Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA/TX-05/0-4160-21		

4. Title and Subtitle DECISION FRAMEWORK FOR SELECTION OF MANAGED LANES STRATEGIES	5. Report Date July 2005 Resubmitted: November 2005
	6. Performing Organization Code
7. Author(s) Grant Fisher and Ginger Goodin	8. Performing Organization Report No. Report 0-4160-21
9. Performing Organization Name and Address Texas Transportation Institute The Texas A&M University System College Station, Texas 77843-3135	10. Work Unit No. (TRAIS)
	11. Contract or Grant No. Project 0-4160
12. Sponsoring Agency Name and Address Texas Department of Transportation Research and Technology Implementation Office P. O. Box 5080 Austin, Texas 78763-5080	13. Type of Report and Period Covered Technical Report: September 2003 - May 2005
	14. Sponsoring Agency Code

15. Supplementary Notes

Project performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration.
Project Title: Operating Freeways with Managed Lanes – Task 6: Decision Matrix
URL: http://tti.tamu.edu/documents/0-4160-21.pdf

16. Abstract

This report documents the development of a decision support methodology that accomplishes two objectives: (1) sorts out the relationships between managed lanes concepts and strategies, and (2) maps the knowledge territory in order to identify gaps. In conjunction with this particular research task, a user-friendly preliminary screening tool has been developed to assist the Texas Department of Transportation (TxDOT) in identifying managed lanes strategy options very early in the conceptual planning process. The framework for the decision support methodology is the backbone for the Managed Lanes Handbook, which offers the resources and guidance to develop a managed lanes project, addressing characteristics unique to individual facilities.

This report also summarizes the evolution of managed lanes in Texas over the last five years, the legislative initiatives that have shaped TxDOT's current approach to implementation, and the gaps in the knowledge base that still leave many questions unanswered. At the national level managed lanes are a relatively new and emerging concept. However, TxDOT has led the nation in research and development with two high-occupancy toll (HOT) lanes and 10 freeway high-occupancy vehicle (HOV) facilities in operation and over a dozen managed lanes projects currently under development in 10 Texas cities. Even with the experience to date, there are still many unanswered questions related to the long-term operation of managed lanes and numerous unknown factors that will require further research and documented practical experience through diligent monitoring and evaluation of facilities as they are implemented.

17. Key Words	18. Distribution Statement
Managed Lanes, Express Toll Lanes, HOV Lanes, HOT Lanes, Express Lanes, Exclusive Transitways, Dedicated Truck Lanes, Exclusive Truck Lanes, Truck Restricted Lanes	No restrictions. This document is available to the public through NTIS: National Technical Information Service Springfield, Virginia 22161 http://www.ntis.gov

19. Security Classif.(of this report)	20. Security Classif.(of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	56	

Form DOT F 1700.7 (8-72) **Reproduction of completed page authorized**

DECISION FRAMEWORK FOR SELECTION OF MANAGED LANES STRATEGIES

by

Grant Fisher
Student Technician IV
Texas Transportation Institute

and

Ginger Goodin
Research Engineer
Texas Transportation Institute

Report 0-4160-21
Project 0-4160
Project Title: Operating Freeways with Managed Lanes – Task 6: Decision Matrix

Performed in Cooperation with the
Texas Department of Transportation
and the
Federal Highway Administration

July 2005
Resubmitted: November 2005

TEXAS TRANSPORTATION INSTITUTE
The Texas A&M University System
College Station, Texas 77843-3135

DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Federal Highway Administration (FHWA) or the Texas Department of Transportation (TxDOT). This report does not constitute a standard, specification, or regulation. The engineer in charge was Ginger Goodin, Texas P.E. # 64560.

ACKNOWLEDGMENTS

This project was conducted in cooperation with TxDOT and FHWA. The authors would like to thank the research program coordinator Gary K. Trietsch, Houston District Engineer, and project director Carlos Lopez, Director of Traffic Operations Division (TRF) of TxDOT, for their leadership and guidance. The authors are also grateful to John Wikander and Heather Ford of the Texas Transportation Institute, who supported this task.

Additionally, the authors would like to extend their sincere appreciation to members of the Project Monitoring Committee, TxDOT Research and Technology Implementation Office (RTI) staff, and TxDOT Managed Lanes Project Managers Committee from across the state, who offered thoughtful insight vital to the research. The research team thanks the following individuals for their participation on these committees:

- Wade Odell, P.E., RTI, TxDOT
- Andrew Griffith, RTI, TxDOT
- Sharon Barta, RTI, TxDOT
- Alex Powers, TRF, TxDOT
- Joseph Carrizales, P.E., Austin District, TxDOT
- Thien Nguyen, Austin District, TxDOT
- Diana Schulze, Austin District, TxDOT
- Matt MacGregor, Dallas District, TxDOT
- Marty Boyd, P.E., El Paso District, TxDOT
- Mohammed Al Hweil, Ft. Worth District, TxDOT
- Curtis Hanan, Ft. Worth District, TxDOT
- Greg Ofield, P.E., Houston District, TxDOT
- Roger Gonzalez, Houston District, TxDOT
- Hassan Nikooei, Houston District, TxDOT
- Jennifer Moczygemba, San Antonio District, TxDOT
- Judy Friesenhahn, P.E., San Antonio District, TxDOT
- Brian Fariello, San Antonio District, TxDOT
- Julie Brown, P.E., San Antonio District, TxDOT
- Frank Fonseco, San Antonio District, TxDOT

- Randy Redmond, Tyler District, TxDOT
- John Obr, Waco District, TxDOT
- Alisa Polansky, Waco District, TxDOT
- Reggie Richardson, Waco District, TxDOT
- David Neumann, Waco District, TxDOT
- Charles H. Berry, P.E., El Paso District, TxDOT
- David B. Casteel, P.E., San Antonio District, TxDOT
- Maribel P. Chavez, P.E., Fort Worth District, TxDOT
- Robert B. Daigh, P.E., Austin, TxDOT
- Clint Jumper, P.E., Traffic Operations Division, TxDOT
- William L. Hale, P.E., Dallas District, TxDOT
- Mark A. Marek, P.E., Design Division, TxDOT
- Mary M. Owen, P.E., Tyler District, TxDOT
- James Randall, Transportation Planning and Programming Division, TxDOT
- Carol Rawson, P.E., Traffic Operations Division, TxDOT
- Phillip Russell, P.E., Texas Turnpike Authority, TxDOT
- Amadeo Saenz, Jr., P.E., Assistant Executive Director for Engineering Operations, TxDOT
- Richard Skopik, P.E., Waco District, TxDOT

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

CHAPTER 1: INTRODUCTION

PURPOSE OF STUDY

This report documents one task in the managed lanes research effort to develop a decision support methodology – also known as the "decision matrix" – that accomplishes two objectives:

- sorts out relationships between managed lanes concepts and strategies; and
- maps the knowledge territory, identifying gaps in knowledge.

The framework for the decision support methodology is the backbone for the managed lanes handbook, which offers the resources and guidance to develop a managed lanes project, addressing characteristics unique to individual facilities. In conjunction with this research task, a user-friendly preliminary screening tool has been developed to assist the Texas Department of Transportation (TxDOT) project managers with identifying managed lanes strategy options very early in the conceptual planning process.

This report also summarizes the evolution of managed lanes in Texas over the last five years and the legislative initiatives that have shaped TxDOT's current approach to implementation of managed lanes facilities. Although managed lanes is a newly emerging concept nationally, TxDOT has led the nation in research and development of facilities with two high-occupancy toll (HOT) lanes and 10 freeway high-occupancy vehicle (HOV) facilities in operation and over a dozen managed lanes projects currently under development in 10 Texas cities. Even with the research developed to date and the hands-on experience of TxDOT project managers, there are still many unanswered questions related to the long-term operation of managed lanes facilities and unknown factors that will require further research and documented practice through diligent monitoring and evaluation of facilities as they are implemented.

OVERVIEW OF MANAGED LANES

The term *managed lanes* evokes different meanings and connotations depending on the public agency or individual project. There is no nationally recognized definition of managed lanes. However, TxDOT developed a definition in 2000 in conjunction with this research project that serves as the agency's official definition. It defines managed lanes in very broad terms to allow flexibility within the diverse urban areas across the state:

> "A managed lane facility is one that increases freeway efficiency by packaging various operational and design actions. Lane management operations may be adjusted at any time to better match regional goals *(1)*."

As specific managed lanes projects in Texas undergo the planning and design process, the definition has been tailored to address specific project needs. For example, the following variation on the TxDOT definition was developed for the I-635 (LBJ) managed lanes project in Dallas:

> "Managed lanes increase freeway efficiency by offering a predictable trip with little congestion for those who carpool, ride bus transit, vanpool, ride a motorcycle or if driving alone, are willing to pay a toll. Lane management operations and pricing structure may be adjusted at any time to better serve modal needs *(2)*."

This project definition narrows the broad statewide definition by specifically addressing priority user groups and the use of pricing as a means to achieve objectives for the LBJ managed lanes project.

