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I-5 Columbia River Crossing Partnership:
Traffic and Tolling Analysis

Toll Rate Structure Options

Working Paper 5.1

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TOLL STRUCTURE OPTIONS FOR THE I-5 AND I-205 CORRIDOR

The purpose of this working paper is to identify tolling rate options that demonstrate material differences in tolling policy, revenue generation and traffic impacts on the I-5 and I-205 Columbia River crossings. In general, the elements that normally constitute a toll policy include:

Passenger Car Tolls

- Single Occupancy Vehicles (SOV)
- High Occupancy Vehicles (HOV)
- Frequent User Discounts
- Residency Discounts
- Electronic User Discounts/Surcharges
- Time of Day Toll Considerations
- Toll Escalation Over Time

Commercial Vehicles

- Definition of Commercial Vehicles
- Vehicle Classification
- Frequent User Discounts
- Electronic User Discounts/Surcharges
- Time of Day Toll Considerations
- Toll Escalation Over Time

These elements can be mixed and matched to create a wide variety of tolling patterns, and can be tailor-made to best fit the corridor of interest.

Toll Options

The initial toll options identified in the scope of work are as follows:

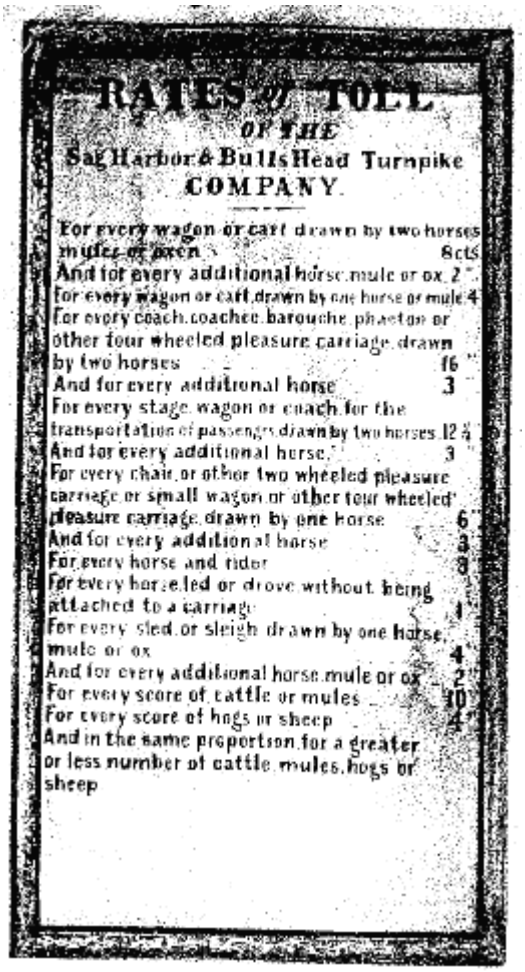
- Uniform toll rate for SOV, HOV, and heavy and medium trucks for all times of day
- Uniform toll rate for SOV, HOV, and heavy and medium trucks with time of day differential
- Differential by vehicle class, constant throughout day
- Differential by vehicle class with time of day differential
- Loyalty discounts
- HOV discounts
- Alternative structures for tolling freight traffic
- Toll rate escalation

The following discussion provides a brief review of these options, presented in the order of the most common usage in the United States. Also included is a discussion of Electronic Toll Collection discounts as well.

Differential by Vehicle Class, Constant Throughout Day

This method of toll collection has been the dominant toll strategy in the US throughout its 200+ year toll history. Figure 1 presents the toll rates established on the Sag Harbor Turnpike (eastern Long Island, New York) in the early 1840s; note the differential by several categories of carts, wagons and livestock. The first modern day toll road, the Pennsylvania Turnpike (which opened in the mid 1930s), has an interchange-to-interchange toll mileage structure; commercial vehicles are charged based upon their weight category.

Figure 1 - Sag Harbor Turnpike Toll Schedule



RATES OF TOLL
OF THE
Sag Harbor & Bulls Head Turnpike
COMPANY.

