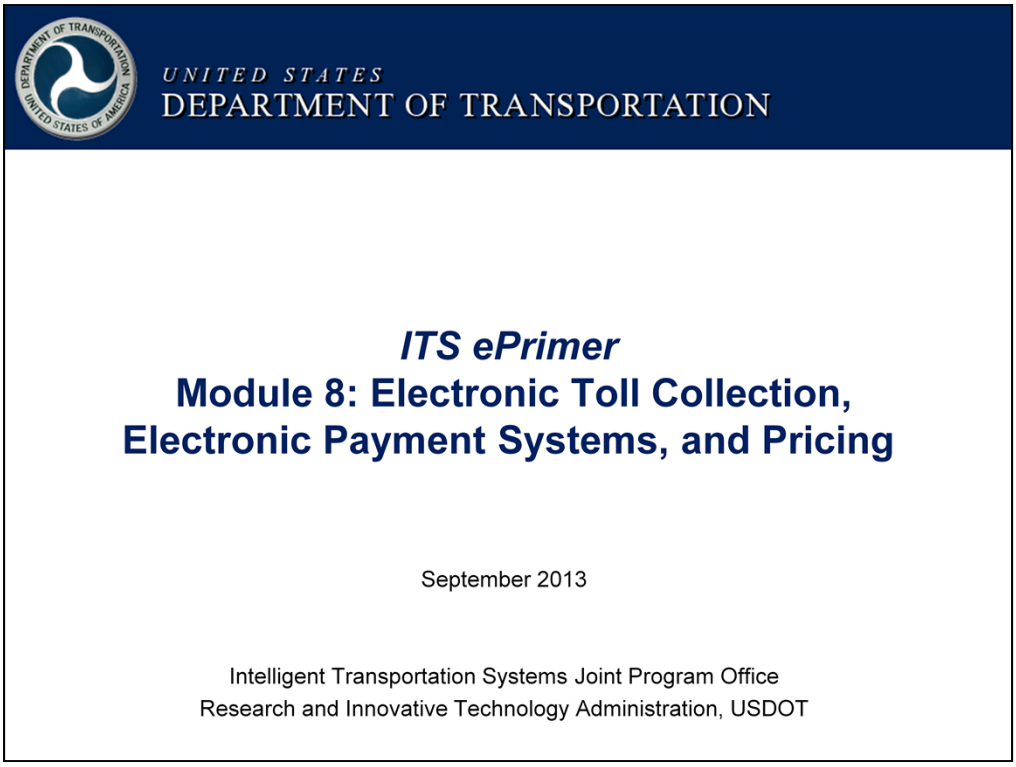

This is the first, title slide in all modules.

The following slides are in this order:

- Instructor
- Learning Objectives
- Content-related slide(s)
- Summary (what we have learned)
- References
- Questions?

This module is sponsored by the U.S. Department of Transportation's ITS Professional Capacity Building (PCB) Program. The ITS PCB Program is part of the Research and Innovative Technology Administration's ITS Joint Program Office.

Thank you for participating and we hope you find this module helpful.

Instructor

Bob McQueen, CEng, MICE
CEO
Bob McQueen and Associates Inc.
Orlando, FL, USA

Learning Objectives

- Understand the basic terminology of electronic payment systems applications and pricing strategies
- Describe electronic payment technologies, applications, and strategies
- Understand the application of electronic payment systems applications to transportation and Intelligent Transportation Systems and describe some challenges
- Understand the approximate costs and benefits associated with electronic payment systems applications and pricing
- Define the role of the private sector in electronic payment systems applications
- Describe some implementation examples and lessons learned

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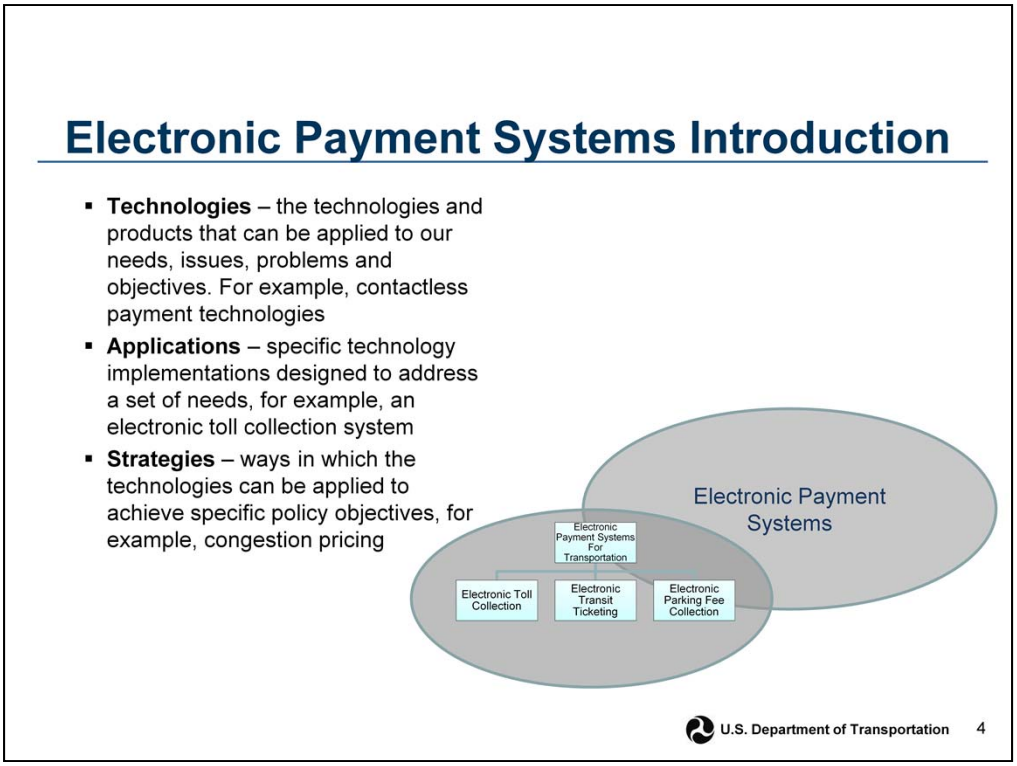
Summary of learning objectives:

Review these with course participants to ensure clear common understanding of the module objectives

Note that this is not a “how to” course, but an awareness building and introductory course



Point out the difference between technologies, applications, and strategies

Explain that transportation payment systems fit into a bigger picture of payments systems for general purposes

Note that there are three primary transportation electronic payment applications—electronic toll collection, electronic transit ticketing, and electronic parking fee collection.