Figure 1 is a diagram that captures the potential lane management applications that fall into this broad definition of managed lanes. On the left of the diagram are the applications of a single operational strategy – pricing, vehicle eligibility, or access control – and on the right are the more complicated managed lanes facilities that blend more than one of these strategies. The multifaceted facilities on the far right of the diagram are those that incorporate or blend multiple lane management strategies.

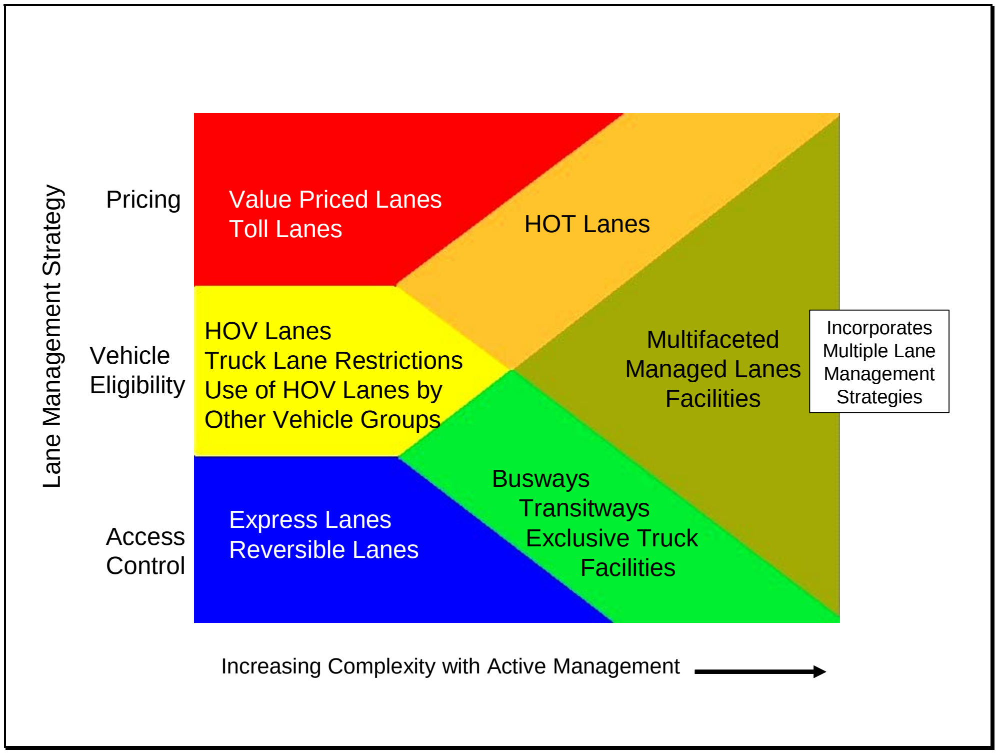

Figure 1. Types of Managed Lanes *(3)*.

The Federal Highway Administration (FHWA) also views managed lanes in this broad sense, as highway facilities or a set of lanes where operational strategies are proactively (real-time) implemented and managed in response to changing conditions *(3)*. Agencies have used lane management strategies for decades to improve flow on freeway facilities. The distinction between managed lanes and other traditional forms of freeway lane management is the operating philosophy of "active management." Under this philosophy, the operating agency proactively manages demand and available capacity on the facility by applying new strategies or modifying existing strategies. The agency defines from the outset the operating objectives for the managed lanes and the kinds of actions that will be taken once predefined performance thresholds are met. The following examples show how demand on a managed lane facility can be reduced through a specific action:

- To maintain a speed of 60 mph, the operating agency raises the toll rate on a priced facility.
- To ensure that bus operating speeds of 50 mph can be maintained, the agency raises the occupancy requirement to use a HOV lane.

- To operate within a volume threshold of 1500 vehicles per hour per lane, the agency closes an on-ramp to express lanes during peak periods.

At the core of the active management philosophy is the development of clear performance objectives and operating threshold values that directly relate to the goals of the project. Additionally, a managed lane facility can be designed and operated to achieve different objectives during different days of the week or different times of the day. For example, a facility could operate as a HOV or HOT lane during peak periods, toll express lanes during off-peaks, and potentially serve as a truck-only facility at certain times of the day.

Candidate Strategies for Managed Lanes in Texas

The managed lanes strategies that have been defined for this project effort are provided in Table 1.

Table 1. Descriptions of Managed Lanes Strategies.

Managed Lanes Strategy	Description
Express Toll Lanes	Separated lanes with limited access where all vehicles pay a toll.
HOV Lanes	Lanes that only allow vehicles that meet or exceed a required number of occupants.
HOT Lanes	HOV lanes that allow vehicles that do not meet the occupancy requirement to use the lanes for a fee or toll.
Express Lanes (non-tolled)	Separated lanes with limited access and no toll charged.
Exclusive Transitways	Lanes or roadways that exclusively serve buses.
Exclusive or Dedicated Truck Lanes	Dedicated lanes in which only large trucks are permitted.
Truck Restricted Lanes	Lanes of the roadway in which large trucks are restricted.

It is important to note that “Express Toll Lanes” can be value priced with variable tolling or operated with a flat toll schedule that does not vary by time of day. As a result, there may be slight variations in the objectives that can be addressed by the two facility types, namely that the variable priced facility can offer greater assurance of free flow speed and travel time reliability.

POLICY AND LEGISLATIVE FRAMEWORK FOR MANAGED LANES STRATEGY SELECTION

Motivation for managed lanes has evolved in Texas since the beginning of this research project in 2000. Early emphasis was placed on a broad definition of managed lanes that embraces multiple operating strategies, with pricing (specifically variable toll rates) viewed primarily as one of a number of demand management techniques. At that time, little importance was placed on revenue implications. With the passage of HB 3588 by the Texas Legislature in 2003 – legislation that instituted broad sweeping changes in the way Texas highways are financed – a philosophical shift has taken place in the view of managed lanes in the state. The new view of managed lanes places greater emphasis on pricing as a means to offset implementation and operating costs.

Most urban areas in Texas are now evaluating managed lanes in existing highway corridors, partially as a means to offer travel options but with greater interest as a mechanism to implement new departmental policy that requires all new capacity to be evaluated for tolling. Revenue expectations for managed lanes have been predictably low, particularly for single-lane directional facilities, and cost recovery has traditionally assumed to be at a level that covers operations and possibly a small portion of capital costs. TxDOT has nonetheless adopted the approach that revenue generated from tolling new lanes is a prudent policy, in that it frees up funding that would have otherwise been needed for operations and maintenance of the facility. The far-reaching and rapid paradigm shift within the department has translated into an evolution of the original expectations of the research project since its inception five years ago. The philosophical shift, however, has potentially led to more widespread implementation of managed lanes in Texas than would have otherwise naturally developed, albeit with a greater emphasis on the revenue-producing benefits of the facility.

As the managed lanes philosophy in Texas has evolved, the resulting “decision matrix” or strategy selection methodology developed under this research task represents TxDOT’s policies toward tolling and managed lanes.

CHAPTER 2:
MANAGED LANES DEVELOPMENT PROCESS

The first step in developing a decision support process was the construction of the flow chart presented in Figure 2. The flow chart maps the general project development process with additional elements unique to managed lanes: identification of managed lanes operating strategy and potential user groups *(4)*. The flow chart benefited from review by a group of TxDOT project managers, the TTI Advisory Committee, and a national peer review by individuals involved in pricing projects throughout the country. Even with the evolution of TxDOT's philosophy on managed lanes over the course of the project, the flow diagram has remained relevant.

Figure 3 provides a simplified version of the flow diagram. The intent of this research task is to develop a decision framework for the upper area of the flow chart:

- to identify potential managed lanes strategies for a corridor that are based on goals and objectives for the project, and
- to use the project objectives coupled with corridor influences to narrow the strategy list.

The bottom portion of the simplified flow chart shows that operational considerations and design parameters come into play once the operating strategy and resulting user groups are defined. The other tasks for the larger Project 0-4160 research effort support the lower boxes of the flow diagram with development steps that involve the design of the facility and the operational components necessary for implementation. These are briefly highlighted below and can be found in more detail in the managed lanes handbook:

- geometric design – access type and spacing, weaving distances;
- traffic control devices – signs and markings for driver information;
- enforcement – approaches for ensuring compliance;
- incident management – guidance for operational approaches;
- interim use – use of managed lanes under special situations;
- evaluation and monitoring – guidance for post-project monitoring; and
- staffing and training – staffing needs given complexities of operation.

