Developing a Value-Pricing Project  
Experience with I-30W in Dallas, Texas

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Limited space to build new roads, fiscal constraints of federal and state government investment to fund new road construction or add capacity to the existing road infrastructure, and the need to use roads more efficiently have triggered in recent years a trend of looking for alternative ways to address the country’s transportation needs. One alternative that has become increasingly accepted by politicians, decision makers, and the public is value pricing. This paper describes the current state of the Dallas, Texas, I-30W value-pricing project. This paper also describes the metrics developed at the beginning of the project to answer key questions related to the implementation of value pricing on I-30W. It presents the findings to date and provides guidance to other transportation agencies on methods to deploy a value-pricing project. Preliminary results for the survey and focus groups about managed lanes and value pricing are presented. The project found that a successful value-pricing project should include early definition of goals, early data collection for performance monitoring, and early development of public outreach.

The limited space to build new roads, the fiscal constraints of federal and state government investment to fund new road construction or add additional capacity to the existing road infrastructure, and the need to use roads more efficiently have triggered in recent years a trend of looking for alternative ways to address the country’s transportation needs. One alternative that has become increasingly accepted by politicians, decision makers, and the public is value pricing.

Value pricing in roads, also known as congestion pricing, is a way of controlling congestion in a road by charging users a fee that varies with the level of congestion. Users are charged higher tolls during peak periods and lower tolls during off-peak periods. In most cases the objective is to keep the speed above a certain level or not to exceed a predetermined traffic volume. As a result, value pricing promotes the more efficient use of roads by incentivizing users to shift their trips to off-peak times, carpool, shift modes, or look for alternative routes. Although the value-pricing concept has been used for several decades in other sectors—such as airlines, hotels, and utilities—its use in roads and potentially other transportation modes such as air and water has only become more popular in recent years.

Several value-pricing projects (VPP) have been implemented in the United States in the past 10 years, such as SR-91 in Orange County and IH-15 in San Diego, California; IH-394 in Minnesota; and SR-167 in Seattle, Washington. In the Dallas–Fort Worth (DFW) region, the Texas Department of Transportation (TxDOT) is in the process of implementing value pricing on the I-30W managed high-occupancy vehicle (HOV) lanes. This will be the first value-pricing application in the region and is considered a test bed. The experience and knowledge gained from this project will become extremely useful for many VPPs that will be deployed in the near future in the DFW region.

This paper describes the current state of the I-30W VPP. The project is being deployed in three phases: HOV, value pricing, and ultimate. This paper also describes the metrics developed at the beginning of the project to answer key questions related to the implementation of value pricing on I-30W. It also presents the findings to date and provides guidance to other transportation agencies on methods for deploying a VPP. During the HOV phase, a survey and focus groups on managed lanes (MLs) and value pricing were conducted, with preliminary results presented in this paper.

SYSTEM OVERVIEW

The DFW region’s 2030 transportation plan designates several corridors to include managed HOV lanes, including I-30W. The DFW region conducted a regional value-pricing study that ranked the priority corridors for value pricing. The I-30W corridor was the highest ranked corridor and was granted designation as a value-pricing test corridor by the U.S. Department of Transportation. The Texas legislature has passed legislation in the past three sessions that gave authority for TxDOT to develop toll road projects on the state system. Several major investment studies, including the I-635 Lyndon B. Johnson Corridor Major Investment Study, recommended MLs as part of their locally preferred alternatives, which received local municipal support (1).

The I-30W corridor consists of a new ML facility that is built in the median of the general purpose lanes. Consistent with regional and state policy, the MLs are being implemented in phases with HOV-only operation as the first phase. Value pricing will be applied to this ML facility. The I-30W ML facility consists of a combination of one- and two-lane reversible flow segments. The two-lane section serves the high demand between SH-360 and Loop 12. Value pricing will be implemented to help ensure the one-lane section has a high level of service.

The I-30W VPP is being jointly developed by TxDOT, the Dallas Area Rapid Transit (DART), and the North Texas Tollway Authority (NTTA) in collaboration with the North Central Texas Council of Governments. This development includes the planning, design, and operational and maintenance needs for the project. The MLs have been established to (a) help address the air quality problems in the region; (b) reduce single-occupant vehicle (SOV) travel by providing...
travel-time and pricing incentives to HOVs and transit passengers, to improve air quality; (c) make available high-speed reliable travel to all users in the corridor (>50 mph); (d) create an area managed HOV lanes test bed to test operation and pricing strategies for the region; and (e) create revenue generation to pay for the MLs' ongoing operation and maintenance (2). The I-30W VPP is considered a test bed for the DFW region and an example for other Texas urban areas. Different approaches are to be implemented and evaluated; as a result, the findings from the I-30W VPP will serve as a precedent for other Texas facilities to follow in implementation.