There are also regional multimodal transportation payment systems.

Each of these applications is covered in this module.

SFPark San Francisco

- The following link points to a video that provides an example of a smart car parking system being implemented in San Francisco
- This shows how electronic payment systems can be applied to fee collection for parking within a wider congestion management context

http://sfpark.org/resources/sfpark-overview-video/

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This video provides information on the effects and goals of the SFPark project.

It illustrates electronic fee collection for car parking, variable fees, and fits within a regional multimodal payment system.

Non-cash Transactions Worldwide

- 260 billion on-cash transactions worldwide
- Electronic payment techniques are growing in importance every year
- The USA accounts for more than 40% of the total, with 104 billion transactions
- Transportation electronic payment systems fit within this larger context and benefit from innovation and development from the wider market

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Highlights the growing importance of electronic payment.

Emphasizes the importance of the non-transportation payment context for innovation and development.

Contactless Payment Systems

- Short-range wireless technologies are used to enable payment without contact between the payment device and the reader
- This example shows a contactless smart card being used to pay for a transit fare in Finland

Contactless Smartcard use for Transit in Finland. Retrieved from: http://en.wikipedia.org/wiki/File:Matkakortti_ja_kortinlukija.jpg on January 31 2013

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Note the use of contactless technologies enables faster transit vehicle boarding and makes the system more reliable.

Near Field Communications

- The use of cell phones and smart phones to support contactless payment is known as Near Field Communications (NFC)
- This differentiates between this use and the use of the phone as a wide area wireless device for voice and data communications
- It also covers communications between one phone and another one

Use of NFC for Transit Ticketing in Austria. Retrieved from: http://en.wikipedia.org/wiki/File:NFCFahrscheinentwerter.jpg, on January 31, 2013

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The Near Field Communications (NFC) standards include ISO/IEC 18092 and those defined by the NFC Forum, which was founded in 2004 by Nokia, Philips and Sony, and now has more than 160 members.

The Forum also promotes NFC and certifies device compliance.

This technology will also be used to purchase items in department stores and for other non-transportation applications.

Smart Phones and Bar Codes

- Several major airlines are now using two-dimensional bar codes as a boarding pass
- You can download the bar code from the airline Web site and have it scanned by a special optical reader at TSA airport security
- The bar code is used as proof of payment

Samsung Focus Smartphone, retrieved from http://upload.wikimedia.org/wikipedia/commons/5/5f/Mobile_boarding_pass_KLM.JPG on January 31, 2013

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Note that even paper boarding passes now have bar codes to enable machine scanning at electronic airport kiosks.

The mobile boarding pass technology is part of the International Airline Transport Association (IATA) Bar Coded Boarding Passes (BCBP) initiative.

At least 30 airlines use mobile BCBP. It is anticipated that at least 12% of airline passengers will use mobile BCBP in 2013.

Bar Code Billboards

- Large bar codes can be used to transmit a lot of information to passersby
- Scan the bar code with your smart phone loaded with a special app and you can be taken to an appropriate Web site for more information

Japan QR Code Billboard, retrieved from http://en.wikipedia.org/wiki/File:Mobile_boarding_pass_KLM.JPG

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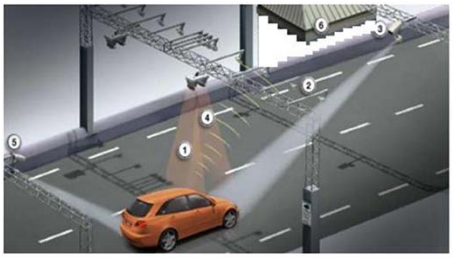
Note that the three dimensional bar code is often referred to as a “QR” or Quick Response code.

Electronic Toll Collection

- Vehicle enters the toll zone and breaks the first laser beam (1), triggers transceiver (2)
- Transceiver signals vehicle's transponder/tag requesting time, date, and transponder, or tag identity
- Camera (3) photographs the vehicle's front license plate
- Vehicle breaks second laser beam (4) triggering the second camera (5)
- Second camera photographs the rear license plate



ETC concept from Stockholm Congestion Charging project. Based on information retrieved from: http://transportationfortomorrow.com/pdfs/commission_meetings/1006_meeting_washington/lamba_presentation_1006_meeting.pdf on June 5, 2013.

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Note that this is how it is done in Stockholm:

As the vehicle enters the toll zone it breaks the first laser beam (1) which triggers the transceiver (2) to wake up.

The transceiver then signals the vehicle's onboard transponder or tag requesting transmission of the time date and transponder or tag identity.

At the same time as the transceiver operates, the camera (3) photographs the vehicle's front license plate.

As the vehicle progresses through the tolling zone it breaks the second laser beam (4) triggering the second camera (5).

The second camera photographs the rear license plate.

Funds can be placed in the account via a website, at a bank, or at a retailer (6) such as a convenience store chain.

There may be variations in technology from one project to another.

This provides an illustration of the process flow only and is not intended to be a detailed design.

Audience Interaction

- What is your opinion regarding open road tolling compared to all electronic toll collection?
  - Should drivers be forced to use electronic means only, or should we always leave the opportunity to pay for cash at the roadside?
  - Do the customer service benefits of accepting cash out weigh the cost of the cash collection?