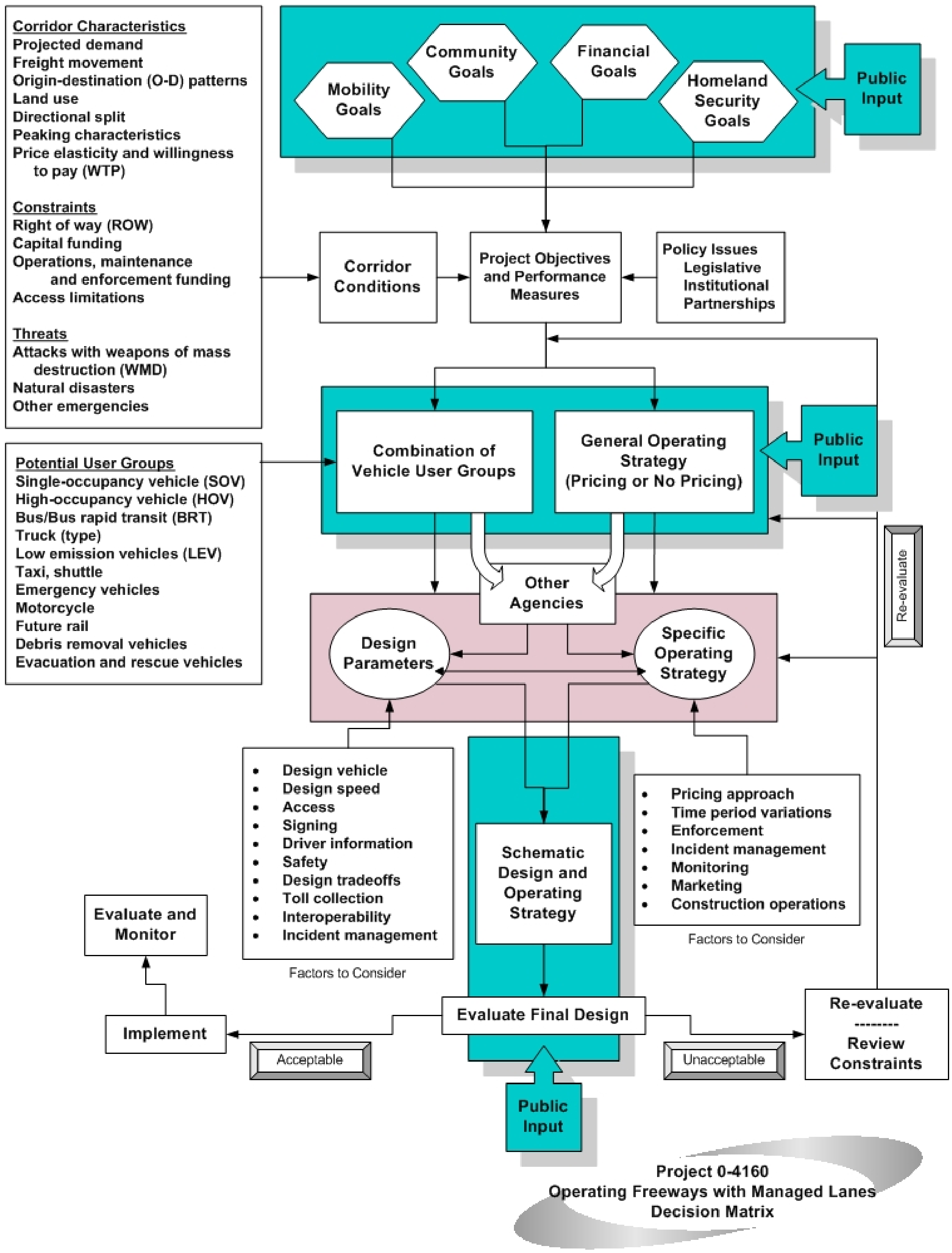

Figure 2. Managed Lanes Project Development Process.

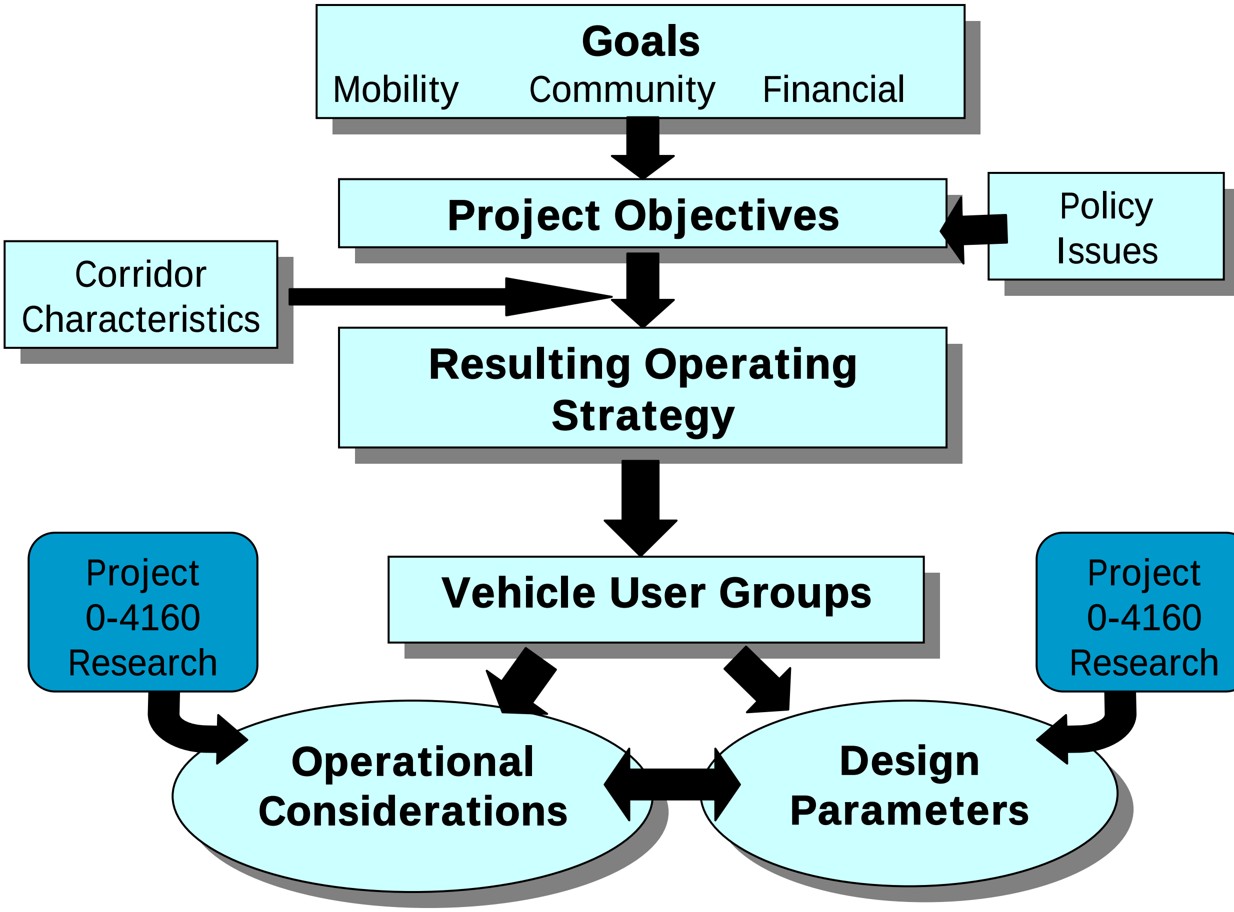

Figure 3. Simplified Conceptual Decision Process Flow Diagram.

In the next chapter, a methodology for preliminary screening is presented that can assist with the identification of potential managed lanes strategies for a given corridor.

CHAPTER 3: STRATEGY SELECTION SCREENING TOOL

BACKGROUND ON SCREENING TOOL

The purpose of the strategy selection tool is to provide a preliminary screening instrument for TxDOT project managers to use that helps define the types of managed lanes strategies that would be conducive for a given corridor. The screening tool is based on the upper elements in the flow diagram shown in the outlined box in Figure 4. It is a simple tool that primarily relies on the defined objectives for the improvements in defining the potential operating strategies.