The MLs will be restricted to HOV (i.e., two-or-more persons per vehicle), SOVs, motorcycles, and transit vehicles. All other classifications, such as trucks, recreational vehicles, and nontransit buses, will not be allowed, but the electronic toll collection system is being designed to charge a toll in the event that unauthorized vehicles utilize the MLs. Hybrids in Texas are not given preferential treatment.

Phased Implementation

The I-30W VPP is being deployed in three phases, which are dependent on the progress of the construction. A detailed description of these three phases is provided below.

HOV Phase

Initially this phase consists of a 5-mi segment from 19th Street to west of Loop 12. This segment was opened to the public in July 2007. The segment will extend past east of Loop 12 in the spring of 2009 for an approximate total length of 11.9 mi, as shown in Figure 1. During the HOV phase the facility will operate as an HOV facility, and no tolls will be charged to the following valid users: HOV 2+ vehicles, vanpools, motorcycles, and transit vehicles that are allowed to use the facility. Illegal users, such as SOVs, are considered.

Value-Pricing Phase

In the second phase, the HOV lanes will be converted to value-pricing lanes. This phase is scheduled to open in 2010. A visual representation (not to scale) is depicted in Figure 2.

The MLs will have variable pricing. As the driver approaches the entrance to the MLs, a series of dynamic message signs (DMS) will display the toll rate for the next two exits. The toll that the user will pay is the one displayed on the DMS or the lowest toll during the trip. The toll will increase as traffic increases in the MLs and decrease as traffic decreases. Users will be able to pay the toll with a valid TollTag or interoperable transponder. Users without a transponder can still use the MLs and will be processed according to the NTTA’s video tolling process and be subject to an additional convenience fee. Certain users, such as HOVs and motorcycles, will pay a reduced toll during peak hours but are still required to carry a valid transponder. A declaration gantry will be used to differentiate between HOVs and motorcycles and other users. The declaration gantry has four lanes, two for HOVs and motorcycles and two for SOVs. Transit and exempt vehicles can travel in any of the lanes.

During this phase, value pricing will be introduced in two stages: fixed schedule mode and dynamic mode.

Fixed Schedule Mode

During the first 180 days after service commencement, the MLs will operate in the fixed schedule mode. During this period, the toll base rate schedule will be used to calculate the tolls. The toll base rate schedule is a fixed rate schedule in which higher rates are charged during peak times and lower rates during off-peak periods. The objective is to maintain an adequate level of service, with average speeds greater than 50 mph, within the facility. On the basis of the facility’s performance, the toll base rate schedule is manually calibrated, by reducing or increasing the rates, to maintain the desired level of service. This calibration occurs no more often than every 30 days.
Dynamic Mode  After the initial 180 days of operation in the fixed schedule mode, the MLs will start operating in the dynamic mode on the basis of a dynamic pricing algorithm currently under development. In the dynamic mode rates can increase or decrease from the base toll rate as often as needed but not more frequently than once every 5 minutes, to manage the demand on the managed HOV lanes. The dynamic mode will provide more flexibility to adapt the base toll rates to prevailing traffic conditions. The maximum toll rate cap is $0.75/mi.

Ultimate Phase

The ultimate phase will construct additional capacity and replace slip ramps with wishbone connections, and the entire facility will be converted to two lanes. This future phase is still in the design stages, and details are not covered in this paper.

Operational Policies and Constraints

The I-30W MLs have several operational policies and constraints that apply to the current system.

Type of Facility

The I-30W MLs are considered a separated reversible high-occupancy toll lanes facility. This type of facility is physically separated from general purpose lanes by concrete barriers or a wide painted buffer. In this case a concrete barrier is present along the entire length of the facility. It is also considered reversible, because the direction of travel changes by time of day to accommodate the peak demand. In this case the facility operates in the eastbound direction in the morning peak hours and in the westbound direction in the afternoon peak hours.

Limited Access and Egress

The I-30W MLs have limited entry and exit points. During the HOV phase morning operation (eastbound), there are one entry and two exit points. During the evening operation (westbound), there are one entry and one exit point. During the value pricing phase morning operation (eastbound), there will be one entry and two exit points, and for the evening operation (westbound), there will be two entry and one exit point. See Figure 2 for a graphical representation. The ultimate phase of this project will increase the number of entry and exit points as more access locations are added to the facility.

Hours of Operation

The I-30W MLs have limited hours of operations. Their main goal is to serve the morning and afternoon peak hours. In the HOV phase, currently the hours of operation are as follows: 6:00 to 10:00 a.m. and 3:00 to 7:00 p.m. 5 days a week. The value pricing phase will extend these hours to 5:00 to 11:00 a.m. and 1:00 to 11:00 p.m.