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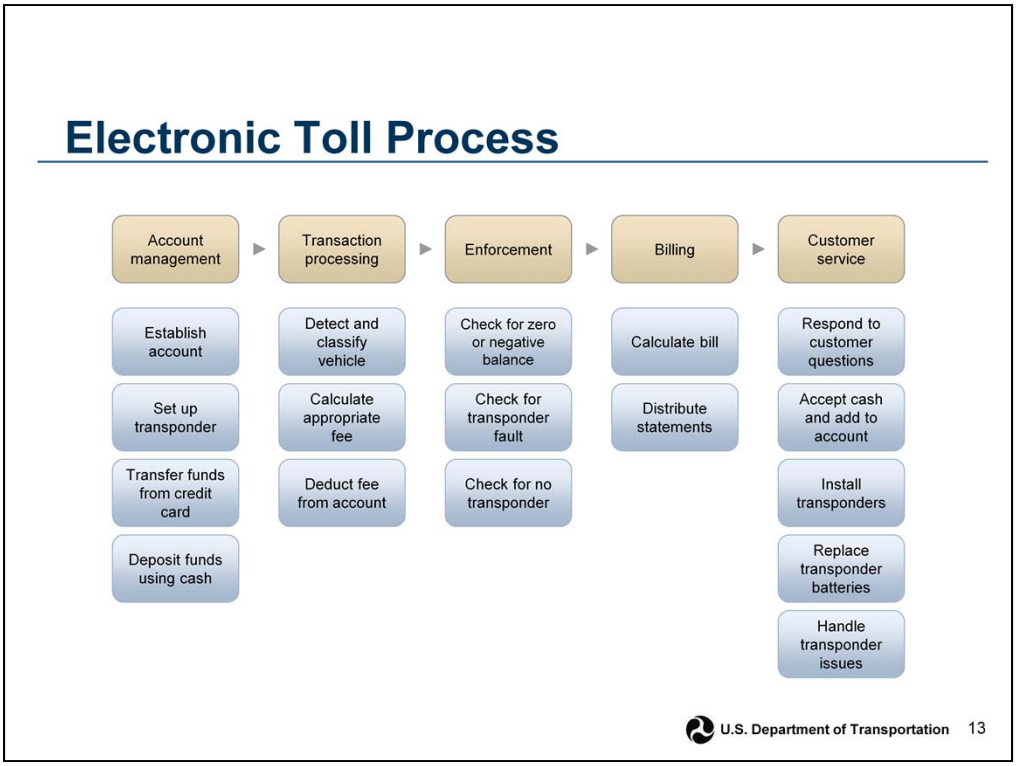
Take this opportunity to engage the audience for a few minutes and ask them for their thoughts and views.

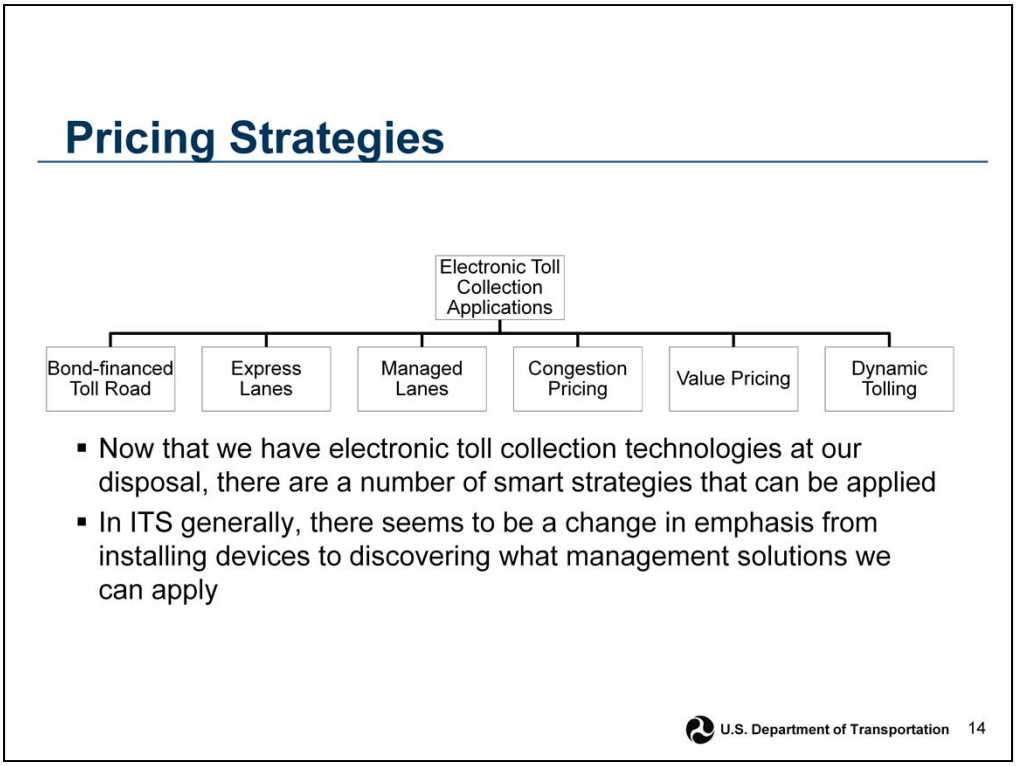


This is a process diagram that captures the steps in an electronic toll transaction from the back office perspective.

The gold boxes at the top are milestones or major processes.

The blue boxes under each gold box break the major process down into smaller steps.

The objective is to illustrate that much of the work and resources are required behind the scenes in the back office.



Bond-financed toll roads: These are either publicly or privately owned and operated highway facilities. The money to plan, design, build, and operate such roads is raised from the private sector on the commercial bond market. This type of approach places an emphasis on maximizing throughput and revenue while delivering the highest possible levels of safety, efficiency, and customer service.

