# Traffic Analysis Toolbox Volume V: Traffic Analysis Tools Case Studies—Benefits and Application

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# Foreword

"Traffic analysis tools" is a collective term used to describe a variety of software-based analytical procedures and methodologies that support different aspects of traffic and transportation analyses. Traffic analysis tools include methodologies such as sketch-planning, travel demand modeling, traffic signal optimization, and traffic simulation. The purpose of this document is to give the reader a summary of real world case studies that demonstrate the benefits of using traffic analysis tools for the project.

This document serves as the final installment of the Traffic Analysis Toolbox, but serves as a document that can be used with decision makers to support the transportation professional.  . Other volumes currently in the toolbox include: Volume I: Traffic Analysis Tools Primer, Volume II: Decision Support Methodology for Selecting Traffic Analysis Tools and Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software.

The intended audience for this report is the transportation professional or manager who needs a high-level introduction into the role of traffic analysis tools in the transportation analysis process.

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**Technical Report Documentation Page**

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| 16. Abstract<br>"Traffic analysis tools" is a collective term used to describe a variety of software-based analytical procedures and methodologies that support different aspects of traffic and transportation analyses. Traffic analysis tools include methodologies such as sketch-planning, travel demand modeling, traffic signal optimization, and traffic simulation. The purpose of this Traffic Analysis Toolbox is to give the reader a summary of real world case studies that demonstrate the benefits of using traffic analysis tools for the project. | | | |
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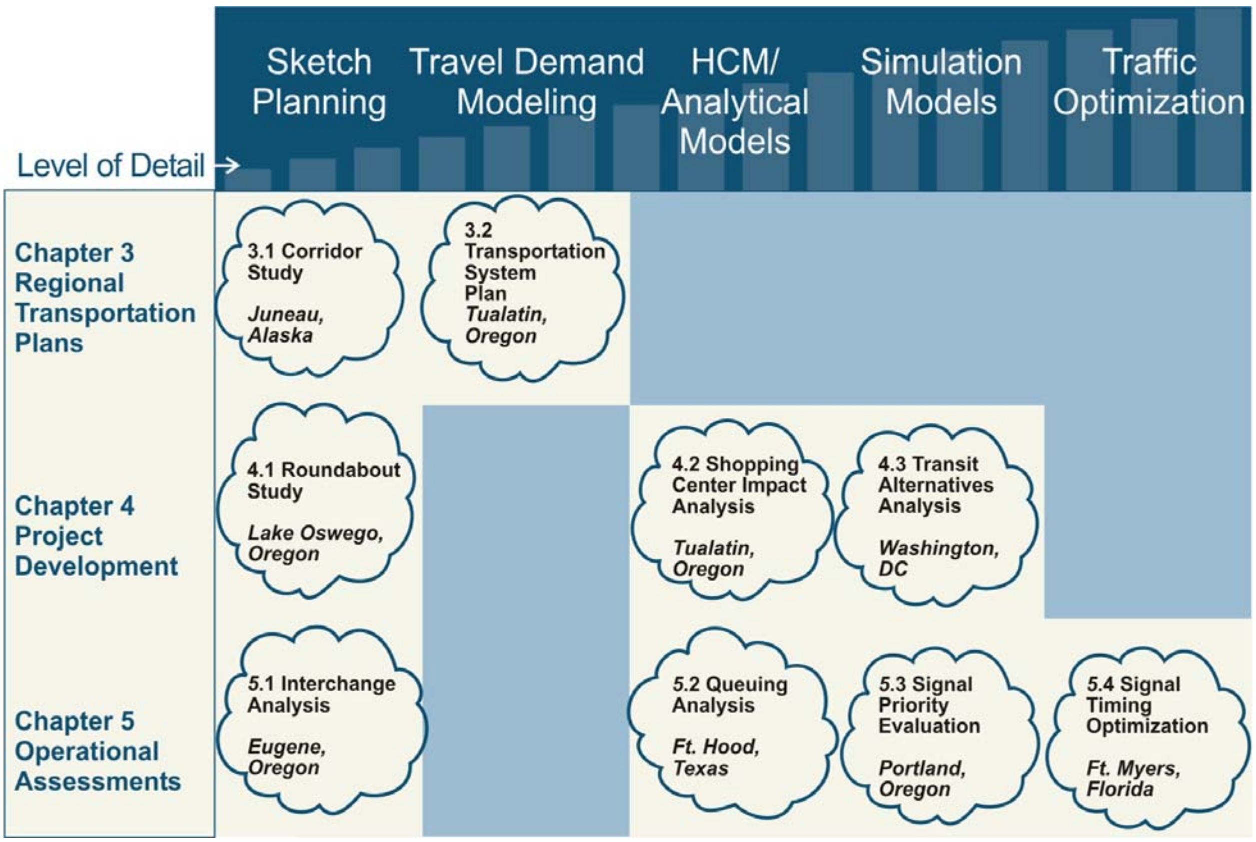
# 1.0 Introduction

Traffic analysis is an essential and complex component of planning, building, and operating our transportation system infrastructure. There are many different analysis tools to aid in these analyses, each of which has been designed with a particular need in mind[1]. Used correctly, these tools provide answers in clear and sufficient detail to inform decision-makers about the likely effects, both positive and negative, of alternative solutions. The *Traffic Analysis Toolbox* helps you and your staff select the right tool for each job, so important investment decisions are made consistently and without delay.

Read through the following pages to learn about real-world examples of what can be achieved when the analysis methods described in the *Traffic Analysis Toolbox* are correctly applied. Altogether, these case studies show how different types of tools have been effectively applied to the wide range of problems that confront every community and agency. You can use the chart below to find the type and level of analysis that is of most interest to you.




[1] See, for example, *Volume I: Traffic Analysis Tools Primer,* available at http://ops.fhwa.dot.gov/Travel/Traffic_Analysis_Tools/tat_vol1/default.htm , for an overview of the full range of traffic analysis tools available today.

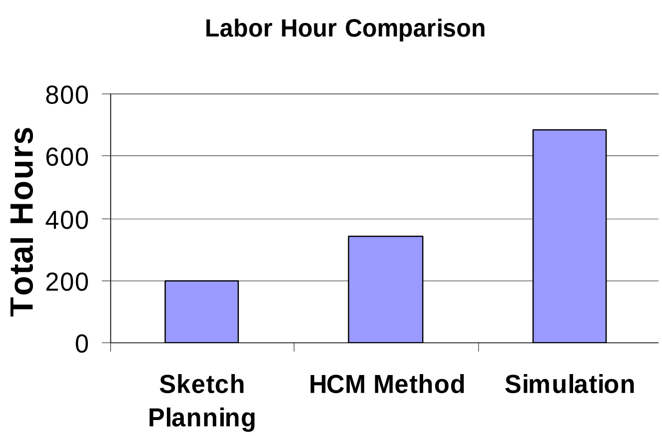
# 2.0 Community Benefits

A safe and efficient multimodal transportation system is important for assuring a strong and vibrant community. It is vital to economic development and quality of life. At the same time, the investment costs required to plan, build, manage, and maintain the necessary physical elements is very high. So it is important for elected officials and transportation decision-makers to have access to reliable, consistent, and clear information about system impacts when they are making choices between competing investment opportunities.

A wide range of traffic analysis tools is available to assist in this purpose. But there is no clear guidance about how best to organize and use these tools in a way that reliably, consistently, and clearly supports the transportation decision-making process. The *Traffic Analysis Toolbox*, developed by the Federal Highway Administration, organizes these tools according to the types of problems and levels of analysis to which they are best suited so that the objectives of reliability, consistency, and clarity can be achieved.

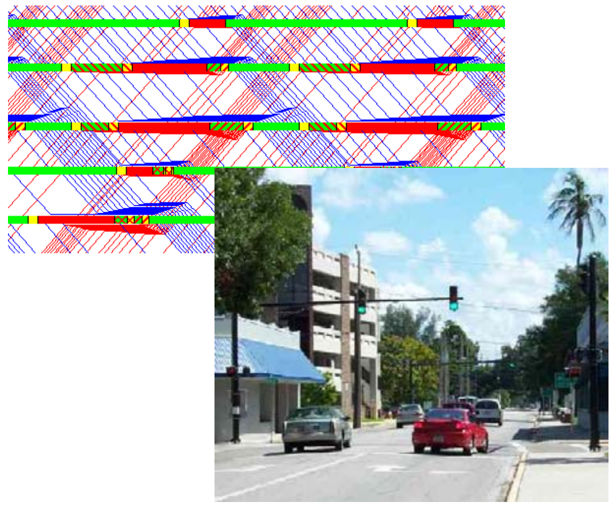

The case studies presented in Chapters 3, 4, and 5 document how various communities have solved real problems efficiently and effectively by applying available traffic analysis tools in the logical and efficient manner described in the *Traffic Analysis Toolbox*. Nine real-world experiences from across the United States show how application of the right traffic analysis tools at the right stage of the analysis saved time for both the projects and the engineers, identifying effective ways to maximize the capabilities of the existing physical infrastructure along the way and directing scarce investment dollars toward projects with the most community benefit:

- In Juneau, Alaska, sketch planning traffic analysis tools helped achieve community consensus by quickly and clearly highlighting the lane and interchange requirements associated with different alternatives.