CORRIDOR PERFORMANCE TO DATE

The project team has started and will continue to test and analyze the implementation of value pricing on the I-30W MLs and provide input on planning and implementation efforts for other VPPs in the DFW region. To accomplish these objectives, key metrics and a comprehensive data collection plan were developed. The objective is to provide the basis for comparing the different phases of the project, as it transitions from HOV-only lanes to the fixed schedule mode and finally to the dynamic mode.

Data Collection

The data collected on this project must be sufficient to answer key questions related to the implementation of value pricing on I-30W:

- Has the implementation of value pricing on I-30W affected the demand for carpools, vanpools, and bus service in the corridor? What are the effects upon corridor performance, air quality, and person throughput? Can these findings be used to inform the regional planning and air quality conformity process for the future?
Vehicle Occupancy

This section describes the trends observed in vehicle occupancy and volumes before opening the I-30W MLs and during the HOV phase. Figure 3 depicts the morning occupancy rate trend from September 2006 to July 2008. The HOV phase began in July 2007. The occupancy rates for the a.m. and p.m. periods have remained fairly constant throughout this period. The I-30W MLs average occupancy rate is 2.07 persons per vehicle, with little variation between the a.m. and p.m. periods. The I-30W general purpose lanes’ average occupancy is higher in the p.m. period (1.16 persons per vehicle) than in the a.m. period (1.08 persons per vehicle). The occupancy rate is for all vehicles, including transit vehicles.

Figure 4 provides vehicle occupancy by hour. From 6 to 9 a.m., the occupancy rate is fairly constant for each of the data collection periods. Only the 6 to 7 a.m. hour on July 31, 2008, has a lower occupancy rate of 1.48. This is attributed to its being the opening date. This is considered the learning period for the drivers, and once confusion cleared during the first hour, the occupancy rate and violation rate stabilized as well.

Vehicle Volumes

A measure of success for the I-30W MLs is observed when the combined number of carpools in the general purpose lanes and the MLs is higher than the number of carpools in the general purpose lanes before the opening of the MLs. An increase would indicate that more drivers see the benefit of the MLs and have made a decision to start carpooling, effectively removing vehicles from the road (4). Figure 5 shows an increase in the number of carpools, both in the general purpose lanes and MLs, after the I-30W MLs opened. Future data collections will confirm this trend.

Figure 6 provides the average daily traffic (ADT) on the I-30W MLs over time. Days with no ADT values are due to inactive sensors. The ADT shown in the figure is the sum of the eastbound morning operations (6 to 10 a.m.) and westbound evening operations (3 p.m. to 7 p.m.) as a result of the reversible approach of the facility. Weekly ADT follows the same pattern: starting with the lowest ADT on Mondays and peaking by Friday. Figure 6 excludes weekends and holidays when the MLs are closed. This schedule will be expanded in the value pricing phase when higher volumes are expected, once SOVs are allowed to use the facility. The current demand in the HOV phase does not justify extended hours of operation and its associated enforcement costs.

### Table 1 Data Collected Quarterly

<table>
<thead>
<tr>
<th>Data Collected</th>
<th>Description</th>
<th>Frequency</th>
<th>Data Collected at</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>I-30W General Purpose Lanes</td>
</tr>
<tr>
<td>Automatic counters</td>
<td>Permanent pneumatic counters</td>
<td>On daily basis 24/7</td>
<td>✓</td>
</tr>
<tr>
<td>Occupancy and</td>
<td>Manually performed 6:00–9:00 a.m.</td>
<td>1 day per quarter</td>
<td>✓</td>
</tr>
<tr>
<td>vehicle counts</td>
<td>and 4:00–7:00 p.m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel time runs</td>
<td>Approximately every 30 minutes</td>
<td>1 day per quarter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6:00–9:00 a.m. and 4:00–7:00 p.m.</td>
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</tbody>
</table>
Violation Rate

There are two types of violations in the current HOV phase: SOVs, with the exception of motorcycles, and illegal vehicles, such as trucks with more than two axles or a gross weight capacity of 5 tons or more and vehicles towing trailers. Figure 7 includes the daily violations for vehicles carrying one person, with the exception of motorcycles. The average violation rate is in the range of 5% to 7% and has been rather stable since the beginning of operations. The higher violation rate on July 31, 2007, can be attributed to this being the opening date. As explained in the previous section, the public went through a learning period during the first few hours after opening the MLs. DART police are responsible for enforcement of this facility. The fine for an HOV violation is $200 per infraction.