Express Lanes: The express lanes term is reserved for those lanes where the user pays a variable or fixed toll in return for use of a special purpose facility that typically operates in parallel with general purpose lanes that are not tolled, offering the driver a choice to pay or not.

Managed Lanes: A highway lane or set of lanes, or a highway facility, for which variable operational strategies such as direction of travel, tolling, pricing, and/or vehicle type or occupancy requirements are implemented and managed in real-time in response to changing conditions. Managed lanes are typically buffer or barrier-separated lanes parallel to the general-purpose lanes of a highway in which access is restricted to designated locations. There are also some highways on which all lanes are managed.

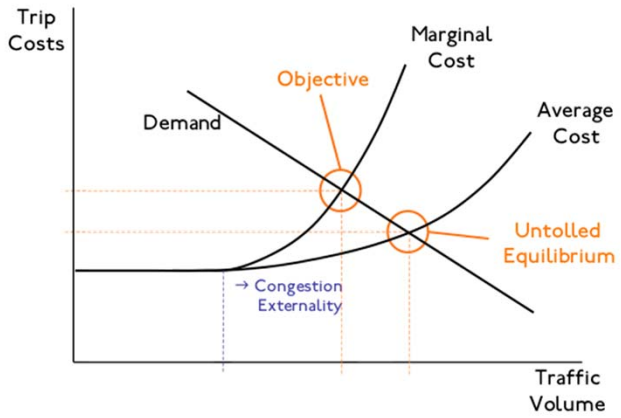
Congestion Pricing: Managing the demand for travel by varying the cost of travel by imposing a fee.

Value Pricing: An operating strategy in which the price to use the facility is varied according the value being delivered. The value can be defined in terms of trip time, average speed or trip time reliability. This can be achieved through the use of time of day pricing according to a pre-published schedule, or by adjusting the toll rates in near real time using dynamic tolling techniques.

Dynamic Tolling: The variation of toll rates for each time period and each road segment to achieve pre-defined service level objectives. Sensor data is used to calculate new toll rates at regular intervals and these are communicate to drivers using dynamic message signs.

Note that there is some confusion in the industry - express lanes and managed lanes are often used interchangeably .

Basic Economic Principles of Pricing



TE-Pricing-Equilibrium Congestion, retrieved from http://en.wikipedia.org/wiki/File:TE-Pricing-EquilibriumCongestion.png on May 21, 2013

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The principle is very simple: the volume or the demand for travel is reduced as the cost of the trip is increased.

For example, in the figure, as trip cost is increased from average cost to marginal cost by imposing a toll or user fee, then traffic volume drops from the un-tolled equilibrium to the objective traffic volume.

The relationship between volume and price with respect to pricing and tolling for congestion is referred to as elasticity.

In economic terms, elasticity is defined as change in demand or volume divided by the change in price. Elasticity can also be defined as the slope of the straight-line shown in the diagram above.

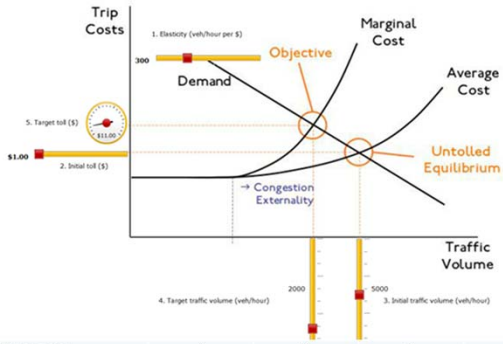
History: In 1920, a British economist by the name of Arthur Pigou described the use of congestion pricing for a congested highway.

He was, in fact, trying to illuminate how social welfare would operate and was merely using a congested road as an example or analogy.

The true father of congestion pricing theory is probably the Economics Nobel Prize Winner, William Vickrey.

He was the first to propose a system of electronic tolling for congestion pricing purposes. He described a process where each car in the Washington metropolitan area would be equipped with a suitable transponder or tag.

Pricing Economics Simulator (1/3)



	Parameter	1	2	3	4	5
Scenario	Description	elasticity (veh/hour/$)	initial toll ($)	initial traffic volume (veh/hour	target traffic volume (veh/hour)	target toll ($)
1	base case	300	1	5000	2000	$11.00
2	change in elasticity	601	1	5000	2000	$5.99
3	change in target traffic	300	1	5000	3801	$3.00

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The variable tolling simulator is designed to illustrate how road pricing principles work. This graphic shows the relationship between the cost of making a trip and the demand for making the trip (traffic volume). The main principle is quite simple - if the trip costs more money then less people will make it and traffic volume will be reduced. There are five main parameters associated with the graphic. These are:

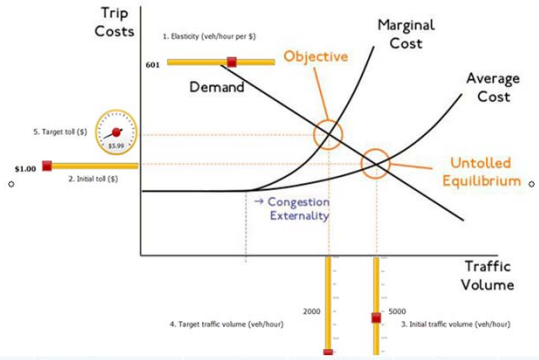
1. Elasticity - this defines the relationship between cost of travel and demand for travel. For the purposes of this simulator elasticity is defined as vehicles per hour per dollar. In other words it specifies how many vehicles per hour will be deflected from making the trip for every dollar increase in the cost of making the trip.
2. Initial toll – even if there was no toll on the road there would be some cost associated with travel in terms of vehicle operating costs. Therefore we have set the initial toll at one dollar on all scenarios.
3. Initial traffic volume – measured in vehicles per hour. This is a measure of the demand for travel before pricing is introduced.
4. Target traffic volume – measured in vehicles per hour. This defines the target demand for travel after the price has been introduced.
5. Target toll – measured in dollars. This is the toll or price that would have to be imposed in order to achieve the target demand for travel or target traffic volume as specified in 4.