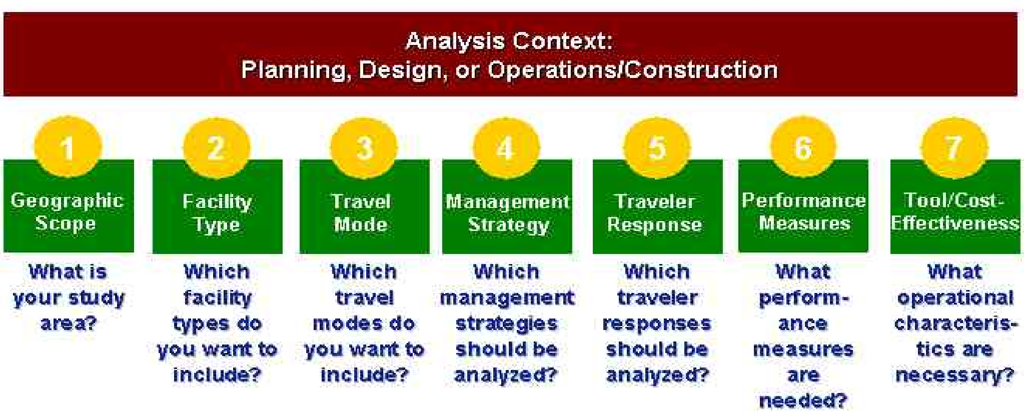
- In Tualatin, Oregon, the right combination of *Highway Capacity Manual* methods and other analytical models identified a signal timing and road realignment strategy that saved millions of dollars in freeway interchange improvements while still accommodating the economic redevelopment of a nearby area.

- In Lee County, Florida, the use of traffic optimization analysis tools resulted in new timing plans for over 100 signals that reduced average peak-hour delays by over 15 percent and saved motorists more than $9 million annually in time, fuel, and vehicle wear.



Clearly, the right application of traffic analysis tools benefits not only the engineers and planners who use them, but also the communities and decision-makers they serve. The *Traffic Analysis Toolbox* includes an expert system to help make these choices: by answering a few questions about key project characteristics, the expert system will suggest the type of traffic analysis tool to get you to clear, complete, and consistent answers that are necessary for making sound transportation investment decisions in your community. What's even better, this expert system is freely available from the Federal Highway Administration. It should be a part of every transportation agency's toolbox, and it can be found at:

http://ops.fhwa.dot.gov/Travel/Traffic_Analysis_Tools/traffic_analysis_tools.htm




While other volumes of the Toolbox provide more specific guidance related to the technical aspects of selecting the right tool, this volume provides insight into the benefits achieved through identifying and using the appropriate traffic analysis procedures and tools.

# 3.0 Regional Transportation Plans and Programs

Large-scale planning efforts will clearly benefit from using the right traffic analysis tools. The questions to be answered in these efforts are basic ones: should the roadway be treated as an expressway or an arterial? How many lanes will be required? What's the best form of control for the intersections? Specially designed traffic analysis tools focus in on the answers to these questions without getting lost in the costly and time-consuming detail of operational and design considerations that will come later. Many such tools have been developed and can be effectively applied within the realms of sketch planning and travel demand modeling. The table below introduces two real-world case studies presented in the remainder of this chapter to demonstrate the benefits that can be achieved through the proper application of traffic analysis tools in regional transportation plans and programs.

| Type of Analysis | Real-World Case Study |
|---|---|
| 3.1 Sketch Planning | West Egan Drive Corridor Study<br>*Juneau, Alaska* |
| 3.2 Travel Demand Modeling | City-Wide Transportation System Plan<br>*Tualatin, Oregon* |

# 3.1 Sketch Planning Case Study—Corridor Refinement Study

Sketch planning traffic analysis tools are often used in regional transportation planning to analyze the impacts of regional growth trends on the transportation infrastructure. These tools can quickly and effectively evaluate the adequacy of roadway networks and intersections. As such, they also help in developing regional plans.

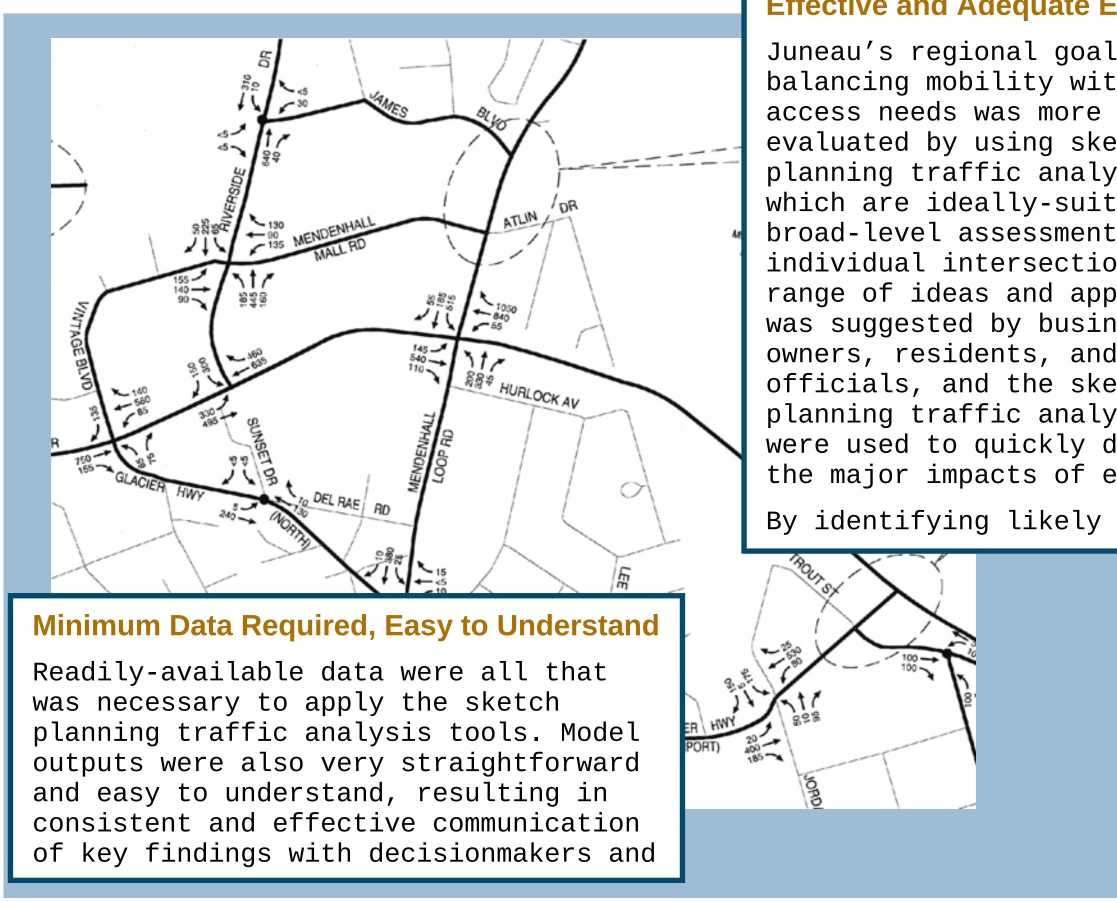
**West Egan Drive Corridor Study - Juneau, AK**

**Key Benefits**

- Clear and adequate information to formulate alternatives
- Less engineering time required than for other types of analysis
- Equal consideration of all stakeholder proposals to be specifically considered

**Other Considerations**

- Output from sketch planning analysis tools should be supplemented with other more detailed analysis procedures prior to final design and implementation concept design




### Effective and Adequate Evaluation

Juneau's regional goal of balancing mobility with local access needs was more easily evaluated by using sketch planning traffic analysis tools, which are ideally-suited to a broad-level assessment of many individual intersections. A wide range of ideas and approaches was suggested by business owners, residents, and elected officials, and the sketch planning traffic analysis tools were used to quickly document the major impacts of each.

By identifying likely areas of

### Minimum Data Required, Easy to Understand

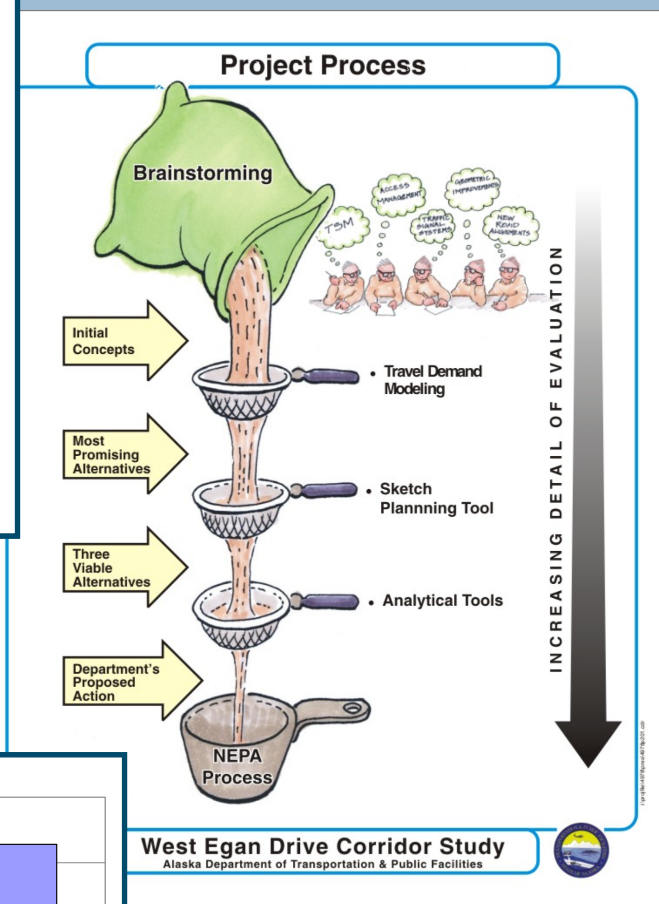
Readily-available data were all that was necessary to apply the sketch planning traffic analysis tools. Model outputs were also very straightforward and easy to understand, resulting in consistent and effective communication of key findings with decisionmakers and