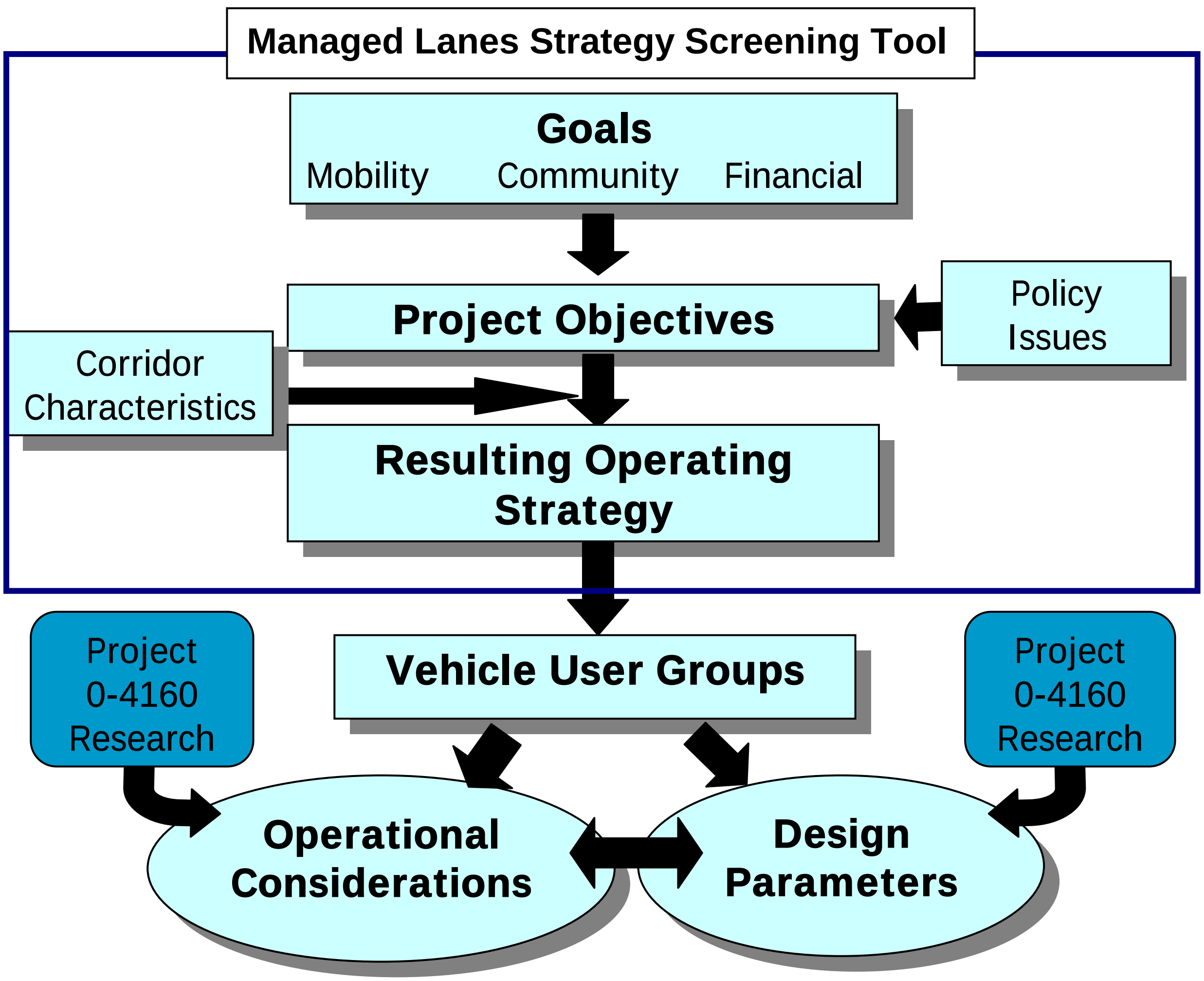

Figure 4. Flow Diagram Showing Elements of the Decision Process Incorporated into the Strategy Selection Tool.

The managed lanes strategy screening tool was created to facilitate the decision-making process by identifying potential managed lanes scenarios to implement. The program incorporates many different calculations made to determine the best possible scenario based upon the objectives chosen by the user. It is important to note that it is a very quick and simple tool to be used early in the planning process to help sort out possible managed lanes operating scenarios. Other screening tools offer further refinement of potential strategies, such as the High Occupancy Toll Strategy Analysis Tool (HOT START) developed for Project 0-4898. That particular tool evaluates the use of HOT lanes in HOV corridors, either through adapting existing HOV lanes or by building HOT lanes instead of HOV lanes in corridors where HOV lanes are planned. As an illustration, if the managed lanes strategy screening tool identifies HOV and HOT as strong candidate strategies, the analyst may consider using the HOT START tool to further refine the decision.

The flow diagram shown in Figure 5 illustrates the steps the screening tool uses to develop a list of candidate strategies. The program itself has four critical steps in determining the appropriate scenario to advocate: the choice of objectives, weighting of the objectives (optional), the constraints, and the processing of the final solution.

The remaining portion of this chapter describes the methodology and underlying assumptions used in the program.

GOALS AND OBJECTIVES FOR MANAGED LANES

The overall goals for the implementation of managed lanes can be divided into three distinct groups: mobility goals, community goals, and financial goals. First, the mobility goals of managed lanes are focused upon such wide topics as demand and accessibility. These goals are characterized as mobility goals because they aim to improve the mobility of the facility or system in question. The second category of goals is the community goals. Community goals are generally defined as goals which aim to help maintain or improve the local community based on the interests of its constituents. Financial goals, much like their name implies, are goals which aim to address the financial realities of infrastructure expansion with limited funding and the financing methods by which an agency pursues the development of projects. Table 2 highlights different mobility, community, and financial goals that may be associated with managed lanes.

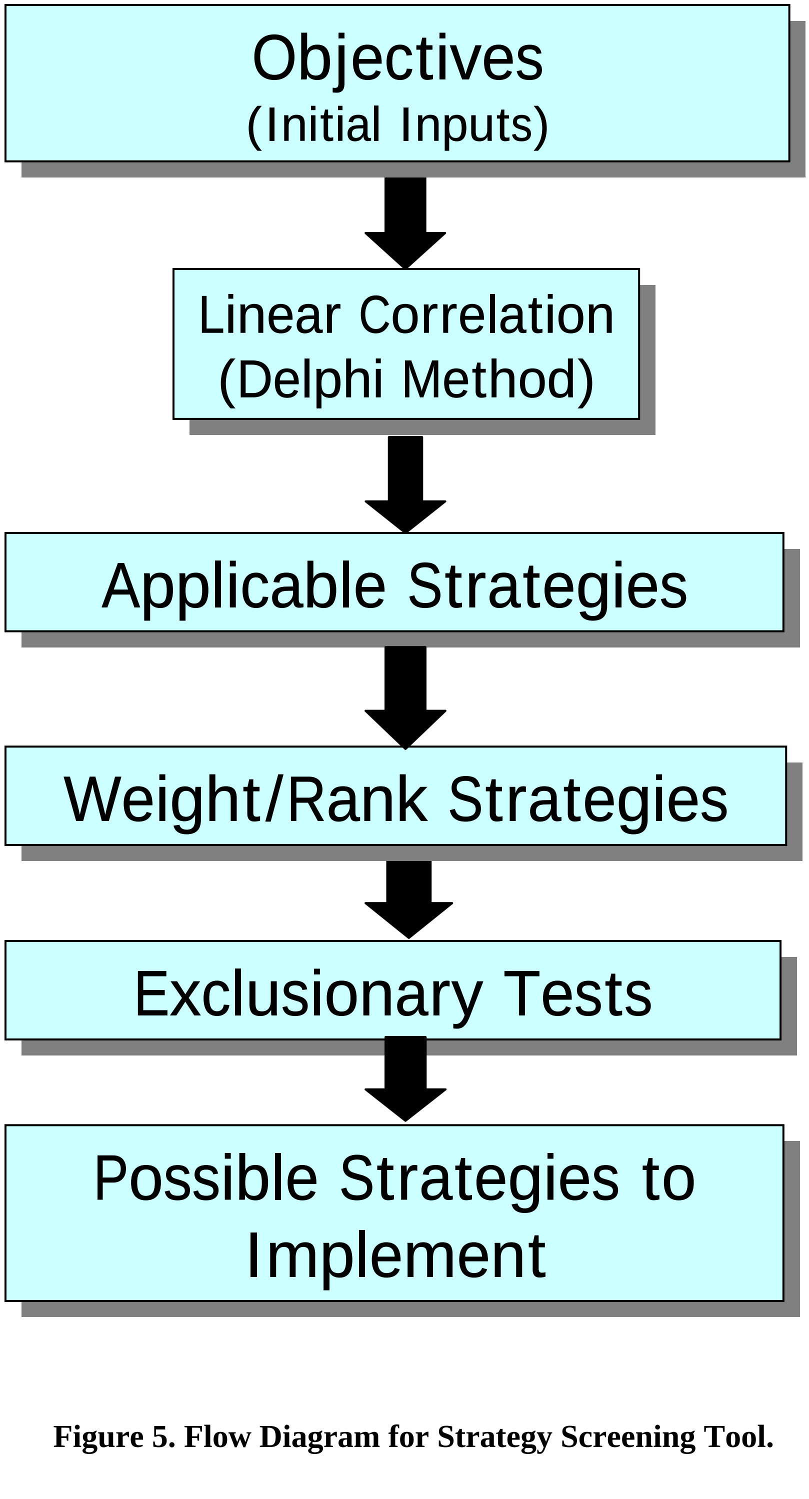

Figure 5. Flow Diagram for Strategy Screening Tool.

Table 2. Possible Managed Lanes Goals.

Category of Goal	Possible Goals
Mobility Goals	• Provide a transportation system that can handle current and future demand • Increase mobility and accessibility by offering travel options • Provide additional facility capacity • Optimize existing managed lanes capacity • Provide congestion relief • Modify travel demand • Enhance alternative modes • Improve accessibility
Community Goals	• Improve the safety of corridor travel • Minimize environmental impacts • Preserve neighborhoods • Maintain an urban form • Maintain land-use patterns
Financial Goals	• Develop transportation improvements that are financially self-sustaining

The overall objectives of various managed lanes can be linked to individual objectives which they are trying to achieve. Table 3 lists the goals above with potential project objectives. The objectives listed in Table 3 were developed over the course of this research project through literature review and meetings with TxDOT staff.

Table 3. Typical Project Objectives for Managed Lanes.