Now let us consider the base scenario as illustrated in the figure. Each of the four parameters have been set at the following values, using the orange sliders:

1. Elasticity – 300 vehicles per hour per dollar
2. Initial toll - $1.00
3. Initial traffic volume – 5,000 vehicles per hour
4. Target traffic volume – 2000 vehicles per hour

As indicated on the target toll gauge (5), a price or toll of $11 would have to be imposed in order to achieve the target traffic volume

Pricing Economics Simulator (2/3)



	Parameter	1	2	3	4	5
Scenario	Description	elasticity (veh/hour/$)	initial toll ($)	initial traffic volume (veh/hour	target traffic volume (veh/hour)	target toll ($)
1	base case	300	1	5000	2000	$11.00
2	change in elasticity	601	1	5000	2000	$5.99
3	change in target traffic	300	1	5000	3801	$3.00

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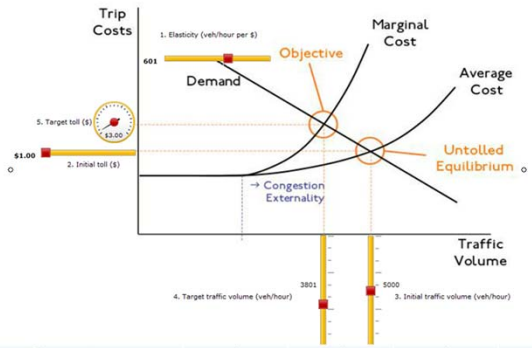
In this scenario the elasticity has been increased from 300 to 601, while all the other parameters remain the same. You can see that this has the effect of reducing the toll or price to be imposed from $11 to $5.99, since more vehicles will be deflected for every dollar increase in price.

Pricing Economics Simulator (3/3)



	Parameter	1	2	3	4	5
Scenario	Description	elasticity (veh/hour/$)	initial toll ($)	initial traffic volume (veh/hour	target traffic volume (veh/hour)	target toll ($)
1	base case	300	1	5000	2000	$11.00
2	change in elasticity	601	1	5000	2000	$5.99
3	change in target traffic	601	1	5000	3801	$3.00

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In this last scenario, the target traffic volume has been increased from 2000 vehicles per to 3801 vehicles per hour. Since we require to deflect less vehicles the target toll is now reduced to $3.00. Note that the elasticity has been held at 601 as in the previous scenario, so this one shows the combined effects of increasing both the elasticity and the target traffic volume compared to the base scenario.

Worldwide Pricing Projects

- There are almost 50 projects worldwide involving some form of pricing strategy.
- These projects represent a combination of toll roads, urban congestion pricing, value pricing, managed lanes, and express lanes strategy implementations.

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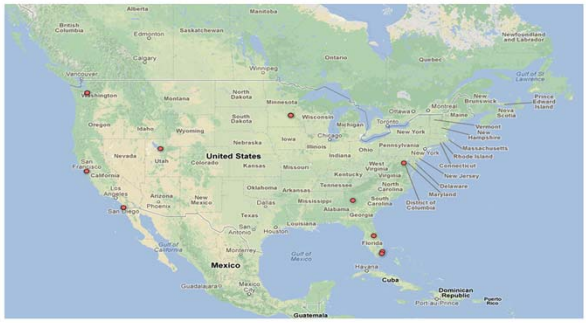
Note that there are not 50 dots on the map as some cities have more than one project.

Interest in the application of pricing is global but implementation strategies vary considerably.

Dynamic Tolling Projects in the USA

- There are 11 projects that are conducting dynamic tolling currently in the U.S.
- Dynamic tolling can be viewed as a subset of managed lanes or express lanes as they are operated under variable tolling regimes in order to achieve a specific traffic conditions objectives.



Is It Variable or Dynamic Tolling?

Variable tolling	Pre-published schedules
	For each segment
	Vehicle classification
	Time of day
	Day of week
Dynamic tolling	For each segment
	Level of service based
	Value of time saved based
	Combination of level of service and value of time

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As noted in the table, variable tolling techniques can simply involve the use of a pre-published table of toll rates updated at 3 to 6 month intervals based on traffic counts.

When a pricing schedule approach is adopted, the tolling is not really conducted in a truly dynamic fashion. A schedule of rates for each vehicle type for each segment of highway is made available to drivers both on the Web and at the roadside.

Drivers are then empowered to make a decision to use the facility or not. You can think of the refresh rate (the rate at which the toll is updated) as 3 to 6 months for this type of project.