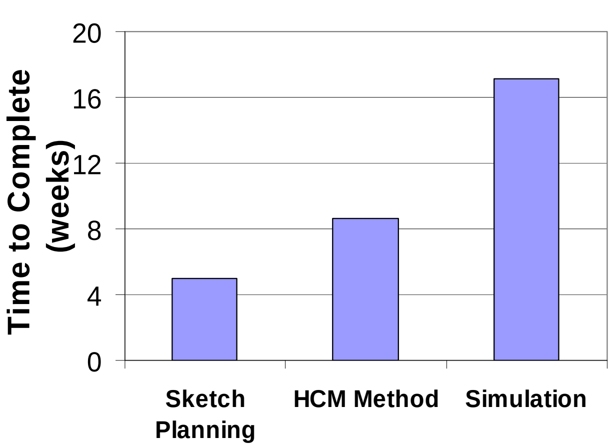
The use of the sketch planning traffic analysis tools provides basic intersection volume-to-capacity ratios and planning level intersection operational results.

With the help of these tools, numerous alternatives can be analyzed quickly and cost effectively. This allows alternatives to be discarded early in the process, with more concentrated efforts of analysis on the most viable alternative. Hence, these traffic analysis tools ensure efficient use of limited project resources.

**Assisted in Decision Making Process**

Juneau's staff were able to screen alternatives on the basis of the sketch planning traffic analysis results by considering the effectiveness of the proposed alternative in conjunction with the anticipated costs. The infeasible alternatives from a cost or objective standpoint were discarded throughout the process before more detailed analysis was completed. More detailed evaluation was undertaken only after four




**Stayed on Schedule**

Use of the sketch planning traffic analysis tool reduced the time necessary to select viable alternatives for more detailed analysis. As a result, the project was able to meet important deadlines

# 3.2 Travel Demand Modeling Case Study – Regional Plan Refinement

A regional travel demand model was used to help create a blueprint for the future transportation system in Tualatin, Oregon. Travel demand models are especially useful for this kind of activity because they take clear and direct account of the key factors that can be managed and controlled – population, employment, land use, and system characteristics. Alternative growth visions for the community were evaluated according to their impacts on congestion and quality of service.

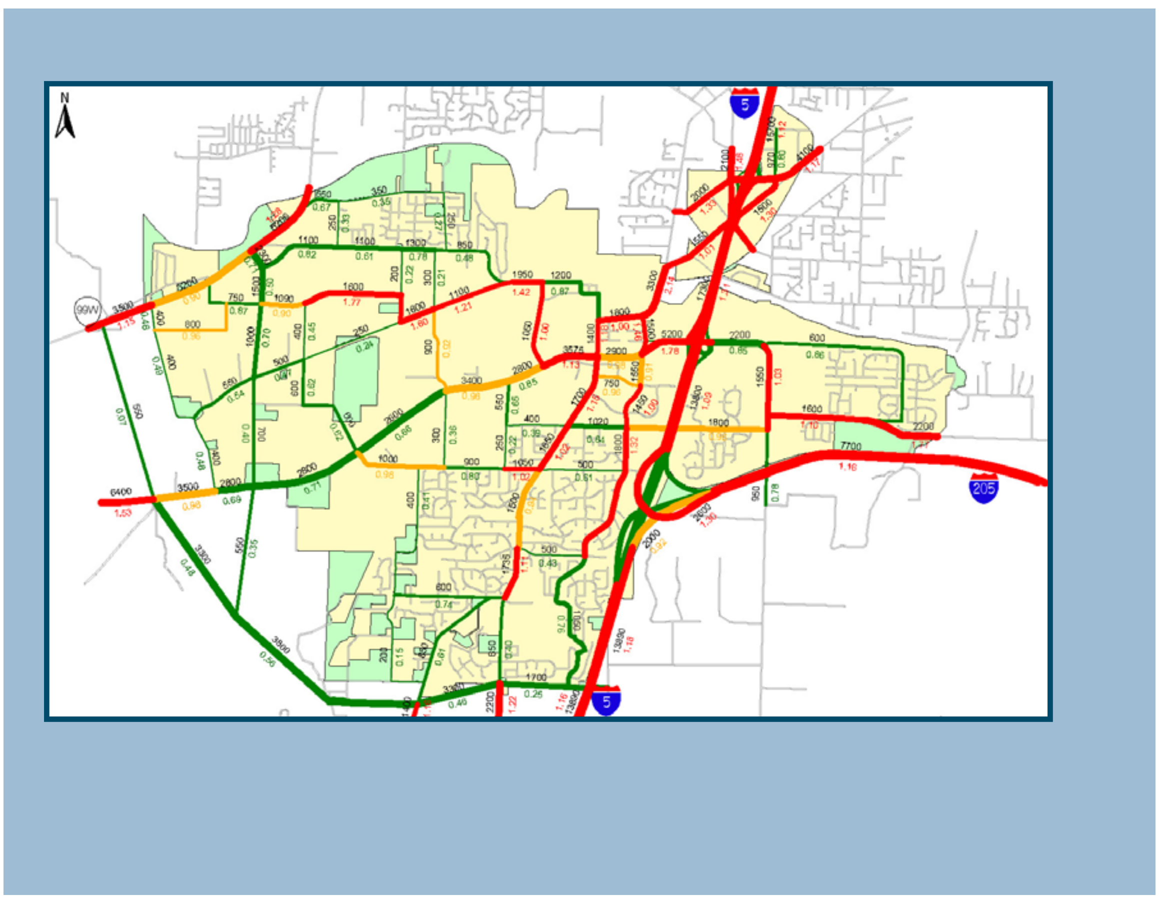
**Transportation System Plan (TSP) - Tualatin, OR**

**Key Benefits**

- Predicted how Tualatin’s transportation system will be affected by land use, demographics, and system improvements.
- Documented and quantified the benefits of future improvements.

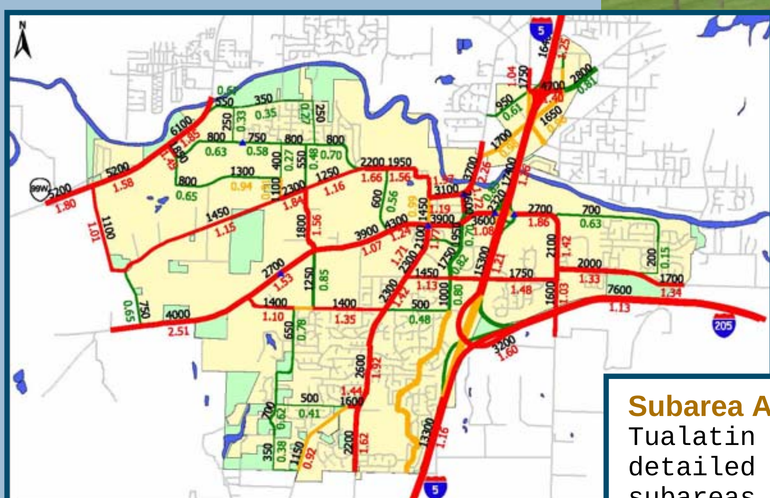
**Other Considerations**

- This type of model should be regularly updated and calibrated.



Travel demand models can also be used to predict the traffic-related effects of alternative transportation policies and projections. Their ability to quantify the impacts of a particular policy or proposed improvement on congestion, infrastructure investment requirements, access to all modes, and quality-of-life issues can help to inform the decision-making that leads to the final adopted plan.

Travel demand models do not work at a level of detail that is sufficient to design and construct the identified improvements, but they provide the essential input other traffic analysis tools will need when the design effort is underway.



**Subarea Analyses**

Tualatin needed to conduct a more detailed evaluation of several subareas within the city where zone changes were being contemplated. The travel demand forecasting model was used to "window in" on these subareas for a more refined analysis. Using this technique, the City was able to evaluate the local

**Informed decision makers**

Tualatin's key decision-makers (City Council and Planning Commission) were kept updated through regular briefings that included colorful graphics from the travel demand model, showing the effects of various policy options on key performance measures like roadway volume and congestion

# 4.0 Project Development

**A** wider range of tools with more detailed output capabilities is needed when transportation-related projects move into the development stage. Here, the focus is usually on geometric considerations, operational characteristics, or both. The practitioner will need access to a variety of analysis tools depending on accuracy and display-ability requirements of the audience. Many such tools have been developed and can be effectively applied within the realms of sketch planning, design/operational analyses, and even simulation. The table below introduces three real-world case studies used in the remainder of this chapter to demonstrate benefits that can be achieved through proper application of these tools in project development environments.

| Type of Analysis | Real-World Case Study |
|---|---|
| 4.1 Sketch Planning | Carman/Quarry/Meadows Intersection Layout and Roundabout Analysis<br>*Lake Oswego, Oregon* |
| 4.2 Operational/Design Evaluation | Bridgeport Village Shopping Center Development<br>*Tualatin, Oregon* |
| 4.3 Simulation Analysis and Display | K Street Busway Transit Alternatives Analysis<br>*Washington, DC* |

# 4.1 Sketch Planning Case Study – Intersection Layout and Roundabout Analysis

Sketch planning traffic analysis tools were used to develop design alternatives to address both operational and safety issues at the Carman/Quarry/Meadows intersection in Lake Oswego, Oregon. Using only basic turning volume information, the tools predicted the number and configuration of lanes required for different types of intersection control. This approach saved substantial time and money, and laid the groundwork for the final design activities.