Goal	Typical Project Objectives
Provide a transportation system that can handle current and future demand	Increase vehicle-carrying capacity Increase person-carrying capacity Increase goods-carrying capacity Maintain or improve Level of Service (LOS) Reduce travel time
Increase mobility and accessibility by offering travel options	Provide travel alternatives Improve express bus service Encourage transit-oriented development Fund new transit and managed lane improvements
Provide additional facility capacity	Increase vehicle-carrying capacity Increase person-carrying capacity Increase goods-carrying capacity Maintain or improve LOS
Optimize existing managed lane capacity	Increase vehicle-carrying capacity Increase person-carrying capacity Increase goods-carrying capacity Maintain or improve LOS
Provide congestion relief	Increase vehicle-carrying capacity Increase person-carrying capacity Reduce travel time Provide travel alternatives Reduce peak period vehicle trips Encourage transit-oriented development
Modify travel demand	Provide travel alternatives Reduce peak period vehicle trips
Enhance alternative modes	Provide travel alternatives Improve express bus service Provide transmodal connectivity and accessibility Encourage transit-oriented development
Improve accessibility	Provide transmodal connectivity and accessibility
Improve the safety of corridor travel	Minimize traffic crashes involving large trucks
Minimize environmental impacts	Provide travel alternatives Improve express bus service Improve air quality from mobile sources Address environmental justice concerns
Preserve neighborhoods	Provide transmodal connectivity and accessibility Address environmental justice concerns Encourage transit-oriented development
Maintain land-use patterns	Provide transmodal connectivity and accessibility Address environmental justice concerns Encourage transit-oriented development
Develop transportation improvements which can pay for themselves	Fund new transit and managed lane improvements Produce enough revenue to cover operations/maintenance (O/M) and enforcement Produce enough revenue to cover debt service Private investment profit

User Input of Objectives in Screening Tool

Initially, the program gathers the input from the user in the form of objectives a user would like to see addressed. This is done by a series of check boxes for which the user can select the appropriate objectives. There are 19 objectives available for the user to select for the screening tool. The list of the possible objectives follows:

1. Increase vehicle-carrying capacity.
2. Increase person-carrying capacity.
3. Increase goods-carrying capacity.
4. Maintain free flow speeds.
5. Maintain or improve the LOS.
6. Reduce travel time.
7. Increase trip reliability.
8. Provide travel alternatives.
9. Reduce peak period vehicle trips.
10. Improve express bus service.
11. Provide transmodal connectivity and accessibility.
12. Minimize traffic crashes involving large trucks.
13. Improve air quality from mobile sources.
14. Address environmental justice concerns.
15. Encourage transit-oriented development.
16. Fund new transit and managed lanes improvements.
17. Produce enough revenue to cover O/M and enforcement.
18. Produce enough revenue to cover debt services.
19. Private investment return on investment.

Correlation of Objectives to Strategies

From the list of objectives provided in Table 3, various objectives can be related to different managed lanes strategies. Table 4 below shows the various objectives (on the right) and how they can relate to the different strategies (on the left). Presented in the table are eight different managed lanes strategies and potential objectives to be achieved by them. This relationship between the objectives and the strategies is based on a web-based survey of practitioners and experts. Electronic mailing lists of professionals involved in managed lanes were used to solicit respondents, including Project 0-4160 managed lanes listserv and Transportation Research Board (TRB) Managed Lanes Joint Subcommittee mailing list. Screen shots of the survey are provided in Appendix A. Twenty-nine responses were received. A linear correlation, or Delphi Method, was used to analyze input from experts and form a direct linear correlation between objectives and strategies. Their answers were aggregated, and the results from their input form the determination used to relate the two sets. The researchers asked the experts about how each objective (taken in isolation) can be fulfilled by the strategies. The results were used by the researchers to combine different objectives to find the best strategy or strategies for achieving the composite objective.

Appendix B shows the initial weighted table for the values associated with the objectives gathered from the expert survey. This array forms the basis for the decision algorithm that identifies the strategies that are a best fit for the objectives selected.

Table 4. Managed Lanes Strategies and Associated Objectives.

Managed Lane Strategy	Objectives
Express Toll Lanes Separated lanes with limited access where all vehicles pay a toll.	Increase vehicle-carrying capacity Reduce travel time Provide travel alternatives Fund new transit and managed lane improvements Produce enough revenue to cover O/M and enforcement Produce enough revenue to cover debt service Private investment profit
HOV Lanes Lanes that only allow vehicles that meet or exceed a required number of occupants.	Increase vehicle-carrying capacity Increase person-carrying capacity Reduce travel time Increase trip reliability Provide travel alternatives Reduce peak period vehicle trips Improve express bus service Improve air quality from mobile sources Address environmental justice concerns Encourage transit-oriented development
Express Lanes Separated lanes with limited access.	Increase vehicle-carrying capacity Reduce travel time Provide travel alternatives

Table 4. Managed Lane Strategies and Associated Objectives (cont.).

Exclusive Transitways Lanes or roadways which are meant to exclusively serve buses.	Increase person-carrying capacity Reduce travel time Increase trip reliability Provide travel alternatives Reduce peak period vehicle trips Improve express bus service Provide transmodal connectivity and accessibility Improve air quality from mobile sources Address environmental justice concerns Encourage transit-oriented development
Exclusive Truck Lanes Dedicated lanes in which only large trucks are permitted.	Increase vehicle-carrying capacity Increase goods-carrying capacity Maintain free flow speed Reduce travel time Minimize traffic crashes involving large trucks
Truck Restricted Lanes Lanes of the roadway in which large trucks are restricted.	Maintain free flow speed Maintain or improve LOS Minimize traffic crashes involving large trucks
HOT Lanes HOV lanes which allow vehicles that do not meet the occupancy requirement to use the lanes for a fee or toll.	Increase vehicle-carrying capacity Increase person-carrying capacity Maintain free flow speed Reduce travel time Improve express bus service Improve air quality from mobile sources Address environmental justice concerns Encourage transit-oriented development Fund new transit and managed lane improvements Produce enough revenue to cover O/M and enforcement Produce enough revenue to cover debt service Private investment profit

Weighting of Objectives

Once a user has determined the appropriate objectives, the values for those rows are summed into a master row, hereafter referred to as "the values." After this step has been completed, the user has the opportunity to "weight" objectives.

The purpose of weighting objectives is to place greater importance upon some of the objectives, while diminishing the importance of others. The option to weight objectives is initially hidden. In order to weight the objectives, the user must enable the weighting process. This option is hidden from the user by default because any choices made in this option will affect the initial array of data created by the experts. Changing the array data, while useful in many circumstances, must be done carefully.

Once the user has enabled the weighting process, he/she is presented with a list of the options he/she had selected earlier in the process (Figure 6). Next to each of the objectives is a box describing the choices the user can make for that objective. The options are: Important (default value), Less Important, and Higher Importance.

If the user leaves the default value selected (Important), no changes are made to the data array linking the importance with the objectives. However, if the user selects “Less Important,” the values for the objective in the data array are divided in half. Likewise, if the user selects a higher level of importance for an objective, the objective values in the array are doubled in value.

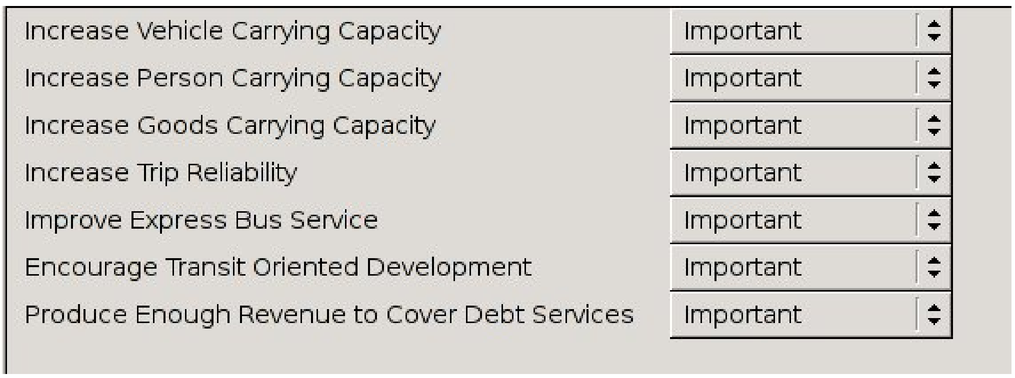

Figure 6. Weighting Screen.

By weighting the objectives themselves, the user is able to place more emphasis upon specific objectives, thereby allowing the user to have a much more fine-tuned result. If the user does not choose to weight the objectives, the default values (Appendix B) are used.

CORRIDOR CONSIDERATIONS

There are other considerations, besides goals and strategies, which must be considered before determining the appropriate type of managed lane to pursue. Not all of the goals and objectives can adequately define all of the possible real-world environments in which managed lanes are to be constructed. The list of other considerations is in Table 5 below, with brief definitions of the other considerations.

Table 5. Corridor Considerations in Strategy Selection.