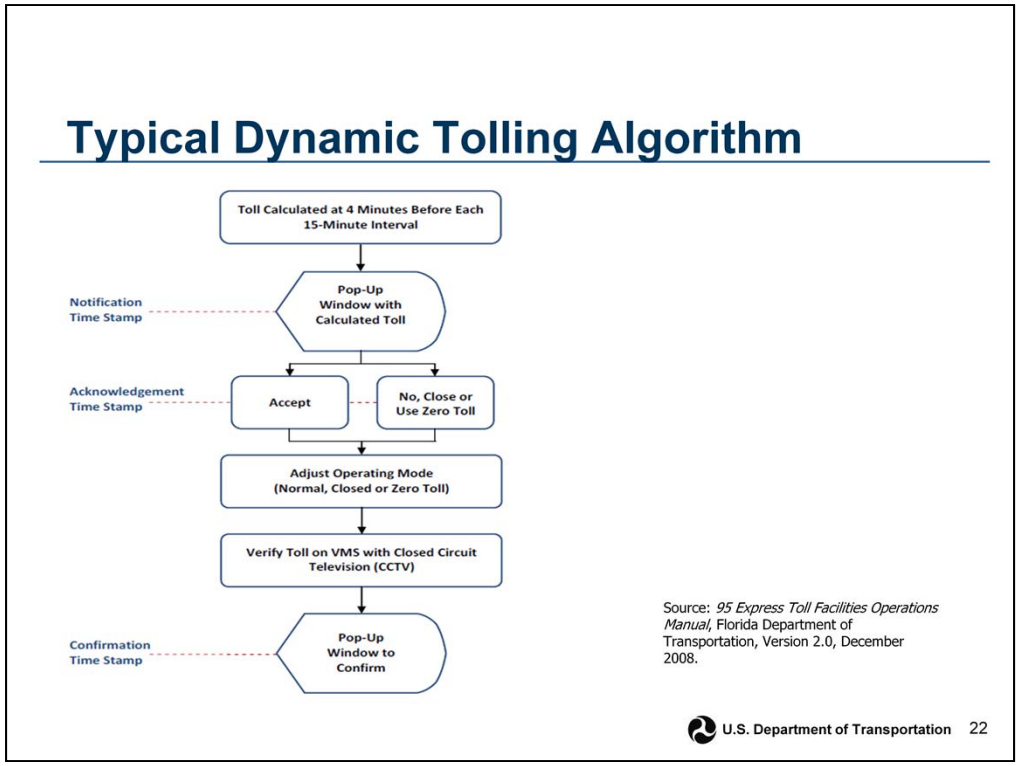
This approach takes advantage of the flexibility of electronic toll systems to make pricing changes rapidly and with minimum expense.

On the other hand, dynamic tolling makes use of sensors in the roadway that are used to continuously monitor traffic flow. Incremental adjustments of the toll are then made to correspond to changes in the traffic flow.

One approach to this is to install sensors in the express lanes and adjust the toll in order to preserve a specific level of service on those lanes.

Another approach involves the installation of sensors on both the express lanes and parallel general-purpose lanes.

Travel times on both facilities are then computed and the toll charged on the basis of the travel timesaving experienced by drivers on the express lanes.



For this implementation the toll is calculated at 15-minute intervals.

The toll calculation is initiated 4 minutes before each 15-minute interval begins to allow time for the new toll to be calculated, the operator to validate the new toll and for it to be communicated to drivers via dynamic message signs.

The system also has “closed” and “zero toll” modes.

These are used when an incident requires that express lanes be closed to traffic (close mode) or when an evacuation scenario requires the toll to be removed completely for a period of time to facilitate evacuation (zero toll mode).

Audience Interaction

- What is your opinion regarding urban congestion pricing?
  - Would you be prepared to pay a mandatory fee for access to a downtown area in the U.S.?
  - Do you think that pricing is fair?

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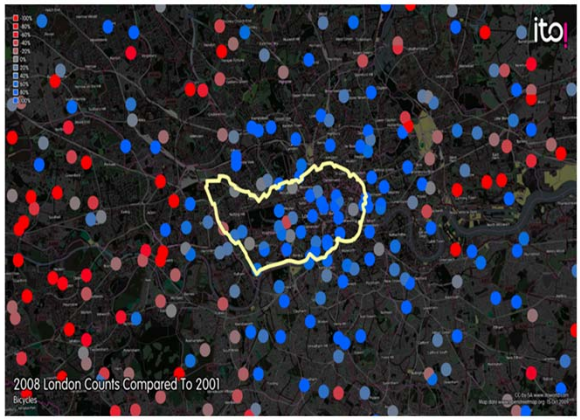
Take this opportunity to engage the audience for a few minutes and ask them for their thoughts and views.

Defining Strategic Objectives

- Congestion Reduction
- Peak Spreading
- Modal Shift
- Revenue Generation



Changes in the counts of bicycles in London at October 2008 compared to October 2001. Retrieved from http://en.wikipedia.org/wiki/File:London_congestion_cycles.png on January, 31 2013

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Both the London and Stockholm projects have the primary objective of congestion reduction. This was achieved by imposing a mandatory charge for travel into downtown congested areas during the daytime.

The objective is to deflect a proportion of the traffic to other modes of transportation or to travel at different times of the day.

The reduction congestion objective can also address emissions management objectives through modal shift and congestion reduction

The modal shift effects of the London congestion pricing project is shown in the figure.

The blue dots show an increase in the number of bicycles counted during traffic counting. The red dots show a decrease.

In some cases the objective is not to divert traffic away from the road, especially if it is a toll road, but to encourage drivers to advance or delay their trips to avoid the peak period.

This strategy is known as peak spreading as the intent is to spread the peak period traffic over a longer period by toll increases during the very peak period.

When the objective is to divert traffic to another mode of transportation such as transit, bicycle or pedestrian modes, then the strategy to be applied is known as modal shift.

This requires that viable alternative modes are available and that good traveler information can be delivered to make drivers aware of the choices.

The revenue generated from a pricing project can be reinvested into transportation infrastructure in the region.

It may also be used to accelerate the development and construction of infrastructure by funding availability payments or some other form of public private partnership.

Note that revenue generation as a strategy can be implemented in tandem with the other strategies above with the exception of modal shift.

Multimodal Electronic Payment Systems

- Regional multimodal electronic payment system - all modes of transportation addressed by single payment system
- While there may be one single payment system there may be different payment devices
  - For example, vehicle-based payment can be achieved by transponder or tag while personal based payments such as ticketing for transit systems can be accomplished with a smartcard
  - The same account can be used for both even if different payment devices are used
- Regional multimodal approach offers more management solution possibilities
  - For example, conditional discounts could be offered where users of the transit system on one particular day may be offered free parking downtown for another day when they decide to take their car

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Note that multi-application does not imply a single payment device.

The single account is often known as a “universal transportation account.”

Challenges

- Requirements definition
- Proprietary technologies
- Funding and financing
- Future proofing
- Privacy and anonymity
- Fairness and equity
- Fitting within the wider context
- Harnessing regional partners
- Finding the best business model

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Proprietary technologies are attractive initially as they represent off-the-shelf solutions but can be a lock-in issue over time.