**Carman/Quarry/Meadows Intersection – Lake Oswego, OR**

**Key Benefits**

- Data required is minimal and readily available in most cases
- Allowed for the consideration of multiple alternatives in a time and cost efficient manner

**Other Considerations**

- Sketch planning products can give decision makers an understanding of the big picture, even though modifications and greater detail is sometimes necessary through detailed design.


**Designing the Intersection**

Sketch planning of intersection improvements helped the public visualize the various scenarios being considered for improving safety at an all-way stop controlled intersection. The sketches illustrated specific impacts to adjacent properties and were the first step towards identifying a preferred

**Context Appropriate Alternatives**

The neighborhood and adjacent property owner’s key concerns were focused on environmental, accessibility, livability, and safety issues, as opposed to pure intersection traffic operations. As such, consideration of the surrounding system, and adjacent land uses was required to develop

## Minimum Data Required

Sketch planning allows for efficient development and comparison of project alternatives, given the minimal data and effort required. Typically, it is only necessary to use:

- Aerial photograph
- Existing right-of-way limits

## Relative Outputs

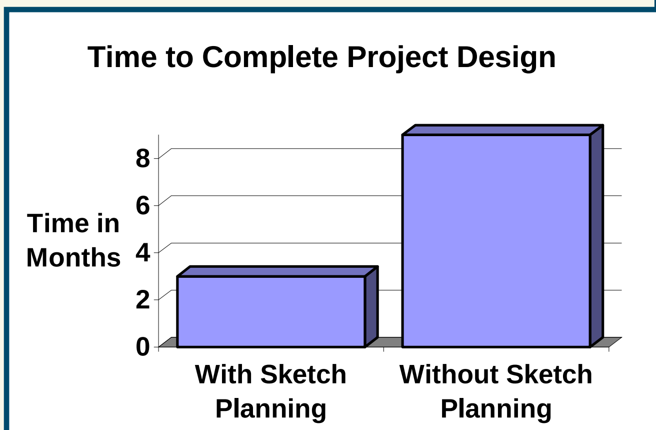
With this basic data, the sketch planning tool can determine:

- Basic geometric layouts
- Magnitude of right-of-way needs
- Property/environmental impacts
- Relative assessment of established evaluation criteria

## Time Effectiveness

Sketch planning facilitated the alternatives evaluation and decision making process in a time efficient manner:

- By reducing the initial effort involved, the decision on the preferred alternative was completed in minimal time
- For each alternative, potentially fatal feasibility issues were identified before significant time




## Cost Effectiveness

- The sketch planning tool saved engineering time as unpromising alternatives were identified and discarded in the early stages of evaluation, without requiring detailed examination or refinement to final stages of design implementation
- By minimizing the number of alternatives taken to refined evaluation and design, there was a cost savings of approximately 35% in engineering and design fees.

# 4.2 Operational/Design Case Study – Traffic Impact Study

In the project development process, HCM and/or other analytical methods provide the kind of detailed analysis that is needed to make decisions such as required number of travel lanes at intersections, length of queue storage required for each turning movement based on signal timing assumptions, and assorted other details. The detailed analysis helps provide the technical support for a list of improvements required for project development.

**Bridgeport Village Shopping Center Development, Tualatin, OR**

**Key Benefits**

- Estimated the impact of the development on the transportation network
- Considered the physical layout of improvements in concert with the analytical analysis lead to a comprehensive solution.

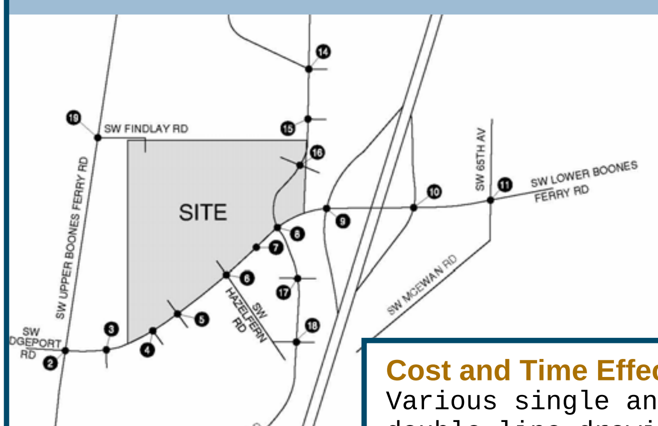
**Other Considerations**

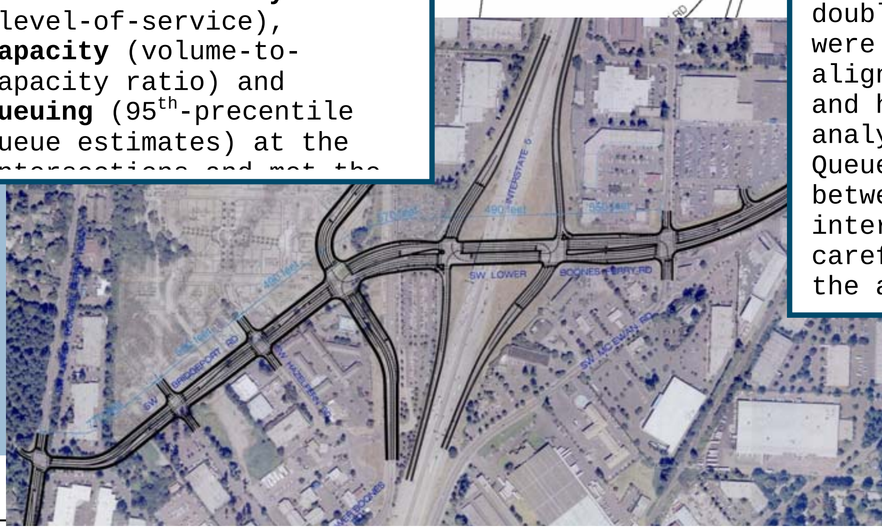
- These procedures require an iterative approach regarding assumptions for design and operations

### Adequacy of Analysis

In the Bridgeport Village project, a 466,000 sq. ft. mixed use development located adjacent to a congested interchange was being considered. The analytical method provided outputs that were adequate for evaluation of the impact of the alternatives.

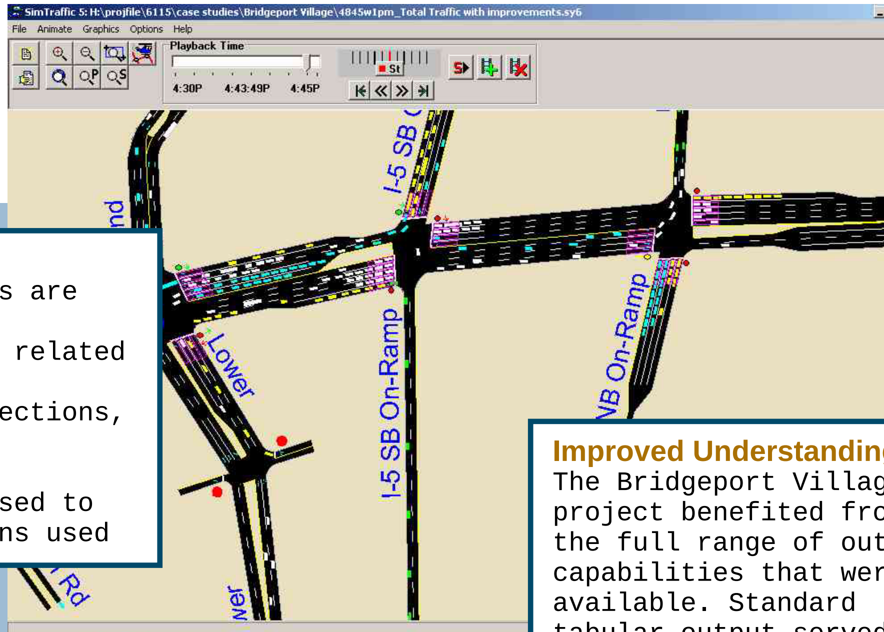
The analytical method evaluated the **delay** (level-of-service), **capacity** (volume-to-capacity ratio) and **queuing** (95th-precentile queue estimates) at the



### Cost and Time Effective

Various single and double line drawings were used to evaluate alignment alternatives and help focus the analytical analyses. Queue interactions between closely spaced intersections were carefully scrutinized in the analytical models, The analytical method can be data intensive and costly if numerous alternatives with different volumes, geometry and signal timing scenarios are to be analyzed. Significant time and budget can be saved if only the most viable alternatives are analyzed in detail.