Corridor Condition	Characteristic
Physical constraints	Physical constraints, including cross-section limitations, right-of-way restrictions, and access limitations may impact the type of strategy that can be used.
Truck characteristics	Level and type of truck traffic, safety considerations, availability of alternative truck routes may have an effect on the choice of strategy.
Origin-destination patterns	The selection of a managed lane strategy may depend on the origin-destination patterns in the corridor.
Land use	Related to origin-destination patterns, the land use (existing and future) may have a bearing on appropriate managed lane strategy to implement.
Price elasticity and willingness to pay	Price elasticity and WTP help quantify the role of value pricing in the corridor and the funding available for improvements.
Funding	Capital funding refers to the initial cost of the project and may exclude possible strategies due to cost and related funding availability. Operations funding refers to the ongoing management, maintenance, and enforcement of the facility.

Exclusionary Tests

After the user has selected the objectives that he or she feels are important, the user is then presented with a list of constraints that must be filled out to rule out possible managed lanes scenarios from being provided to the user at the conclusion of the program. There are 20 general constraints which are directly tied to the seven possible managed lanes strategies. Appendix C lists all of the constraint questions and the data sources necessary for the end user to answer them.

The constraints questions are provided below:

1. Is there currently enough right of way within the existing or proposed development to add a lane in each direction?
2. Is there currently enough right of way within the existing or proposed development to add two additional lanes?
3. Do other corridors in the region currently have HOV lanes?
4. What percentage of crashes are caused by trucks?
5. Is the route currently a hazardous materials (HAZMAT) route?
6. How long is the proposed managed lane?
7. Do you expect to recover operating costs and more than 10 percent of capital costs from revenue generated by the facility?
8. What percentage of peak period traffic is freight?

9. What type of drivers use the roadway most often?
10. What type of trucks use the roadway?
11. Are there currently truck restricted lanes on the corridor?
12. Is the corridor a trucking route?
13. Are there parallel alternative truck routes nearby?
14. Does the proposed route serve a major activity center?
15. What is the congestion index for the roadway in question?
16. What is the median family income in the corridor?
17. What is the average number of vehicles per household in the corridor?
18. Besides buses, is there another form of mass transit in the corridor?
19. How many buses will use this managed lane per day?
20. Is there political opposition to toll roads in your city?

Once the user enters the constraints section, a queue is formed using all of the previous answers. The queue has a list of all of the possible strategies to implement along with values associated with each strategy. The data for the queue come directly from the above-mentioned steps (choosing the objectives and weighting the objectives). The constraints section takes the values in the queue and lowers the values depending upon the user's answers of the various constraints. Appendix D provides the point system used to adjust scores according to the answers to the constraints questions.

The viability of the strategies is largely based in the initial section of the program where the objectives are matched to the strategies. The corridor constraints function only excludes the possibilities based upon responses to the constraint questions. So, depending upon the inputs a user makes initially when choosing the objectives, applicable strategies are identified using the data gleaned from the expert survey.

The reason there are constraints is that the strategies advocated by the experts were too close in some fields, most notably truck traffic and financial considerations. So, the constraints were identified to separate the possible strategies to determine whether or not trucks should be advocated or not, and also tolling or not. Essentially, the answers given by the experts were too similar (points wise) between strategies that were very different (hypothetically, truck lane restrictions and HOV, which are very different). Therefore, the constraints are put into place to determine which one should be given as an appropriate answer.

The constraints can be configured to be strict or lenient. If the “strict” constraints are selected, a much more strict method in reducing the values in the queue is implemented (thereby eliminating more possible strategies). However, if the “lenient” constraints are selected, a managed lane strategy will not necessarily be eliminated due to constraints alone. Although it will be pushed down in the queue of appropriate strategies to implement, the values will not be as low as with the strict interpretation. The algorithm developed to filter the constraints is then run on the possible strategies, eliminating those that do not meet the basic criteria for use in the corridor.

These scores are then totaled for each of the strategies and are parsed by an algorithm (which takes into account if the constraints should be interpreted loosely or not). The remaining sum for each strategy is then divided by the sum gathered in the objective stage to determine the appropriate strategies to implement.

RESULTS FROM THE STRATEGY SELECTION TOOL

The final screen presented to the user takes all of the input and offers three strategy options and their scoring. This task takes the values associated with the objectives and totals the values to determine which possible scenario best meets the criteria of the user. The constraints are then applied depending upon the user’s preference (lenient or strict), and the final array is completed containing all of the possible strategies listed in order of acceptability. After this step is complete, the answers are then displayed to the end user for approval. Next to each possible strategy is the final queue value for that particular strategy. This “score” is used to determine the placement in the queue and can vary drastically in number between 200 and 1.

DEFINING USER GROUPS

Once an operating strategy or multiple operating strategies are identified, defining vehicle user groups for a managed lane facility is the next important step in the managed lanes development process for several reasons:

- It helps in evaluating financing for the project if non-paying or exempt users are identified.

- It establishes the design vehicle used to control the geometrics of the facility design elements.
- It offers insight into driver communication and signing needs, especially if the user group can be categorized as a familiar, semi-familiar, or non-familiar user.
- It offers insight into potential enforcement opportunities and challenges.
- It provides a starting point for establishing a long-term "concept of operations," where variations in user eligibility can be illustrated over time in order to maintain operational performance thresholds and communicate expected changes over time. This is illustrated in Figure 7, which shows how one HOT lane facility over time is expected to modify operations – both in terms of who can use the HOT lane and who will be tolled (3).

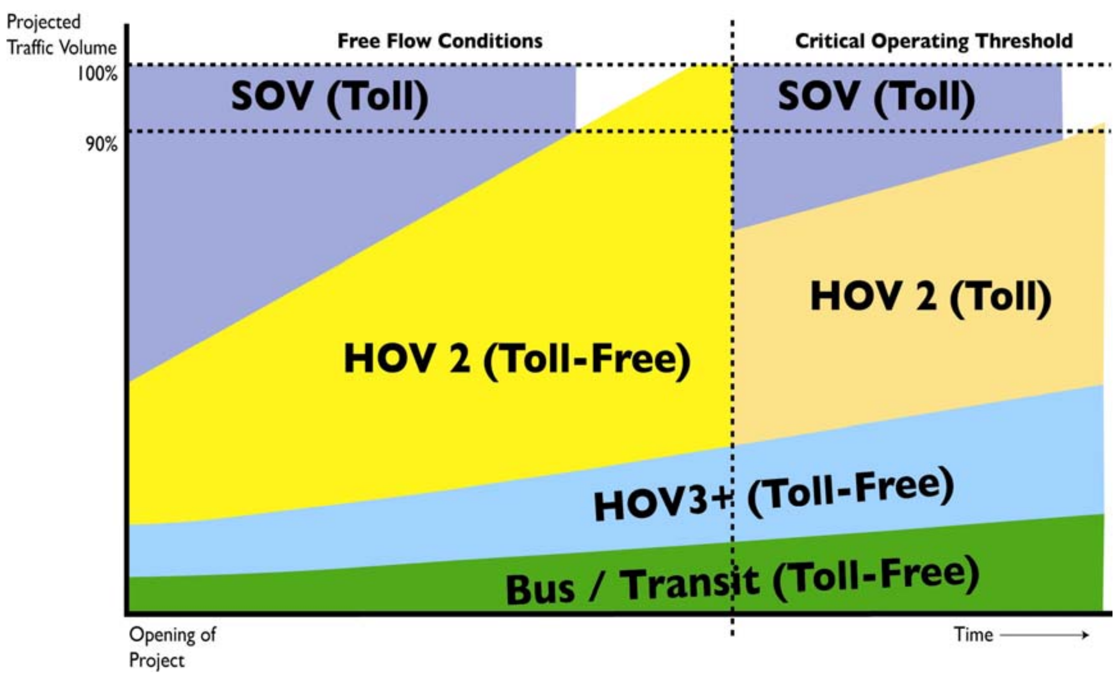

Figure 7. Life Cycle of a Facility *(3)*.

Table 6 depicts the seven operational strategies and candidate user groups for each strategy. There are several issues to keep in mind when defining potential user groups for a project:

- The table below has a broad definition of "trucks." The objectives and characteristics of each individual facility will have to be carefully examined to determine if trucks should be included and the type of truck allowed (single unit versus semi-trailer, for example).

- There may be a desire to incorporate rail as a future component of a managed lanes envelope. As such, design criteria should reflect the stricter vertical and horizontal criteria for rail vehicles and associated bridge loadings.
- "Emergency Vehicles" as listed below includes not only on-duty police, fire, and emergency medical vehicles, but also vehicles necessary to respond to threats such as natural disasters or terrorist attacks. This would include debris removal vehicles and evacuation/rescue vehicles.

Table 6. Potential Vehicle User Group Scenarios.

