8.0 Planning for Future Ramp Meter Deployments

8.0 Planning for Future Ramp Meter Deployments

Potential ramp metering strategies can be tested and screened using various analysis and traffic simulation packages. This section presents planning and micro-simulation tools that can be used in the context of a ramp metering deployment plan.

8.1 ITS Deployment Analysis System (IDAS)

IDAS is a sketch-planning analysis tool that can be used to estimate the impacts, benefits, and costs resulting from the deployment of ITS components and strategies, including ramp metering. IDAS operates as a post-processor to travel demand models and is used by metropolitan planning organizations (MPOs) and other agencies for transportation planning purposes.

The set of impacts evaluated by IDAS include changes in user mobility, travel time/speed, travel time reliability, fuel costs, operating costs, accident costs, emissions, and noise associated with the full spectrum of ITS components and strategies from ramp metering to traveler information systems. IDAS also provides benefit/cost comparisons of various ITS improvements individually or in combination.

Table 8.1 lists the different ITS components that can be analyzed in IDAS. Ramp metering analysis may be conducted in IDAS, requiring identification of metered ramps and affected freeway links, as well as input of ramp metering parameters. Then IDAS can be used to answer the following metering deployment questions:

- What types of impacts/benefits result from the deployment of different types of ramp metering?
- Which ramp metering deployment provides the greatest benefits for the region?
- On which facilities does the deployment of metering provide the greatest level of benefits?
- At which geographic locations does the deployment of metering provide the greatest level of benefits?
- What is the impact of combining different types of ITS components?

Table 8.1 ITS Components in IDAS

Arterial Traffic Management Systems

- Isolated Traffic Actuated Signals
- Preset Corridor Signal Coordination
- Actuated Corridor Signal Coordination
- Central Control Signal Coordination
- Emergency Vehicle Signal Priority
- Transit Vehicle Signal Priority

Freeway Management Systems

- Pre-set Ramp Metering
- Traffic Actuated Ramp Metering
- Centrally Controlled Ramp Metering

Advanced Public Transit Systems

- Fixed Route Transit – Automated Scheduling System
- Fixed Route Transit – Automatic Vehicle Location
- Fixed Route Transit – Combination Automated Scheduling System and Automatic Vehicle Location
- Fixed Route Transit – Security Systems
- Paratransit – Automated Scheduling System
- Paratransit – Automatic Vehicle Location
- Paratransit – Automated Scheduling System and Automatic Vehicle Location

Incident Management Systems

- Incident Detection/Verification
- Incident Response/Management
- Incident Detection/Verification/Response/ Management combined

Electronic Payment Systems

- Electronic Transit Fare Payment
- Basic Electronic Toll Collection

Railroad Grade Crossing Monitors

Emergency Management Services

- Emergency Vehicle Control Service
- Emergency Vehicle AVL
- In-Vehicle Mayday System

Regional Multimodal Traveler Information Systems

- Highway Advisory Radio
- Freeway Dynamic Message Sign
- Transit Dynamic Message Sign

Regional Multimodal Traveler Information Systems (continued)

- Telephone-Based Traveler Information System
- Web/Internet-Based Traveler Information System
- Kiosk with Multimodal Traveler Information
- Kiosk with Transit-only Traveler Information
- Handheld Personal Device – Traveler Information Only
- Handheld Personal Device – Traveler Information with Route Guidance
- In-Vehicle – Traveler Information Only
- In-Vehicle – Traveler Information with Route Guidance

Commercial Vehicle Operations

- Electronic Screening
- Weigh-in-Motion
- Electronic Clearance – Credentials
- Electronic Clearance – Safety Inspection
- Electronic Screening/Clearance combined
- Safety Information Exchange
- On-board Safety Monitoring
- Electronic Roadside Safety Inspection
- Hazardous Materials Incident Response

Advanced Vehicle Control and Safety Systems

- Motorist Warning – Ramp Rollover
- Motorist Warning – Downhill Speed
- Longitudinal Collision Avoidance
- Lateral Collision Avoidance
- Intersection Collision Avoidance
- Vision Enhancement for Crashes
- Safety Readiness

Supporting Deployments

- Traffic Management Center
- Transit Management Center
- Emergency Management Center
- Traffic Surveillance – CCTV
- Traffic Surveillance – Loop Detector System
- Traffic Surveillance – Probe System
- Basic Vehicle Communication
- Roadway Loop Detector
- Information Service Provider Center