**Queue Interaction**
The HCM procedures are insufficient for addressing issues related to closely spaced signalized intersections, and so additional modeling of queue interaction was used to confirm assumptions used

Bridgeport Village
2005 Total Traffic PM Peak Hour 1: Lower Boones Ferry & Boones Ferry

| Lane Group | EBL2 | EBL | EBR | NBL | NBT | NBR | SBL | SBT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | 0 | <1> | 0 | 1 | 1 | 1 | 1 | 1> | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | | | | |
| Storage Length (ft) | | 0 | 0 | 200 | | 250 | 175 | | | | | |
| Storage Lanes | | 0 | 0 | 1 | | 1 | 1 | | | | | |
| Total Lost Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | | |
| Leading Detector (ft) | 50 | 50 | | 50 | 50 | 50 | 50 | 50 | | | | |
| Trailing Detector (ft) | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | | | | |
| Turning Speed (mph) | 18 | 18 | 9 | 15 | | 9 | 15 | | | | | |
| Right Turn on Red | | | No | | | No | | | | | | |
| Link Speed (mph) | | 30 | | | 30 | | | 30 | | | | |
| Link Distance (ft) | | 1497 | | | 968 | | | 1633 | | | | |
| Travel Time (s) | | 34.0 | | | 22.0 | | | 37.1 | | | | |
| Volume (vph) | 10 | 5 | 10 | 5 | 655 | 520 | 60 | 835 | | | | |
| Confl. Peds. (#/hr) | | | | | | 4 | | | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| Heavy Vehicles (%) | 2% | 2% | 2% | 3% | 3% | 3% | 2% | 2% | 2% | 2% | 2% | 2% |
| Lane Group Flow (vph) | 0 | 25 | 0 | 5 | 655 | 520 | 60 | 840 | 0 | 530 | 40 | 0 |
| Act Effct Green (s) | | 7.0 | | 49.0 | 49.0 | 49.0 | 49.0 | 49.0 | | 32.0 | 32.0 | |
| Actuated g/C Ratio | | 0.07 | | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | | 0.32 | 0.32 | |
| v/c Ratio | | 0.21 | | 0.07 | 0.72 | 0.70 | 0.43 | 0.92 | | 0.94 | 0.08 | |
| Uniform Delay, d1 | | 43.8 | | 13.4 | 20.1 | 19.8 | 16.4 | 23.7 | | 33.0 | 23.7 | |
| Delay | | 43.9 | | 15.2 | 21.2 | 20.9 | 19.7 | 34.2 | | 51.0 | 24.6 | |
| LOS | | D | | B | C | C | B | C | | D | C | |
| Approach Delay | | 43.9 | | | 21.0 | | | 33.3 | | 49.1 | | |
| Approach LOS | | D | | | C | | | C | | D | | |
| Queue Length 50th (ft) | | 15 | | 2 | 317 | 247 | 24 | 477 | | 326 | 18 | |
| Queue Length 95th (ft) | | 42 | | 9 | 478 | 392 | 69 | #769 | | #549 | 44 | |
| Internal Link Dist (ft) | | 1417 | | | 888 | | | 1553 | | 2283 | | |
| | | | | 200 | | 250 | 175 | | | 175 | | |
| | | | | | 23% | 6% | | 34% | | 35% | | |
| | | | | | 33% | 23% | | 43% | | 52% | | |
| | | | | | 1 | 92 | | 23 | | 17 | | |

**Improved Understanding**
The Bridgeport Village project benefited from the full range of output capabilities that were available. Standard tabular output served to document analysis results and quantify key design parameters that would be necessary in the subsequent design effort. Visual animation was useful to both the engineers (who used it to confirm the reasonableness of input

**Pedestrian Consideration**
The HCM procedures address issues related to pedestrian timing needs at signalized intersections, which is an often-overlooked issue. In this case, pedestrian timing needs were included in the analysis and calculated

# 4.3 Traffic Simulation Model Case Study—Transit Alternatives Analysis

The K Street Busway Study assessed a proposed busway that included transit service planning and detailed simulation analysis. Simulation was used to determine the effects of street reconstruction on all modes, to contrast the alternatives, and to determine a recommended solution that met the City's policies.

**K Street Busway - Washington D.C**

**Key Benefits**

- Evaluation of impacts on all modes over several scenarios
- Efficient communication of project outcomes to stakeholders and decision makers

**Other Considerations**

- Detailed information is needed on design and operational characteristics

**Clear communication of the project**
The busway provided exclusive right-of-way for buses throughout the corridor. Animation was used to communicate the nature of the changes to the corridor to the public. Project engineers indicate that the visualization significantly improved project

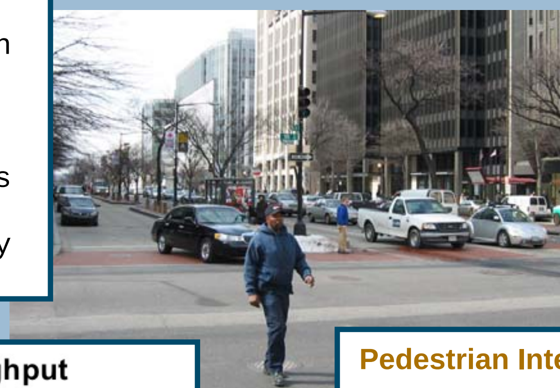
**Assessment of alternatives**
The project evaluated alternatives to improve the person carrying capacity for the K Street corridor in Washington, D.C. Transit service alternatives were tested to insure the person carrying capacity of the busway was maximized and the

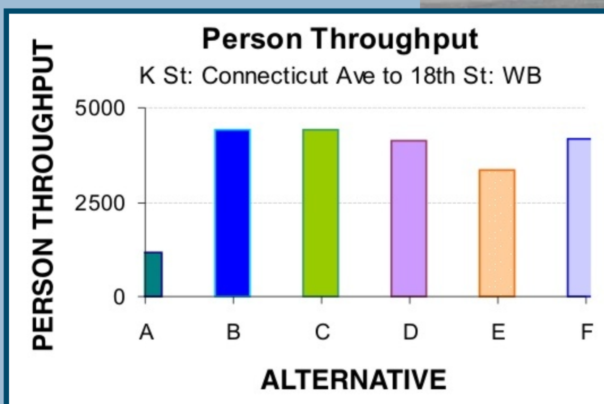
Microsimulation can assess a much wider range of issues present in the corridor including effects to general automobile traffic, pedestrians, and existing and proposed bus service. This allows for decisions to be made while considering all modes.

Another important dimension of this project is the complexity of the analyses that was performed. As a dense urban area, pedestrian interaction throughout the boulevard required careful consideration of the interaction of pedestrians and vehicle movements that are rarely encountered.

**Microsimulation**

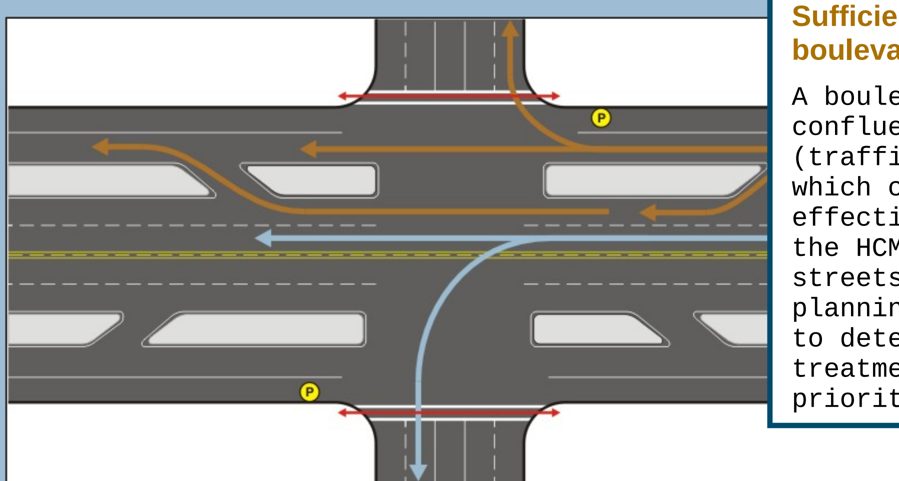
Microsimulation provided an output for assessing the capacity of a busway under a variety of scenarios, which lead to modifications to a transit service plan and transportation capacity calculations.






**Pedestrian Interaction**

Pedestrian interaction within the boulevard was carefully considered in the project because access to transit was important to the public. Pedestrian accessibility to transit was an important element in



**Sufficient analysis of a boulevard**

A boulevard is a complex confluence of movements (traffic and otherwise), which could not be effectively analyzed using the HCM procedure for urban streets. Elements of sketch planning methods were used to determine appropriate treatments of signal priority, but the simulation

# 5.0 Operational Assessments

Traffic analysis tools that can answer detailed operational questions should be in the toolbox of any practitioner who needs to get the most in capacity and performance out of the existing system. The answers these tools provide can guide the engineer and system owner toward effective solutions where expensive and significant changes to the system are just not possible. They do this by answering the detailed questions that usually control individual operational decisions: what signal phasing strategy will maximize capacity and minimize queuing? How is a tolling/inspection station best operated to maximize its throughput? Can an arterial signal system promote transit ridership and still meet the needs of other road users? What can be done to increase average travel speeds in an entire surface street network without building new roads or making any major physical improvements? A complete range of proven and fully-tested tools has been developed, and which one to use in any particular situation depends on the characteristics of the problem. The table below presents four case studies that show how some of these tools were used in real-world situations to improve performance and quality of service without the need for significant new infrastructure investments.

| Type of Analysis | Real-World Case Study |
|---|---|
| 5.1 Sketch Planning | Interchange Analysis<br>*Eugene, Oregon* |
| 5.2 HCM/Analytical Models | Queuing Analysis<br>*Ft. Hood, Texas* |
| 5.3 Simulation Models | Transit Signal Priority Evaluation<br>*Portland, Oregon* |
| 5.4 Traffic Optimization | Signal Timing Plan<br>*Ft. Myers, Florida* |

# 5.1 Sketch Planning Case Study – Interchange Analysis

A sketch planning traffic analysis tool can be an effective way to resolve signal timing issues at interchanges. This type of tool does not need an extensive amount of input data, and can be used to quickly and effectively evaluate such things as phase sequencing, number of approach lanes, and lane configuration at the signalized intersections.