Travel Time and Speed

Travel time savings are directly related to operating speed. Researchers found that to encourage the formation of carpools or to increase bus utilization, a minimum of 5 min of total travel time savings over the general purpose lanes is required (4). Figure 8 shows that during
the a.m. peak hour, the time savings were 5 min or more. However, for April and July 2008 the time savings were less than 1 min, because the general purpose lanes were uncongested. This can be explained by the road construction west of the HOV lanes’ access point. The road work is having an impact on the general purpose lanes. The construction area has a new and curvier alignment, no shoulders, and narrower lanes. All this is causing two conditions that might explain the improved traffic condition east of the conflict area: (a) a metering effect—by slowing down traffic it creates better conditions downstream and (b) people might be seeking an alternative route to avoid the construction zone. Future data collection periods after construction completion will confirm if the travel time savings are greater than 5 min.

Figure 9 shows the average speeds for the general purpose lanes and the MLs during the January 2008 data collection period. In the morning peak hour the I-30W MLs provide a much faster commute.
than do the general purpose lanes, where stop and go conditions are observed. During the afternoon period, westbound traffic in the general purpose lanes is minimal, with speeds of about 10% lower than in the MLs.

**USER PERSPECTIVE**

To gather public opinion on the introduction of value pricing in the DFW region, current perception of the I-30W ML, and possible signing for the corridor, the team conducted a survey and three focus groups meetings.

### Survey

A web-based survey was conducted of I-30W corridor users. Since the target market for the I-30W MLs is derived from peak-period commuters, the following methods for recruiting respondents were pursued:

- Requests for participation from employers within the gravity zones along the corridor and in the Dallas central business district;
- Postcards sent to people who attended public hearing meetings related to transportation;
Press releases targeting the media, which resulted in newspaper articles, radio segments, and television news asking people to take the online survey;
- Requests by the Dallas downtown business association to its members to take the survey; and
- Public websites with links to the survey, such as DART and the City of Arlington, Texas.

The team chose to use a web-based platform, because it enhances iterative testing possibilities and minimizes cost. Specific elements for this survey included

- Created web-enhanced survey instrument—using the web, real-time calculations can be made specific to the participant and
- Bilingual surveys—the Web-based survey was made available in both English and Spanish.

The survey was active during July and August 2008. A total of 1,088 responses were received. The final survey report is being written, and only preliminary results are available at this time. The findings presented in this paper are preliminary and will be confirmed once the final survey report is complete.

Figure 10 shows the responses for the question: For a typical trip, how much time do you think you save using the managed HOV lane compared with using the general purpose lanes on I-30W? The percentage of respondents who believed they saved between 1 to 9 min by using the I-30W ML was 60%. This is consistent with the travel time results reported in the section above, with average travel time...
savings of approximately 1 to 5 min. This shows that the users had an accurate perception for the times savings benefits of using the ML.

Figure 10 also shows the responses to the statement: Please select your reasons for using the managed HOV lane. By a large margin, the responses were to avoid congestion and save time, which can be interpreted as similar answers. The combined response for these two answers was 59%.

Focus Groups

In this task, focus groups of targeted individuals recruited from the survey were conducted to delve more deeply into opinions and information learned in the survey. The focus group participants were recruited from survey respondents. The groups allow the researchers to discuss the rationale and reasoning behind opinions and assess how these opinions may change on the basis of information. For sign comprehension, the focus group approach allows for the testing of various signs and provides a mechanism to allow participants to explain the issues associated with the proposed signage. This effort is currently under way and expected to be completed in November 2008.

The tasks associated with focus groups are

- Identifying appropriate target groups,
- Developing focus group scripts and supporting material,
- Recruiting focus group participants, and
- Conducting focus group meetings.

LESSONS LEARNED

The evaluation of the I-30W ML has revealed some lessons that can be applied by other transportation agencies attempting to establish value pricing or value-pricing evaluation programs.

First, goals of the ML should be established early in the project. The goals should be used to define the metrics of the evaluation program. For example, a goal of travel reliability might be established. For that goal, the metric may be the 95th percentile travel speed or the difference between mean and 95th percentile travel speed. The evaluation program must include the ability to collect sufficient data to calculate these metrics. For the above example, that would be enough travel time runs to generate mean and 95th percentile travel times.

Second, construction of the ML can affect the period before data collection. If the phasing of the construction is perceived to have significant impacts on the travel patterns in a corridor, then this should be identified early. Agencies may try to consider starting the data collection period even before any construction starts, in an attempt to control for data collected in the construction period.

Third, if general purpose capacity is being added at the same time as the ML, then expectations on benefits must be adjusted to account for the reduction in congestion that the new general purpose lane capacity will provide. General purpose lane congestion must be monitored before and during ML operation to account for ridership and travel time savings.

Fourth, the use of a control corridor is an effective way to supplement the evaluation methodology. This is especially true if no construction or capacity additions are planned in the control corridor. The control corridor should have similar characteristics (i.e., radial facility versus circumferential, number of lanes, etc.) and serve similar population and employment patterns.

Fifth, a value-pricing evaluation will benefit from strong public outreach. Surveys, interviews, and focus groups are effective ways of getting public input on user needs of an ML.

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REFERENCES


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