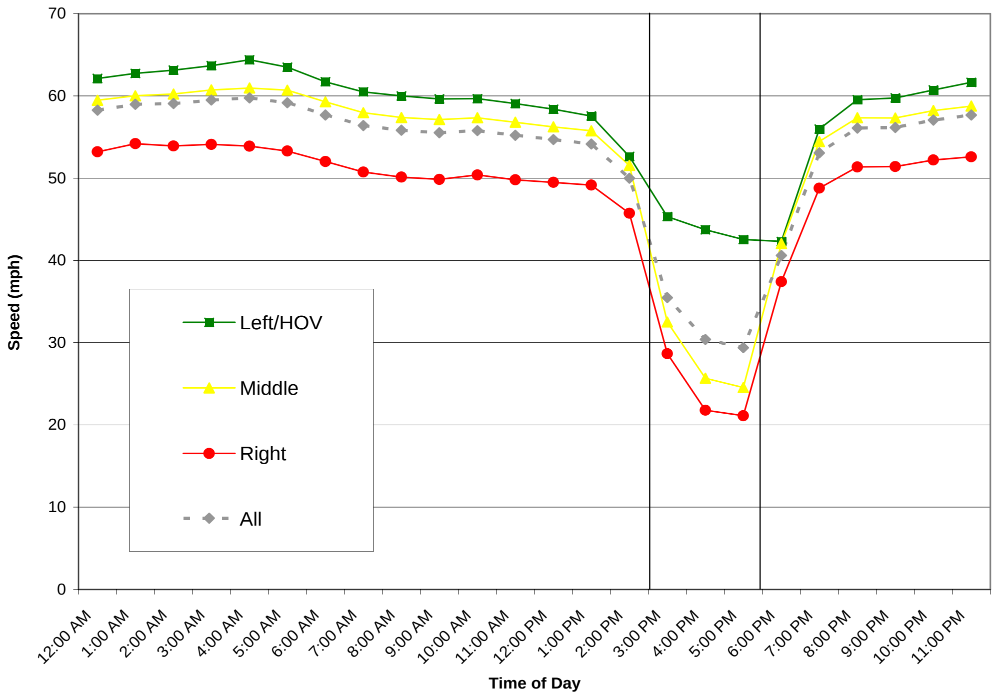
Several system management strategies are already in place on the region's highways and the benefits of most can be seen in the data. One of the most visible examples of this is ODOT's use of ramp metering at almost all entrances to the freeways. The graph below shows one example where the introduction of ramp metering *increased* travel speed. The data for this graph came from an ODOT study that demonstrated ramp metering saved nearly 15 minutes on the commute from Hillsboro into Portland.

Exhibit 11: The Travel Speed Benefits of Ramp-Metering



On one section of I-5 northbound, the region has its only High-Occupancy Vehicle (HOV) lane, also known commonly as a carpool lane because, when the restriction is in effect from 3-6pm on weekdays, only vehicles carrying 2 or more people (and motorcycles) can use it. As the graph below shows, during the evening rush hour, when the HOV rule is in effect, the people who are able to use that lane travel significantly faster (45 miles per hour) than the people traveling in the "general purpose" lanes (20-25 miles per hour).