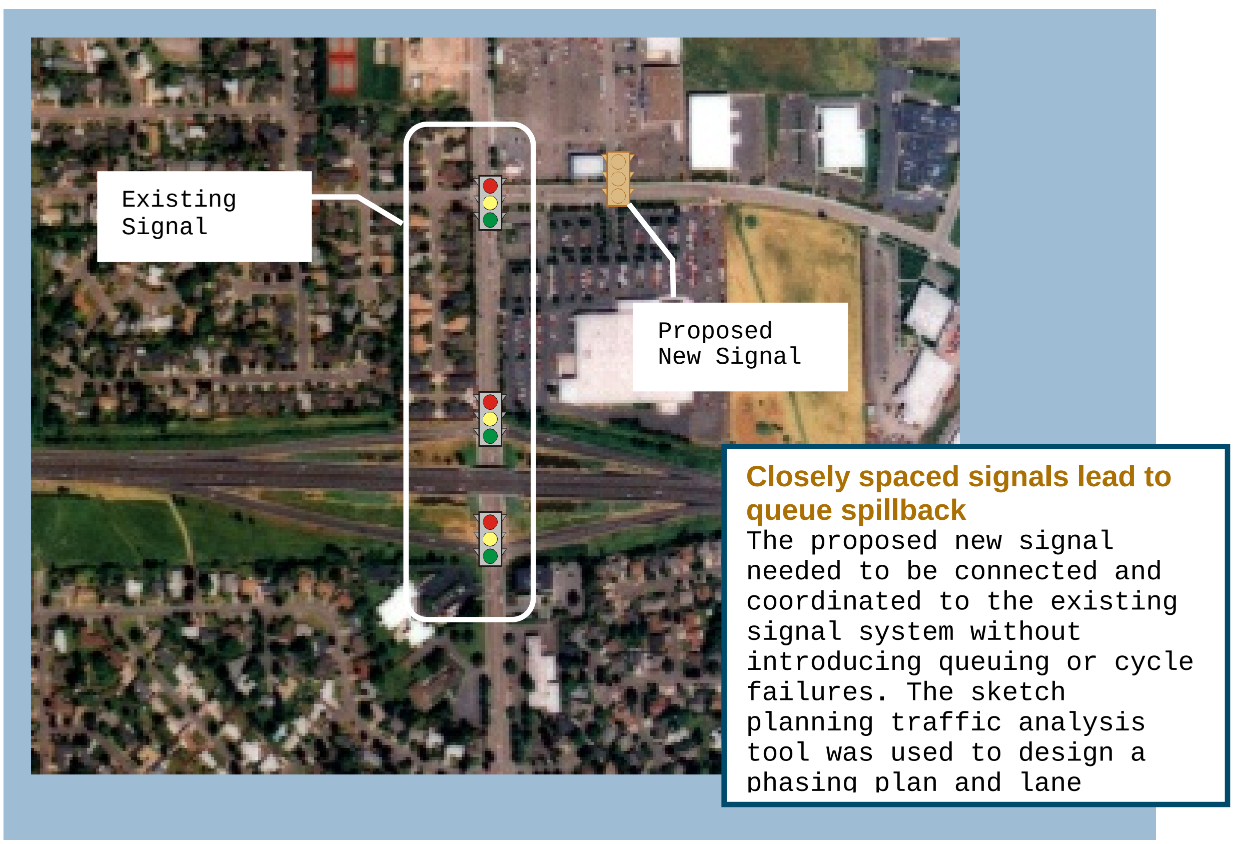
**Coburg Interchange – Eugene, OR**

**Key Benefits**

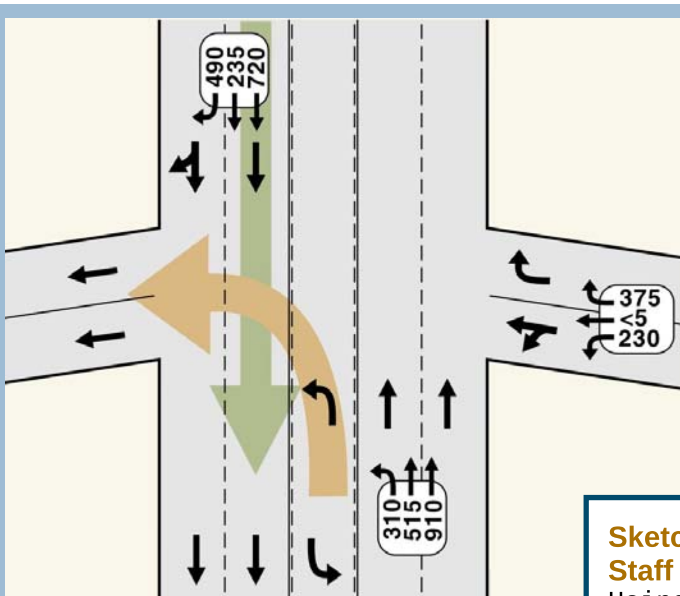
- Quickly identified the reason for long queues and the range of possible solutions
- Used data that is readily available and easy to collect
- Reduced analysis time by 50-70% compared to a standard operational analysis procedure

**Other Considerations**

- This type of traffic analysis tool provides an overall assessment of intersection operation (under-, near-, or over-capacity), but does not estimate the intersection level-of-service.



Sketch-planning traffic analysis tools only need data that are almost always readily available: hourly movement volumes, number of approach lanes, and lane control. Even though sketch-planning traffic analysis tools are not detailed enough to use in final design, their output serves as essential input to other traffic analysis tools that can be used for this purpose.

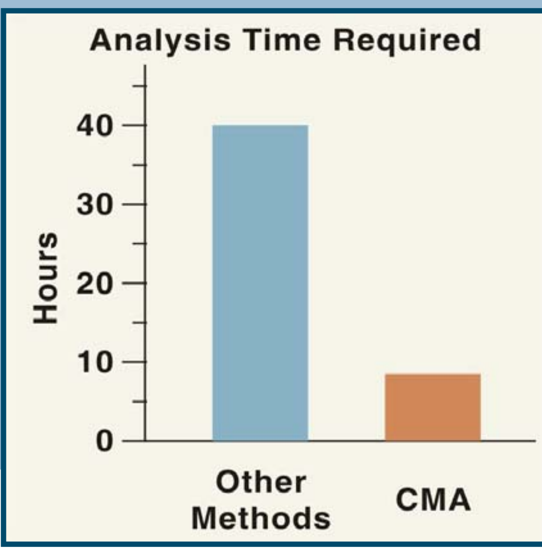



**Sufficient Data for a Solution**

Inspection of traffic volumes at the interchange showed that the existing controller phasing (starting and ending both ramps together) resulted in unnecessary congestion. By eliminating this constraint, the southbound arterial traffic was free to fill the space between the intersections,

**Sketch Planning Reduces Staff Time Required**

Using sketch planning traffic analysis tools, the Coburg Road intersection analyses were completed in 25-30 percent of the time that would have been required if the traditional traffic analysis tools had been applied, and




**Eliminate Costly Improvements**

The intersections along Coburg Road needed to meet minimum volume-to-capacity ratio (v/c) thresholds. Sketch planning traffic analysis tools were able to meet this need. As a result, the need for a $1 million interchange reconfiguration was

# 5.2 HCM/Analytical Model – Queuing Analysis

Analytical models can be used in combination with more detailed analysis procedures to provide a robust examination of complex situations. Deterministic tools such as the HCM or other analytical models are effective ways to get answers to some questions like lane control and queue space requirements. Their output is relatively easy to understand and they also provide an efficient way to compare and contrast alternatives.

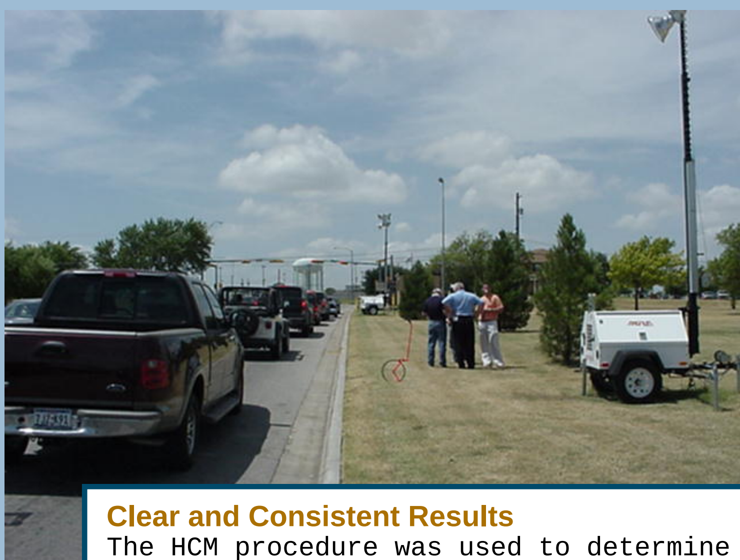
**Security Screening Analysis – Fort Hood, TX**

**Key Benefits**

- Provided visual confirmation of vehicle ingress and egress characteristics under different lane configurations
- Confirmed infrastructure needs
- Demonstrated the need for optimizing checkpoint operations and resources

**Other Considerations**

- These models require moderate to detailed amounts of data that sometimes require significant collection effort.
- Calibration of the models is important to ensure they produce consistent results.