Funding and financing challenges must be addressed through clear communication of the value proposition and the services to be delivered by the project.

Future proofing is never guaranteed but we should look as far ahead as we can when planning these systems.

Privacy and anonymity can be traded for service and benefits under optional mechanisms.

Fairness and equitable treatment are key to public acceptance.

Getting the most out of regional investments in technology needs context.

Partners can share the cost of deployment and operations, avoiding duplicate investments.

The business model should match the capabilities and constraints of the technology chosen.

Electronic Payment, Transportation, ITS

- Electronic toll collection and pricing considered as a subset of ITS
- Many ITS applications complementary to electronic toll collection and pricing systems
- Electronic toll collection and pricing set within a wider context of performance management
- Electronic payment systems applications can be powerful collectors of data for performance management
- Electronic payment systems applications fit within ITS and transportation management through delivery of more efficient data collection and demand management
- The flexibility of electronic systems to adjust payment provides demand management possibilities

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Consider the case of a toll agency operating an express lanes facility in a major urban area.

One of the most important success factors in system operation lies in effective marketing to tell the drivers how to use the facility, how much it is going to cost them, and how they should go about preparing themselves to use the system.

In short, there is a need for traveler information.

The Role of the Private Sector

- Providing technology products and services
  - The private sector may have already invested considerable sums in technologies, products and services that can be incorporated into a public agency project
- Providing expertise and experience
  - Many private sector companies have the ability to conduct business worldwide and may have gathered expertise and experience that is difficult to accumulate in a local context
- Providing financing
  - It may also be possible for the private sector to provide financing under a suitable public private partnership relationship

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The private sector may have already developed a number of technologies, products and services that are available off the shelf.

Adapting the design of the project to take advantage of these commercial off-the-shelf elements could have substantial cost reduction consequences.

It should also be recognized that commercial off-the-shelf products have been developed on the basis of an understanding of the business process for previous initiatives.

It may be valuable to consider the nature of these prior business processes before embarking on a complete redesign of the business process for your project.

In some cases the private sector has particular expertise and experience not found in public sector organizations. This is especially true when private sector resources are drawn from areas beyond transportation.

A private sector organization may also have had the opportunity to gain experience over a number of regions and a number of projects.

This experience would be very complementary to the public sector agency experience which goes into great detail in one single region.

The specialist resources could be particularly important in both the planning and design stages of project. In many cases, private sector organizations also have specialist expertise in operations, maintenance and management.

In addition to providing expertise the private sector may also be able to deliver the resources required to help plan, design, build, operate, maintain, and manage the project.

Not every public agency has the in-depth operational experience or expertise required to successfully execute an Electronic payment systems payment project.

In today's economic conditions the public sector may not always have the resources required to fund the project.

It may be possible that the private sector could provide finance for the project if a suitable compensation mechanism can be defined.

Electronic payment systems are particularly suitable for this approach because they have an inherent charging mechanism.

For example a transaction fee could be applied to every transaction to compensate the private sector for financing resources invested in the project.

Experience has shown that this approach requires careful structuring of the business model and contractual agreements.

Illustrative Examples

	Name of Project	Description	Web Link
1	ORCA Card	Implemented a single smart card for bus, rail, and ferry services in the Seattle Metro area. Single card, multiple modes, multiple service providers	www.orcacard.com
2	New Jersey Transit Google Wallet trial	Trial of smartphone technology to pay for transit fares in New Jersey with Google Wallet	http://www.reuters.com/article/2010/09/21/usvisamobileidUSTRE68K2DG20100921 on February 2 2013
3	New York and New Jersey NFC payment trial	Trial involving MasterCard and Visa on the use of smartphones with NFC technology for transit fare payment	http://www.reuters.com/article/2010/09/21/usvisamobileidUSTRE68K2DG20100921
4	Houston Katy Freeway Express Lanes	Dynamic tolling on express lanes retrofitted in the median of major freeway	https://www.hctra.org/katymanagedlanes/how_it_works.html on January 31 2013
5	WMATA Washington DC – SmarTrip	Smart card system for paying bus and Metro fares in Washington DC	http://www.wmata.com/fares/smartrip/
6	CTA Chicago Card	Smart card system for paying bus and Metro fares across multiple operators in the Chicago Metropolitan Area	http://www.chicagocard.com/ccplus/firsttime.aspx
7	I15 FasTrak Tolls San Diego	First implementation of dynamic tolling on express lanes in the USA	http://www.sandag.org/uploads/publicationid/publicationid_6_1065.pdf
8	EZPass Group	Coalition of agencies in the northeast sharing interoperable electronic toll collection system and central clearing/settlement	http://www.ezpassiag.com/aboutus/overview
9	Oregon Mileage Based Road User Fees	Pilot projects and legislation development to replace fuel based taxation with distance based	http://www.oregon.gov/ODOT/HWY/RUFPP/pages/rucpp.aspx

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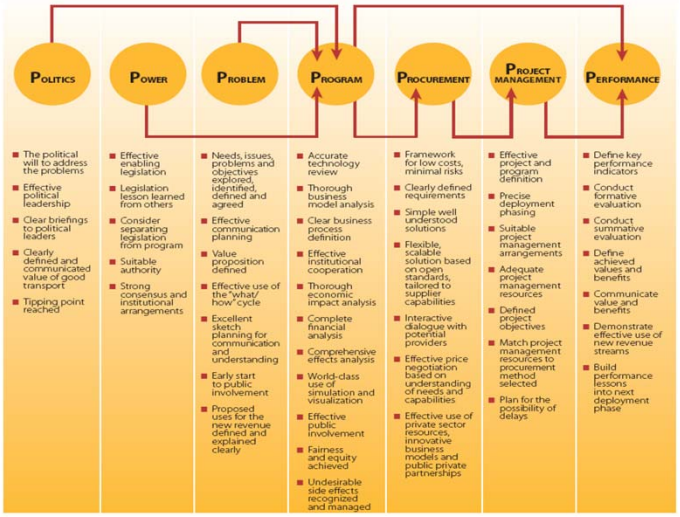
The above nine examples cover a range of transportation electronic payment applications.