Managed Lanes Strategy	Potential Vehicle User Groups	
	Tolled	Non-tolled
Express Toll Lanes	• SOV • HOV • Trucks • LEV • Taxi/Shuttle • Motorcycle	• Bus/BRT • Emergency Vehicles
HOV Lanes		• HOV • Bus/BRT • LEV • Taxi/Shuttle • Motorcycle • Emergency Vehicles
HOT Lanes	• SOV • Trucks	• HOV • Bus/BRT • LEV • Taxi/Shuttle • Motorcycle • Emergency Vehicles
Express Lanes (non-tolled)		All vehicle user groups
Exclusive Transitways		• Bus/BRT
Exclusive or Dedicated Truck Lanes		• Trucks
Truck Restricted Lanes		All vehicle user groups except trucks

CHAPTER 4:
RESEARCH GAPS

EXPLANATION OF THE GAPS IDENTIFIED IN THE PROJECT 0-4160 RESEARCH

The five-year Project 0-4160 research effort focused largely on design and operations issues associated with managed lanes and delved to a lesser degree into some of the policy, legislative, financial, and public outreach concerns. While the managed lanes research program has offered TxDOT direct guidance for application in current project development, the program has also identified new challenges and areas for further exploration. Of particular interest are the next generation projects that are incorporating managed lanes as a mobility strategy encompassing a broad range of operational possibilities, challenges, and complexities *(*5,6*)*. Each of the new challenges pose tough questions that have not been tackled in the projects currently in operation.

Planning and Policy Research Gaps

A summary of the research gaps related to managed lanes planning and policy is provided below:

- the role of revenue generation and the competing objectives of maximizing person movement through HOV exemptions and maximizing revenue generated by the project;
- the role of bus transit, including BRT, and its integration in managed lanes operations;
- analytical tools that estimate travel demand, revenue projections, and operational impacts interactively;
- evaluation of managed lanes in the National Environmental Policy Act (NEPA) analysis, including the relationship of managed lanes to purpose and need, revenue forecasts versus regional forecasts, and how managed lanes are considered in the alternatives analysis and fiscal constraint analysis;
- equity and environmental justice concerns, including burden of cost, distribution of funds, and geographic equity;
- evaluation of public/private initiatives involving managed lanes;

- legislative authority, particularly related to operating agencies and their powers to operate as toll authorities in collecting fines and enforcing compliance using automated techniques;
- integration of managed lanes projects into the existing and planned transportation system (freeway, arterial, and transit systems) and connectivity with other managed lanes;
- feasibility and application of truck-only toll lanes; and
- economic impact of communities served by managed lanes.

Design and Operations Research Gaps

A summary of research gaps related to managed lanes design and operation is provided below:

- multiple mid-point ingress/egress points and the ripple effect on technical and operational complexity, including tolling operations, lane separation, enforcement, safety, and driver information;
- the safety implications of buffer or striped separation between managed and general purpose lanes, and the ability to effectively enforce access restrictions and toll evasion;
- the design of managed lanes facility termini and impacts on the overall system, in terms of delay, travel time, and safety;
- design and operations of single-lane directional managed lanes, including passing over long distances and best application of pricing strategies;
- improved methods for enforcement of HOV preference in managed lanes – technological, procedural, and institutional;
- signing and motorist information needs in an operating environment where strategies may change dynamically and where competition with signing in adjacent freeway lanes may create driver information overload;
- sustaining operational flexibility over the life cycle of the facility, and communicating to policy makers and the public that freeway express lane operations will be adjusted as needed over time according to predefined performance objectives; and

- dynamic operations beyond pricing, including methods and approaches to dynamically modify vehicle eligibility or access on a managed lanes facility.

Future Research

FHWA is in the process of developing a 10-year research plan for managed lanes. Most of the above-mentioned topics have been identified as research issues. TxDOT continues to serve as a leader in advancing research in the managed lanes arena through participation in national level research efforts and through its own research program. Listed below are the FY 05 and FY 06 TxDOT research projects that will address some of the topics above. Several of these research studies were developed as the direct result of the ongoing work of the larger managed lanes research effort:

- Project 0-4898 – Criteria for Adapting HOV Lanes to HOT Lanes,
- Project 0-5208 – Evaluation of Environmental Justice Aspects of the Tolling of Existing Non-Toll and Toll Roads,
- Project 0-5079 – Use of Traveler Information to Enhance Toll Road Operations,
- Project 0-6446 – Guidelines for Signs and Markings on Toll Roads,
- Project 0-5284 – Feasibility and Guidelines for Applying Managed Lane Strategies to Ramps,
- Project 0-5286 – The Role of Preferential Carpool Treatment in Managed Lane Facilities,
- Project 0-5426 – Separation Treatments between Toll and Non-Toll Lanes, and
- Project 0-5547 – Best Practices for Access between Toll Lanes and Free Lanes.

REFERENCES

1 B.T. Kuhn and V.D. Goodin. *Year 1 Annual Report of Progress: Operating Freeways with Managed Lanes*, Research Report 0-4160-2. Texas Transportation Institute, College Station, TX, January 2002.
2 *LBJ Circular*. Texas Department of Transportation. Summer 2001.
3 T.S. Collier and V.D. Goodin. *Managed Lanes: A Cross-Cutting Study*, FHWA-HOP-05-037. Federal Highway Administration, McLean, VA. November 2005.
4 *Project Development Process Manual*. Texas Department of Transportation. August 2003. http://manuals.dot.state.tx.us/dynaweb/coldesig/pdp.
5 Managed and Priced Lanes: Summary of Workshop Results, FHWA and Transportation Research Board, Key Biscayne, FL, November 2003.
6 Texas Department of Transportation, Research Project 0-4160, *Operating Freeways with Managed Lanes*. Presentation to External Stakeholder Committee, September 22, 2004.

APPENDIX A: EXPERT SURVEY

Managed Lanes Survey on Strategy Selection

Thank you for participating in this Managed Lanes Survey. The purpose of this survey is to identify if correlations exist between potential project objectives and managed lane strategies that could address the objectives.

This survey is divided into two parts: in the first part you will be asked to determine if the possible strategies (listed on the top of the screen) could support the available project objectives (listed on the left of the screen). If you feel that the managed lane strategy in question would be beneficial in addressing the objective, please check the box where the objective and managed lane strategy intersect. *If you feel no correlation exists, please leave the box unchecked.*

This is an example of the described process:

	Toll Express Lanes	HOT Lanes	HOV Lanes
Increase Vehicle Carrying Capacity	☑	☑	☐
Increase Person Carrying Capacity	☐	☑	☑

You will notice that this user has decided that Toll Express Lanes would help Increase Vehicle Carrying Capacity. At the same time, this user feels that HOV Lanes would ***not*** Increase Vehicle Carrying Capacity.

Defining the Strategies

- **HOV Lanes** - High Occupancy Vehicle Lanes (HOV) are lanes that only allow vehicles that meet or exceed a required number of occupants.
- **HOT Lanes** - High Occupancy Toll (HOT) Lanes are HOV lanes which allow vehicles that do not meet the occupancy requirement to use the lanes for a fee or toll.
- **Toll Express Lanes** - Separated lanes with limited access where all vehicles pay a toll.
- **Non-Tolled Express Lanes** - Separated lanes with limited access.
- **Transitways** - Lanes or roadways which are meant to exclusively serve buses.
- **Exclusive Truck Facilities** - Dedicated lanes in which only large trucks are permitted.
- **Truck Restricted Lanes** - Lanes of the roadway in which large trucks are restricted.

If at any time you require assistance, there is a help link on the upper right hand corner of the screen that you may click for help.

You may begin the survey if you wish.

Thanks again!

Place check the boxes where you feel that a managed lane strategy would benefit an objective.

When you are done, please leave comments in the comment box and click the submit button at the bottom.

HELP

Managed Lanes Strategies

Objectives	HOV Lanes	HOT Lanes	Toll Express Lanes	Non-Tolled Express Lanes	Transitways	Exclusive Truck Facilities	Truck Restricted Lanes
Increase Vehicle Carrying Capacity	☐	☐	☐	☐	☐	☐	☐
Increase Person Carrying Capacity	☐	☐	☐	☐	☐	☐	☐
Increase Goods Carrying Capacity	☐	☐	☐	☐	☐	☐	☐
Maintain Free Flow Speed	☐	☐	☐	☐	☐	☐	☐
Maintain or Improve Level of Service	☐	☐	☐	☐	☐	☐	☐
Reduce Travel Time	☐	☐	☐	☐	☐	☐	☐

Managed Lanes Strategies

Objectives	HOV Lanes	HOT Lanes	Toll Express Lanes	Non-Tolled Express Lanes	Transitways	Exclusive Truck Facilities	Truck Restricted Lanes
Increase Trip Reliability	☐	☐	☐	☐	☐	☐	☐
Provide Travel Alternatives	☐	☐	☐	☐	☐	☐	☐
Reduce Peak Period Vehicle Trips	☐	☐	☐	☐	☐	☐	☐
Improve Express Bus Service	☐	☐	☐	☐	☐	☐	☐
Provide Transmodal Connectivity and Accessibility	☐	☐	☐	☐	☐	☐	☐
Minimize Traffic Crashes Involving Large Trucks	☐	☐	☐	☐	☐	☐	☐
Improve Air Quality from Mobile Sources	☐	☐	☐	☐	☐	☐	☐

Managed Lanes Strategies

Objectives	HOV Lanes	HOT Lanes	Toll Express Lanes	Non-Tolled Express Lanes	Transitways	Exclusive Truck Facilities	Truck Restricted Lanes
Address Environmental Justice Concerns	☐	☐	☐	☐	☐	☐	☐
Encourage Transit Oriented Development	☐	☐	☐	☐	☐	☐	☐
Fund New Transit and Managed Lane Improvements	☐	☐	☐	☐	☐	☐	☐
Produce Enough Revenue to Cover O/M and Enforcement	☐	☐	☐	☐	☐	☐	☐
Produce Enough Revenue to Cover Debt Service	☐	☐	☐	☐	☐	☐	☐
Private Investment Profit	☐	☐	☐	☐	☐	☐	☐

If you have any comments or ideas for possible objectives please tell us.