**Consistent Evaluation**

Changes in security policies required an evaluation of the security checkpoints at the Army base in Fort Hood, Texas. Analyses were completed to optimize checkpoint operations and minimize delays across varying traffic conditions throughout a typical day. The traffic analysis tool provided a consistent frame of

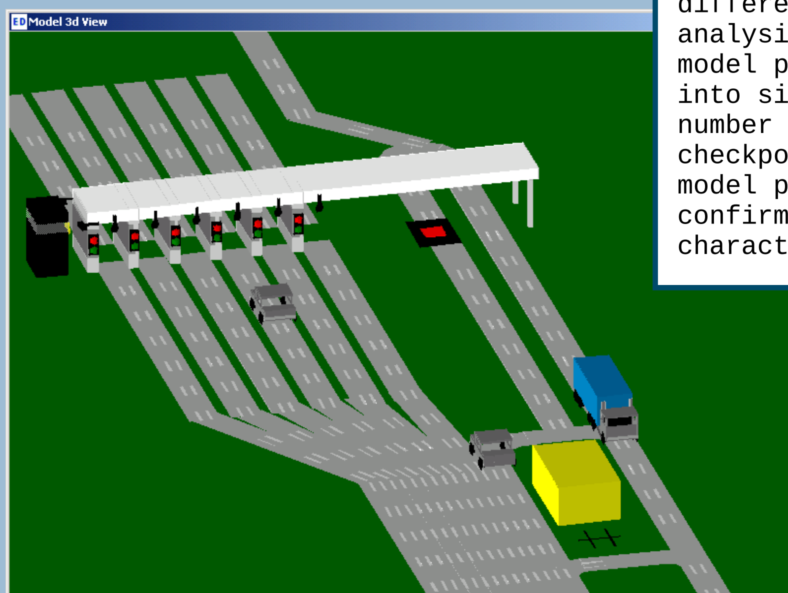
**Clear and Consistent Results**

The HCM procedure was used to determine an initial estimate for queuing based on military standards for gate processing times for several threat condition levels. Analysis results were presented in an easy-to-understand tabular format that clearly identified the effects of different options on staffing requirements and vehicle delay.

Microsimulation was subsequently used for

The output from the analytical tools can also be used as input to microscopic simulation models capable of a much more detailed analysis. For example, simulation allows visual confirmation of operating characteristics as well as examination of more detailed issues.

Base personnel used the traffic simulation model to support presentations to military officers and other key stakeholders. Ultimately, the simulation model was used to support full, detailed design of access control points.

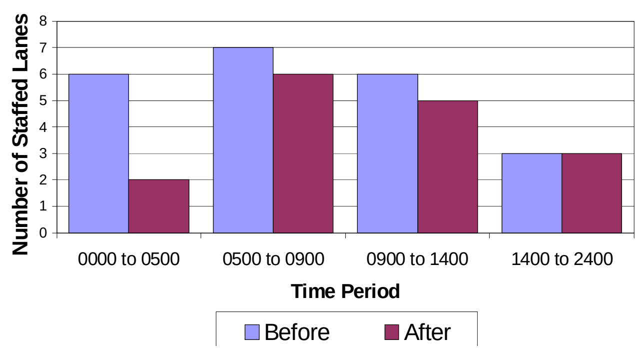



**Effective Use of Several Tools**

This project benefited significantly from the sequential application of two different levels of traffic analysis tools. The analytical model provided basic insights into sizing issues such as number of lanes and number of checkpoints. The simulation model provided visual confirmation of operating characteristics and allowed

**Development of Cost Effective Solutions**

Using these traffic analysis tools, lane configurations were developed for use in determination of staffing levels by time period. Prior to the analysis, staffing levels were overestimated and resulted in needless costs to the agency.



# 5.3 Traffic Simulation Model Case Study – Transit Signal Priority Evaluation

Microsimulation was the appropriate tool to evaluate the effects of transit signal priority strategies on traffic flow along major arterial corridors in Portland, Oregon. This is because it was able to predict important performance measures that other analysis tools could not – including, for example, vehicle delay and both on-time performance and travel time variability for various levels of bus service. Its ability to illustrate the effects of alternative control strategies through animation was a very effective way for engineers and decision-makers alike to assess the overall system performance characteristics.

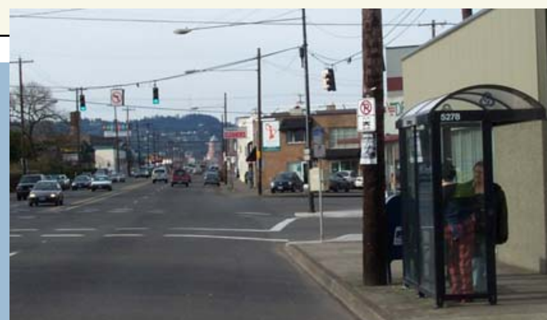
**Transit Signal Priority - Portland, OR**

**Key Benefits**

- Demonstrated how bus travel speed can be increased without significant effects on traffic flow
- Documented and quantified important operational details (queues, delay, etc.)

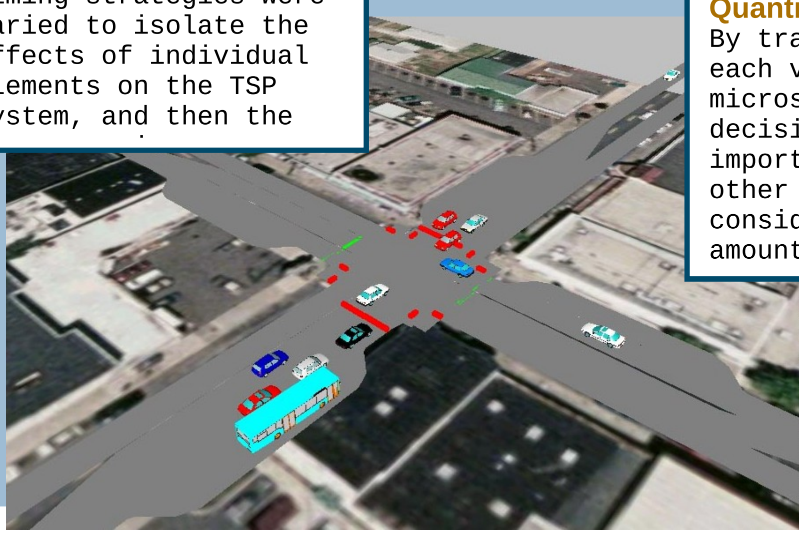
**Other Considerations**

- Effective use of microsimulation requires investment in data collection and calibration.



**Designing the system**

Microsimulation allowed the system design to be fine-tuned to meet the City of Portland's needs. Bus stop locations, stop service percentage, traffic conditions, and signal timing strategies were varied to isolate the effects of individual elements on the TSP system, and then the



**Quantifying key parameters**

By tracking the movement of each vehicle individually, microsimulation can give the decision maker a handle on important considerations that other analysis tools cannot – considerations like the amount of travel time

**Hardware-in-the loop**

Hardware-in-the-loop uses a combination of simulation software and field signal controller equipment to evaluate traffic conditions in an office setting prior to field implementation. Using this technique reduces disruptions for traffic and transit during installation and allows analysis to quantify the

**Sufficient assessment of strategies**

Use of simulation insured that limitations of the field hardware were addressed and resolved prior to implementation. This approach reduced the amount of staff time in the field required to implement the strategy,

**Controller Interface Device**


**VISSIM Simulation** **170 Traffic Controller**

**Effects of variability**

Performance of the signal priority system is dependent on the controller settings and transit operations. Reducing travel time variability is a key to improving on-time performance for transit and simulation of elements such as boarding and traffic interaction allowed assessment of key measures

# 5.4 Traffic Optimization Case Study – Signal Timing Plan Development and Implementation

**A** traffic optimization tool was used when Lee County, Florida undertook the retiming of over 100 signals along 18 arterials, including 20 signals in downtown Fort Myers. The tool was used to develop initial signal timing plans to minimize stops and delays to arterial through traffic. The plans were implemented and then fine-tuned in the field.