Use the Web links provided to show further information on each project.

Lessons Learned



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Summary of lessons from the London and Stockholm congestion charging projects. These could be summarized as the 7 “Ps” to make them easier to remember.

The Cost of Change Lesson

- The lesson is simple – ambiguity costs money.
- Ambiguity appears in system requirements due to lack of formal agreement on what the system is designed to do and lack of definition on specific requirements.
- As a rule of thumb it will cost approximately $1,000 to correct problems during the deployment stage.
- While that same problem could have been dealt with during the requirements gathering stage for approximately $1.
- That is why it's worthwhile investing heavily in initial requirements analysis and objectives agreement.

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Boehm demonstrated through his study of a number of large-scale system development projects that failure to remove ambiguity will cost an increasing amount of resources through the different stages of the project.

As the figure clearly illustrates, the cost of ambiguity rises dramatically as the project progresses.

Typical Cost Elements

Application	Payment Device	Point of Sale Device	Telecommunications	Back Office
Electronic Toll Collection	Transponder: $20 Or Sticker tag: $4 each	Toll zone readers, lane computer, enforcement system: $1 million per zone for 3 lanes	Design and Install Fiber Optic Cable: $40 per foot	Account management, transaction processing, enforcement, billing and customer service hardware, software: $400,000
Electronic transit ticketing	Contactless Smart Card: $5 each	Fare Box with Smart Card Reader: $15000	Wireless Communications between Vehicles and Back Office	Account management, transaction processing, enforcement, billing and customer service hardware, software: $400,000
Electronic Fee Collection for Car Parking	Transponder: $20 or Sticker tag: $4 or smart card $5 or smartphone $0 each	Access control system: $15,000 per lane, or Kiosk: $15,000 or Smart Meter: $10,000	Design and Install Fiber Optic Cable: $40 per foot	Account management, transaction processing, enforcement, billing and customer service hardware, software: $400,000

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These are estimated costs taken from the FHWA benefit cost database.

These are for determining the approximate scale of the project.

Actual project costs should be determined based on a detailed analysis of the specific implementation.

Summary

- Electronic payment systems for transportation fit within a wider context of payment systems
- Electronic payment systems are comprised of technologies
- Electronic payment systems solutions are applied to a number of application areas.
  - Electronic toll collection
  - Electronic transit ticketing
  - Electronic fee collection for parking
  - Multimodal electronic payment systems
- Electronic toll collection can be carried out in a number of ways.
  - Open road tolling
  - All electronic toll collection
  - Dynamic tolling
- There are a number of pricing strategies that can be applied
  - Bond financed toll roads.
  - Express lanes.
  - Managed lanes
  - congestion pricing.
  - Value pricing
  - Dynamic tolling
- Pricing is based on a basic economic principles relating cost of travel to demand for travel
- There are multiple potential roles for the private sector in an electronic payment system
- Multiple lessons have been learned from prior implementations
- A significant body of knowledge has been developed for both benefits and costs
- Electronic payment systems have been proven to deliver value in terms of safety, efficiency, and customer service

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This slide summarizes the key points of the presentation.

It should be used to set the scene for the subsequent slide, which poses a serious of questions to the students in order to gauge their understanding of the material.

References

The following additional resources can be used to gather more information and practical insight into electronic payment systems applications, electronic toll collection, and pricing:

- For electronic toll collection: The International Bridge Tunnel and Turnpike Association. Web site: www.Ibtta.org
- For electronic ticketing systems for transit: Intelligent Transportation Systems Society of America. Web site: www.itsa.org and the American Public Transportation Association. Web site: www.apta.com
- For pricing: Federal Highway Administration Value Pricing Program. Web site: http://www.ops.fhwa.dot.gov/tolling_pricing/value_pricing/ and Federal Highway Administration Technologies That Enable Congestion Pricing – a Primer: Web site: http://ops.fhwa.dot.gov/publications/fhwahop08042/cp_prim2_05.htm
- For electronic fee collection for car parking: The Smart Card Alliance. Web site at www.smartcardalliance.org

Questions

1. What is the difference between ORT and AETC?
2. Describe one electronic payment technology, one application, and one strategy.
3. What is the relationship between electronic payment systems and performance management?
4. Name two challenges that could be faced implementing electronic transportation payment systems.
5. Name one benefit of electronic payment systems applications and pricing.
6. Define one role that the private sector might play in electronic payment systems.
7. Describe two implementation examples and results achieved.

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Sample answers to questions:

1. What is the difference between ORT and AETC? – Open Road Tolling (ORT) operation allows drivers to pay by cash at separate plaza facilities off to the side of the mainline. Under All Electronic Toll Collection (AETC) operation, the driver must pay electronically, either by transponder or video tolling.
2. Describe one electronic payment technology, one application and one strategy – smart cards, transit ticketing, dynamic tolling.
3. What is the relationship between electronic payment systems and performance management? - Electronic payment systems applications can be powerful collectors of data for performance management.
4. Name two challenges that could be faced implementing electronic transportation payment systems – Two challenges are Privacy and anonymity and Fairness and equity.
5. Name one benefit of electronic payment systems applications and pricing – reduced delay, reduced emissions, and improved customer service would all be correct answers.
6. Define one role that the private sector might play in electronic payment systems - Providing Technology Products and Services, Providing Expertise, and Experience and Providing Finance would all be correct answers.
7. Describe two implementation examples - Houston Katy Freeway Express Lanes (dynamic tolling on express lanes retrofitted in the median of major freeway), WMATA Washington DC – SmarTrip (smart card system for paying bus and Metro fares in Washington, DC).