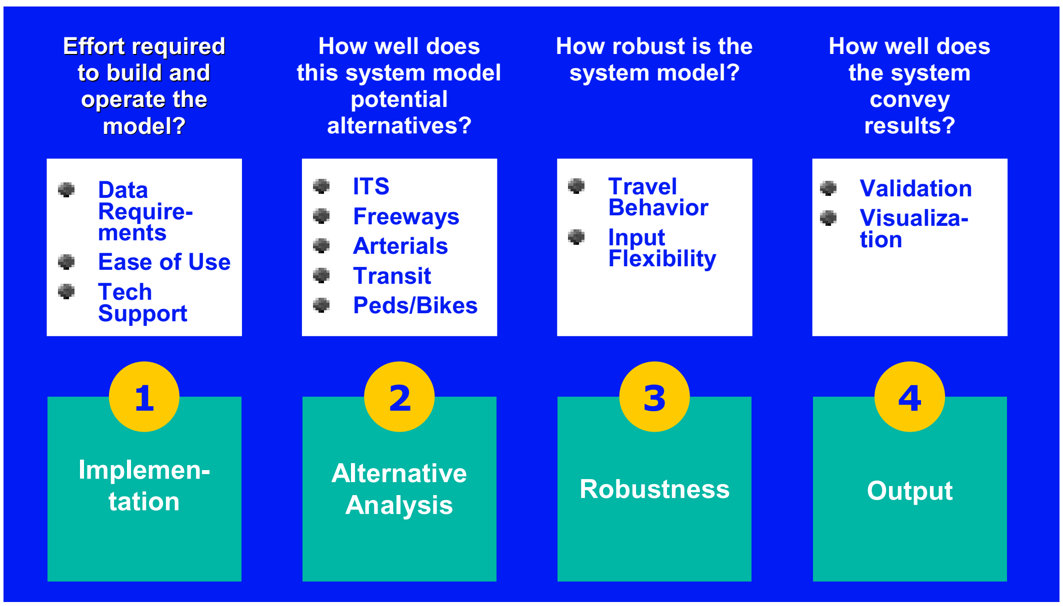
Generic Deployments

- Link-based
- Zone-based

8.2 Traffic Simulation Tools

IDAS is not intended to be used as a design tool to evaluate infrastructure modifications or to optimize ramp meter operations. A traffic simulation model is more appropriate for obtaining more detailed analysis of the planned metering deployment. In this section, three traffic simulation tools are being evaluated for ramp metering analysis, including Paramics, VISSIM, and CORSIM. Figure 8.1 presents the criteria used in evaluating these tools. The following sections present brief overviews of each traffic simulation tool, which are also summarized in Table 8.2.

Figure 8.1 Simulation Tool Evaluation Criteria



8.2.1 Paramics

Paramics is a suite of simulation tools designed to model the movement and behavior of individual vehicles on urban and highway road networks. It consists of Paramics Modeler, Paramics Processor, and Paramics Analyzer; each designed to build, run, and view the networks, respectively. Figure 8.2 illustrates a sample view of Paramics.

Paramics has a smaller program size, is easier to use, and provides for an advanced ability to model driver behavior and individual vehicles. To work properly, networks must be built in detail, which requires more input data and manpower effort than the other simulation tools. However, Paramics has an established customer support group and a well-maintained official web site to attend to customer inquiries.

Table 8.2 Simulation Tool Comparison

Category	Task	Paramics	VISSIM	CORSIM
Data requirements	Import capabilities	Poor	Poor	Average
	Network geometry	Extensive	Average	Minimal
	Trip distribution	Good	Average	Good
	Transit	Poor	Average	Poor
	Parking	Poor	Average	Good
	Driver behavior	Good	Average	Poor
Ease of use	User interface	Good	Average	Good
	Stability	Average	Average	Average
	Customer support	Average	Average	Average
	Cost	High	High	Low
ITS modeling capabilities	Transit signal priority	Good	Good	Poor
	Ramp metering	Good	Average	Average
	Variable message signs	Good	Average	Poor
	Traffic signal coordination	Average	Good	Good
	Interchanges	Good	Average	Average
	Loop detectors	Good	Good	Average
	Incident management	Good	Poor	Poor
	Electronic toll collection	Average	Poor	Poor
	In-vehicle messaging	Good	Good	Poor
Transit modeling capabilities	Bus transit	Average	Good	Poor
	Bus lanes	Average	Good	Poor
Traveler response modeling capabilities	Route diversion and traffic assignment	Good	Average	N/A
	Mode shift	Poor	Average	N/A
	Temporal diversion	Poor	Poor	N/A
	Induced demand	Poor	Poor	N/A
	Queues	Good	Good	Good
	Travel times	Good	Good	Good
Input flexibility	Vehicle types	Good	Good	Good
	Driver type settings	Good	Average	Poor
	Pedestrian/cyclist	Poor	Good	Poor
	Travel lanes modeled	Good	Good	Average
Validation	VMT, VHT	Good	Good	N/A
	Link volumes	Good	Good	Good
	Turn volumes	Good	Good	Good
	Link speeds	Good	Good	Good
	Trip tracking	Good	Average	N/A
Visualization	Scale	Good	Average	Poor
	Realism of animation	Good	Good	Good
	Image quality	Good	Good	Good
	Perspective	Good	Good	Average
	Travel modes	Poor	Good	Poor
	Simultaneous simulation	Good	Poor	N/A