Submit

APPENDIX B: SURVEY RESPONSES IN ARRAY

Entries in the Array

Objectives

1. Increase Vehicle-Carrying Capacity
2. Increase Person-Carrying Capacity
3. Increase Goods-Carrying Capacity
4. Maintain Free Flow Speeds
5. Maintain or Improve the LOS
6. Reduce Travel Time
7. Increase Trip Reliability
8. Provide Travel Alternatives
9. Reduce Peak Period Vehicle Trips
10. Improve Express Bus Service
11. Provide Transmodal Connectivity and Accessibility
12. Minimize Traffic Crashes Involving Large Trucks
13. Improve Air Quality from Mobile Sources
14. Address Environmental Justice Concerns
15. Encourage Transit-Oriented Development
16. Fund New Transit and Managed Lanes Improvements
17. Produce Enough Revenue to Cover O/M and Enforcement
18. Produce Enough Revenue to Cover Debt Services
19. Private Investment Return on Investment

Strategy Abbreviations

TE: Tolled Express

NTE: Non-Tolled Express

Transit: Transitways

Dedicated: Dedicated Truck Lanes

Restricted: Truck Restricted Lanes

Obj	HOV	HOT	TE	NTE	Transit.	Dedicated	Restricted
1	9	21	20	24	6	9	12
2	24	22	10	10	25	4	2
3	2	4	14	9	4	25	10
4	18	23	23	9	13	11	13
5	16	20	21	15	15	14	15
6	25	25	25	17	18	15	14
7	19	20	24	11	22	15	11
8	22	22	20	9	20	9	4
9	21	11	12	4	17	0	3
10	23	17	12	5	24	0	0
11	15	8	5	4	19	14	4
12	3	4	5	1	3	22	19
13	21	14	15	8	22	10	3
14	16	9	4	8	15	3	1
15	13	6	5	0	24	0	0
16	0	16	20	0	0	0	0
17	0	16	21	0	0	0	0
18	0	12	20	0	0	0	0
19	0	9	19	2	1	5	0

Weighting Example

The process of modifying the objective values is done by taking the objective in question and either doubling or halving the values in the given row. For example, if the user were to label "Increase Vehicle Carrying Capacity" (row one) as Higher Importance, the table given above (in the Objectives category) would be modified to this end result:

Obj	**HOV**	**HOT**	**TE**	**NTE**	**Transit.**	**Dedicated**	**Restricted**
1	*18*	*42*	*40*	*48*	*12*	*18*	*24*
2	24	22	10	10	25	4	2
3	2	4	14	9	4	25	10

APPENDIX C: DATA REQUIREMENTS FOR SCREENING TOOL

Question	Data Required	Resources Needed
Is there currently enough right-of-way (ROW) within the existing or proposed development to add an additional lane?	Less than 16 feet, maintaining a 10 foot shoulder	Lane geometric design and measurements
	More than 16 feet, maintaining a 10 foot shoulder	
Is there currently enough ROW within the existing or proposed development to add two additional lanes?	Less than 28 feet, maintaining a 10 foot shoulder	Lane geometric design and measurements
	More than 28 feet, maintaining a 10 foot shoulder	
Do other corridors currently have HOV lanes?	No	
	Yes	
What percentage of accidents are caused by trucks?	Less than 20%	Crash data; DPS or local source
	More than 20%	
Is the route currently a HAZMAT route?	No	National Hazardous Materials Route Registry http://hazmat.fmcsa.dot.gov/nhmrr/query.wc
	Yes	
How long is the proposed managed lane?	Less than 7 miles	Preliminary Plans
	More than 7 miles	
Do you expect to recover operating costs and more than 10% of capital costs from revenue generated by the facility?	No	Financial analysis
	Yes	
What percentage of peak period traffic is freight?	Less than 20%	Field data (classification counts), travel demand model/link or market analysis
	More than 20%	
What types of drivers use the roadway most often?	Residents (local)	Travel demand model/link or market analysis
	People passing through (external)	
What types of trucks use the roadway?	Non-freight (light duty)	Classification counts
	Freight	
Are there currently truck-restricted lanes in the city?	No	
	Yes	
Is the corridor a trucking route?	No	
	Yes	

Question	Data Required	Resources Needed
Are there parallel alternative truck routes?	No	
	Yes	
Does the proposed route serve a major activity center?	No	
	Yes	
What is the congestion index for the roadway in question?	Less than 1	http://mobility.tamu.edu/ums/report/methodology_appB.pdf Page 28, Equation 16 without arterial components
	More than 1	
What is the median family income in the corridor?	Less than $30,000	Census
	More than $30,000	
What is the average number of vehicles per household in the corridor?	Less than 1	Census
	More than 1	
Besides buses, is there another form of mass transit in your city?	No	
	Yes	
How many buses will use the managed lane per day?	Less than 100	Data from transit agencies
	More than 100	
Is there political opposition to toll roads in your city?	No	
	Yes	

“Unknown” is an alternative answer for every question if you are unsure of the question or do not wish to answer it.

APPENDIX D: SCREENING TOOL RATING SYSTEM FOR EXCLUSIONARY TESTS

The rating system used for the exclusionary tests involving corridor constraints is provided in this appendix.

1. Is there currently enough ROW in each direction within the existing or proposed freeway section to add a lane?

If available space in one direction is less than 16 ft, maintaining a 10 ft shoulder:
HOV: +100
HOT: +100
TE: +100
NTE: +100
Transitways: +100
Truck Dedicated: +100

2. Is there currently enough ROW in each direction within the existing or proposed freeway section to add 2 lanes?

If available space in one direction is more than 28 ft, maintaining a 10 ft shoulder:
HOV: -10
HOT: -10
TE: -10
NTE: -10
Transitways: -10
Truck Dedicated: -10

3. Do other corridors in the region currently have HOV lanes?

If Yes:
HOV: -5
HOT: -5

4. What percentage of accidents are caused by trucks?

If More Than 20%:
Truck Dedicated: -20
Truck Restricted: -20
HOV: +10
HOT: +10
TE: +10
NTE: +10
Transitways: +10

If less than 20%:
Truck Dedicated: +10
Truck Restricted: +10

5. Is the route currently a HAZMAT route?
If Yes:
Truck Dedicated: -5

6. How long is the proposed managed lane?
If Less Than 7 Miles:
HOV: +10
HOT: +10
Transitways: +10

7. Do you expect to recover operating costs and more than 10% of capital costs from revenue generated by the facility?
If Yes:
HOV: +10
HOT: +5
Tolled express: -10
Non-tolled express: +10
Transitways: +10
Truck dedicated: +10
Truck lane restrictions: +10

8. What percentage of peak period traffic is freight?
If More Than 20%:
HOV: +10
HOT: +10
Tolled Express: +10
Non-Tolled Express: +10
Transitways: +10
Truck Dedicated: -10
Truck Restricted: -10

9. What types of drivers use the roadway most often?
If Residents:
Truck Dedicated: +10
Truck Restricted: +10

10. What types of trucks use the roadway?
If Non-Freight:
Truck Dedicated: +10
Truck Restricted: +10

11. Are there currently truck restricted lanes in your city?
If Yes:
Truck Dedicated: -10

12. Is the corridor a trucking route?
If Yes:
HOV: +5
HOT: +5
Tolled Express: +5
Non-Tolled Express: +5
Transitways: +5
Truck Dedicated: -20
Truck Restricted: -20

13. Are there parallel alternative truck routes?
If Yes:
Truck Restricted: -10

14. Does the proposed route serve a major activity center?
If No:
HOV: +5
HOT: +5
Tolled Express: +2
Non-Tolled Express: +2
Transitways: +2

15. What is the congestion index for the roadway in question?
If Less Than 1:
HOV: +5
HOT: +5
Tolled Express: +5
Non-Tolled Express: +5
Transitways: +5

16. What is the median family income in the corridor?
If Less Than $30,000:
HOV: -5
HOT: -5
Tolled Express: +5
Transitways: -10

17. How many vehicles per household are in the corridor?
If Less Than 1:
Transitways: -10

18. Do you have another form of mass transit in the corridor?
If Yes:
Transitways: +10

19. How many buses will use this managed lane per day?
If Less Than 100:
Transitways: +15

20. Is there political opposition to toll roads in your city?
If Yes:
HOT: +10
Tolled Express: +15