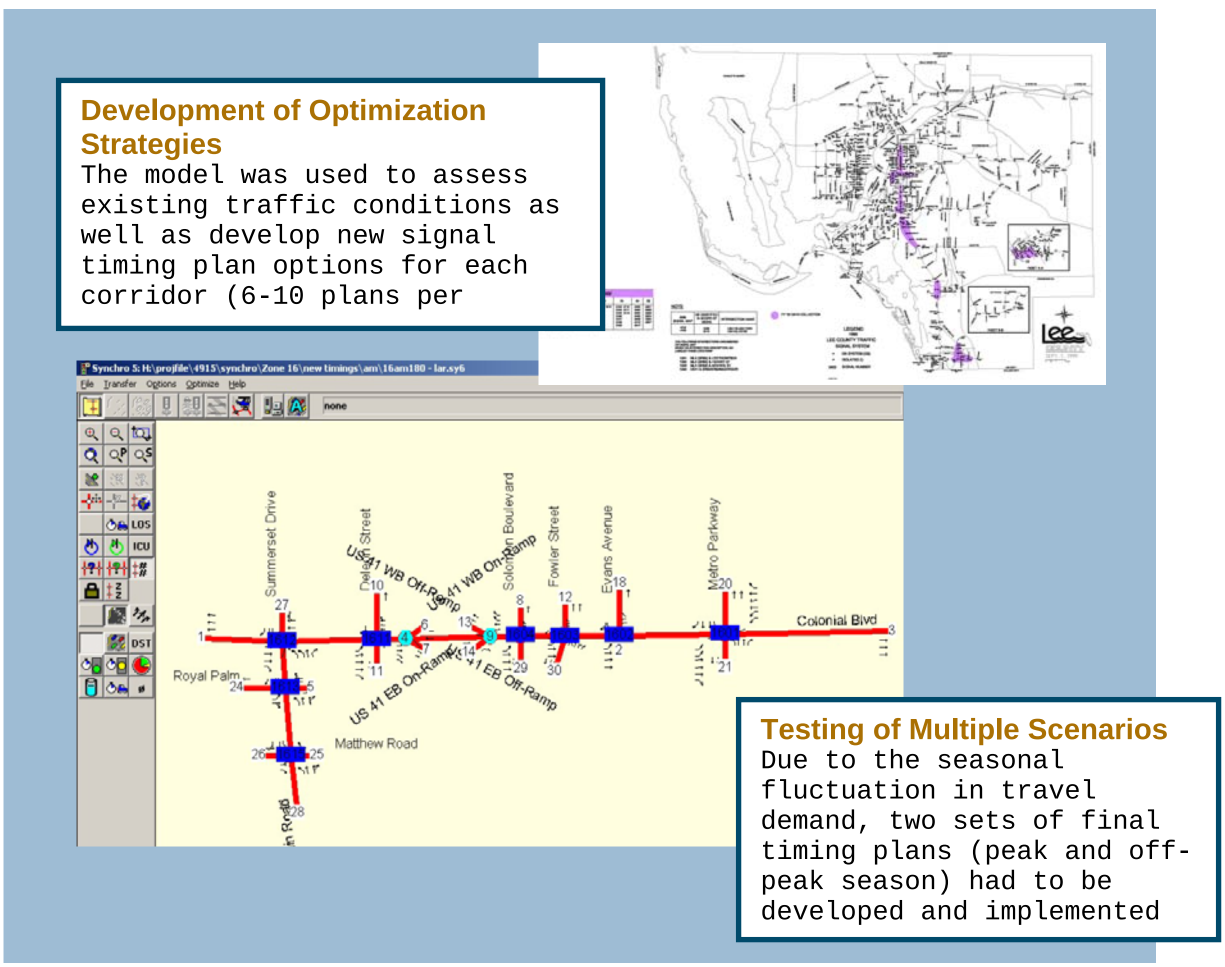
**Countywide Signal Retiming - Fort Myers, Florida**

**Key Benefits**

- Efficient way to test multiple scenarios and strategies
- Improved quality of service to road users

**Other Considerations**

- Tool must first be calibrated to field conditions to ensure the development of realistic performance expectations



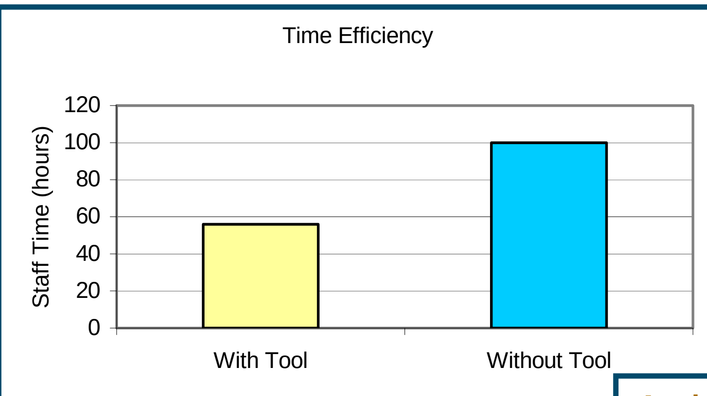
The traffic optimization tool allowed for the testing, evaluation, and refinement of multiple strategies for each scenario prior to field implementation. Visual outputs that are available from this type of tool can be useful to engineers in affirming the correctness of the input as well as in demonstrating the benefits of the new signal timing plans to others.

### Benefits Achieved

- More effective use of engineers' time
- Average peak-hour delays were reduced by 16% and stops were reduced by 22%.
- Easier field implementation

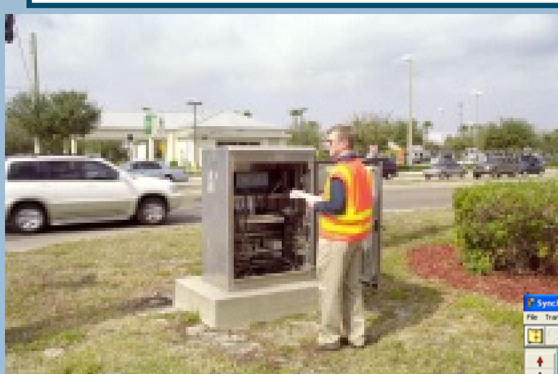
### Efficiencies Gained

Using an optimization tool gained both cost and time efficiencies by providing a means to test and refine strategies, prior to field implementation. This minimized the amount of staff time spent in the field, reduced the amount of staff time required overall, and minimized



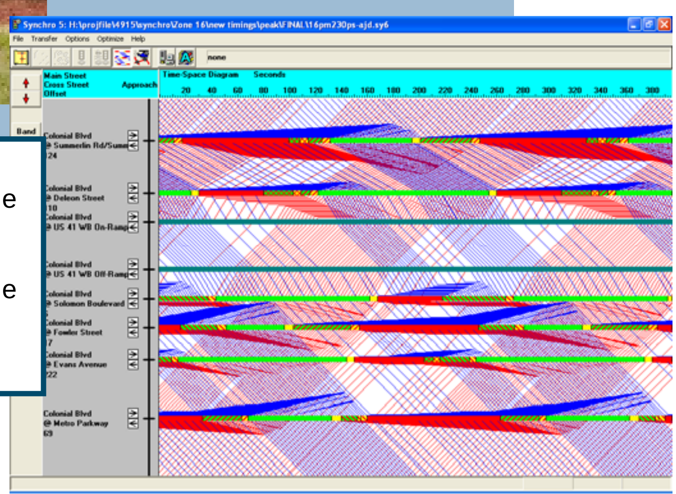

### Assistance in Decision Process

The optimization tool helped in making key project decisions by testing and evaluating multiple strategies in an efficient



### Assistance in Implementation

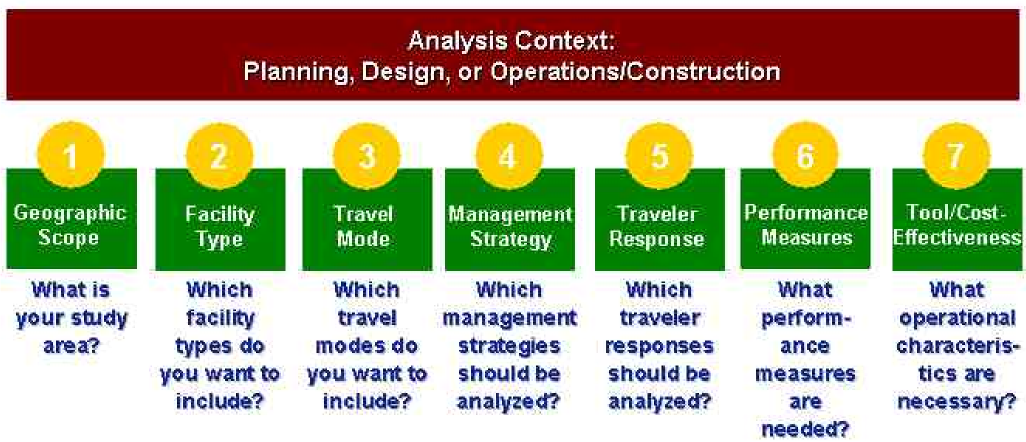
Field implementation was made easier through the tool's ability to create signal timing worksheets, time-space diagrams, and flow profiles that were then used to develop controller-ready



# 6.0 What Next?

Selecting the right traffic analysis tool for a project used to require the judgment, insight and knowledge that came only from years of experience and application. These continue to be important even today, of course, but now an expert system is also available that makes the job considerably easier. By answering a few questions about key project characteristics, the expert system will suggest the type of traffic analysis tool to get you to clear, complete, and consistent answers that are necessary for making sound transportation investment decisions in your community. What's even better, this expert system is freely available from the Federal Highway Administration; it should be a part of every transportation agency's toolbox, and it can be found at:

http://ops.fhwa.dot.gov/Travel/Traffic_Analysis_Tools/traffic_analysis_tools.htm.



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