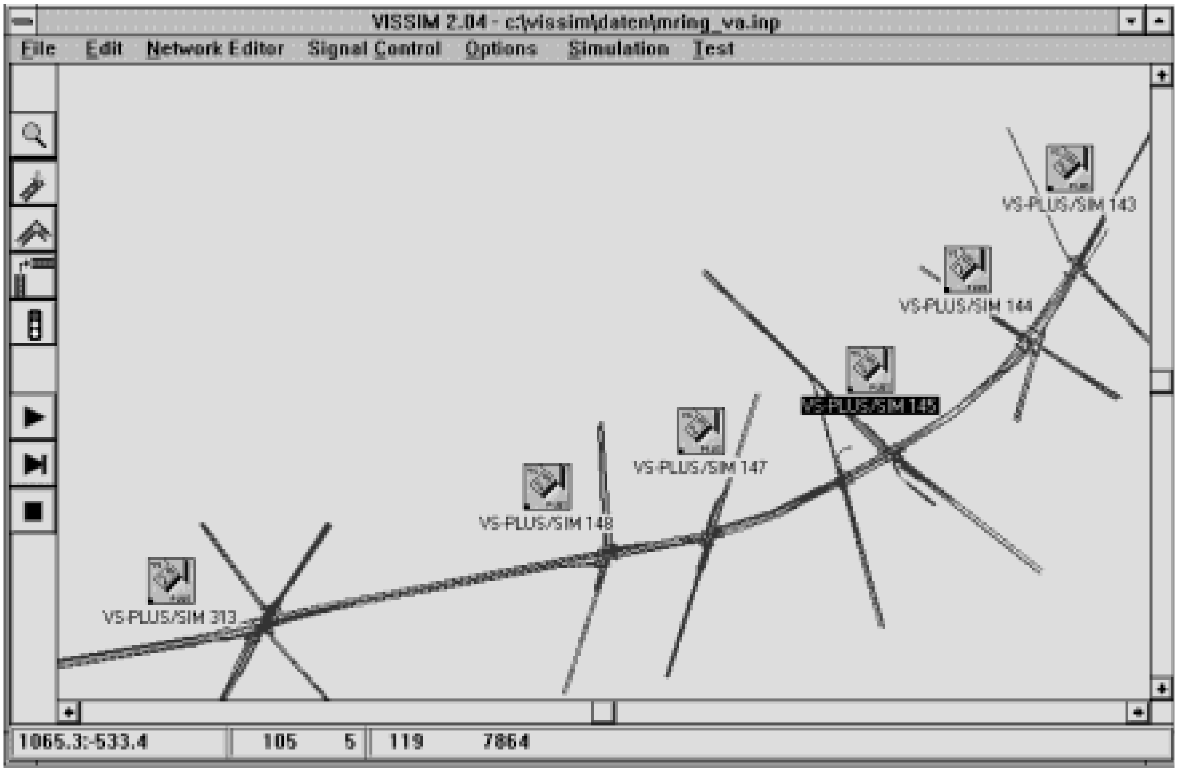
Figure 8.2 Sample View of Paramics

Paramics can simulate route diversion between freeways and arterials with relative ease – an important component in ramp metering evaluations to estimate traffic diversion on parallel arterials due to ramp delays. It can also effectively simulate fixed-time ramp metering operations, but a separate "programmer's license" and a custom plug-in software must be developed to be able to simulate more advanced ramp metering strategies. It also features 3-D views and car tracking modes for presentation purposes.

8.2.2 VISSIM

VISSIM is another established simulation tool that may be used to evaluate ramp metering operations. Originally built to evaluate alternative transportation operations, such as transit, bicycles, and pedestrians, VISSIM may not be as robust in modeling freeway operations. Trip distributions are done through turn tables as opposed to zone-to-zone volumes, and network construction is simpler than Paramics. Figure 8.3 shows a sample view of VISSIM.

Figure 8.3 Sample View of VISSIM



VISSIM is a simpler tool, which makes it easier to learn, and requires less input. It is relatively easy to use with many project examples to draw upon for guidance. Unfortunately, few ITS components can be directly modeled in VISSIM. VISSIM also does a good job handling the input and producing a variety of simulation output in multiple formats, and its visualization tools are good.

8.2.3 CORSIM

CORSIM was developed by the FHWA to simulate freeway and highway networks. This tool is very robust when used to evaluate intersections and general freeway operations, but it does not simulate ITS components well. In its recent assessment, the FHWA has decided to depart the role of model developer in the commercial market, and instead pursue a greater role in facilitating the private markets, making the future status of CORSIM's technical support questionable. In sum, CORSIM may not be the best tool available for simulating ramp meter operations. While clearly more widely used as a simulation tool, the unique nature of the ramp metering planning process requires a more robust tool than CORSIM.