Exhibit 12: Speed by Lane and Time of Day on I-5 Northbound at Portland Blvd



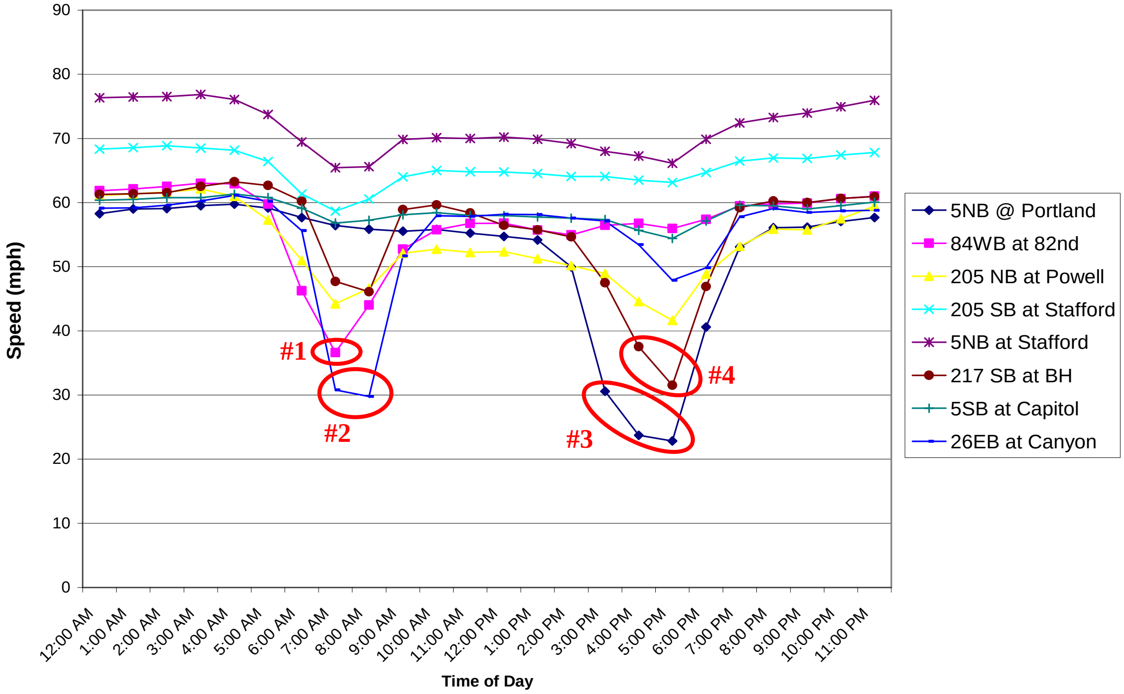
There are other strategies for managing the freeways as well, such as incident management and traveler information. The same data that ODOT uses to run the ramp meters (and that it shares with PSU) can also be used to provide the kind of congestion data featured in this report to drivers in real-time. Using the internet, telephone, or broadcast media, ODOT can disseminate information about where there is congestion, especially when it exceeds normal conditions, such as construction activity or a crash scene. By providing this information, travelers have the option to choose an alternate route, mode or time to travel, thereby avoiding additional congestion.

5. Chronic Bottlenecks

In addition to the emphasis on non-recurring congestion and the strategies designed to address it, there remains a large amount of congestion that is due to chronic bottlenecks. These locations receive frequent attention in the media because they are such a perennial nuisance, especially for daily commuters, truck drivers, and others. Returning to the ten "cross section" locations used for the analysis earlier in this report, the graph below displays the 2005 average speed profiles for each of those locations.

Showing these different speed curves together illustrates that, by and large, traffic in the metropolitan region averages 55-60 miles per hour. In fact, there are only four locations from this sample where speeds fall below two-thirds of free-flow speed, or 40 miles per hour (a common definition of congestion). As indicated on the graph, these locations are I-84 westbound (#1) and US26 eastbound (#2) in the morning peak as well as I-5 northbound (#3) and OR-217 southbound (#4) in the evening peak.

Exhibit 13: Traffic Speeds by Time of Day from around the Region



In addition to these area of peak-oriented congestion, some of the lines foreshadow a what may be the future of congestion. The line representing I-205 near Clackamas Town Center (yellow, triangles), for example, shows minor peak-period congestion during both the morning and the evening – a sign that traffic is heavy in both directions. In addition, the average speed does not quite regain the free flow level between the peaks, a period of time in which most trucks make their trips delivery goods around the region. At this location and elsewhere, this means it is imperative to closely track if and how the peak period congestion is growing both more extensive (hours of the day) and severe (decrease in speed).

In 2006, the Federal Highway Administration asked the Department of Transportation in each state to submit its list of top bottlenecks. Of the top ten submitted by ODOT, five were from the Portland metropolitan area. The list is consistent with the data presented in this section of the system profile:

1. I-5 Columbia River Crossing/Bridge Influence Area
2. I-5/I-84 Interchange
3. I-205 from I-5 to Oregon City
4. I-205/OR-224 Interchange
5. OR99W Newberg/Dundee

The remaining two sections of the report are being completed as the data is generated/collected. The findings will be presented as comprehensively as possible at TPAC on 1/5.

Part Two: The Rest of the System

Based on data from the regional travel demand model, this section will identify local bottlenecks. It will also present "travel time contours," which are plots that show how much area (and how many people) are within a certain travel time of a specified location. For example, from what parts of the region can you reach downtown Portland in 15, 30, 45 and 60+ minutes? These plots will be generated for a variety of regional centers and industrial lands.

The section will also make a link to the Safety Profile that has been prepared. That profile includes SPIS rankings from jurisdictions throughout the region. This data covers the entire road network (highway and local).

Part Three: Asset Management

This section will present data about the condition of bridges, pavements, and operational assets such as traffic signals and message boards.

VI. CONCLUSION

This section will discuss the relationship between the key findings (such as the five trends identified in section II) and implications for the RTP.