For every wagon or cart drawn by two horses mules or oxen	8cts
And for every additional horse mule or ox	2 "
For every wagon or cart drawn by one horse or mule	4 "
For every coach coachee barouche phaeton or other four wheeled pleasure carriage drawn by two horses	16 "
And for every additional horse	3 "
For every stage wagon or coach for the transportation of passengers drawn by two horses	12 ½
And for every additional horse	3 "
For every chair or other two wheeled pleasure carriage or small wagon or other four wheeled pleasure carriage drawn by one horse	6 "
And for every additional horse	3 "
For every horse and rider	3 "
For every horse led or drove without being attached to a carriage	1 "
For every sled or sleigh drawn by one horse mule or ox	4 "
And for every additional horse mule or ox	2 "
For every score of cattle or mules	10 "
For every score of hogs or sheep	4 "
And in the same proportion for a greater or less number of cattle mules hogs or sheep	

Alternative Structures for Tolling Freight Traffic

As consistent as the policy of charging tolls by vehicle class has been, toll structures for commercial vehicles have been at the opposite end of the spectrum. There are few major toll facilities that have the same commercial vehicle toll structure. The Pennsylvania Turnpike is one of the few facilities using weight as a vehicle class delineator. The two most common practices in the US are: 1) axle-count, and 2) visual vehicle delineator.

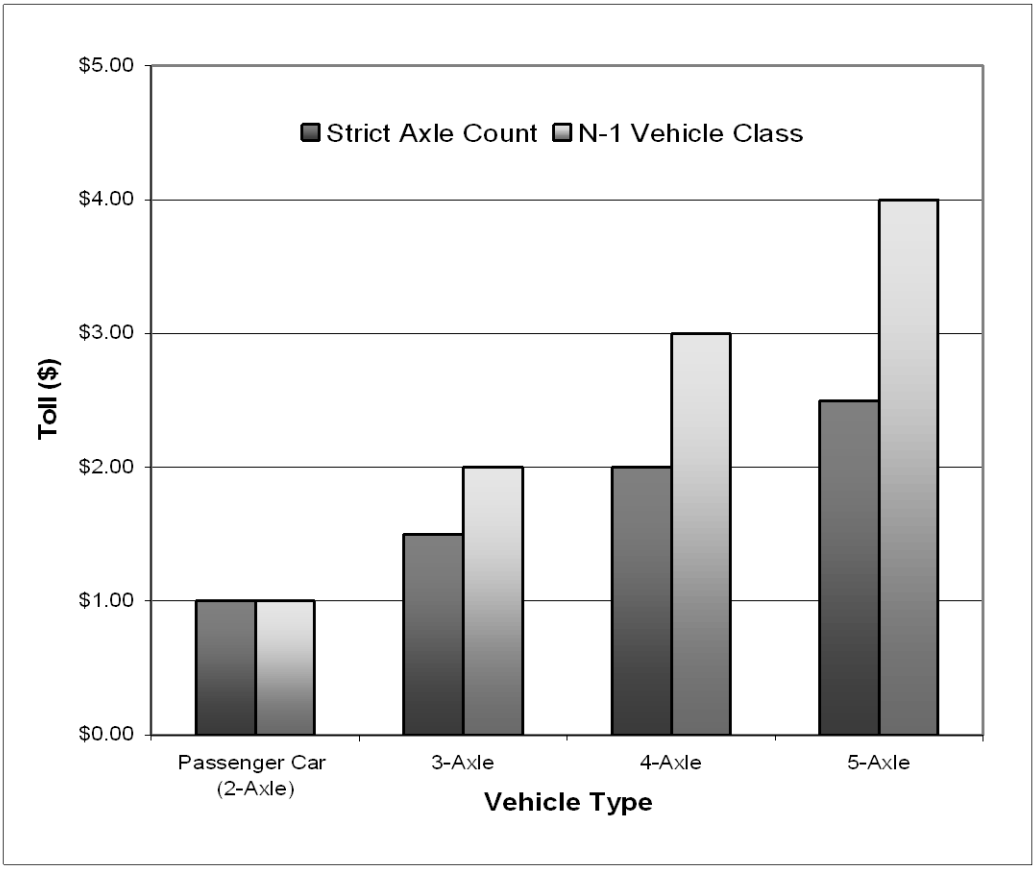
Within the axle count method, there are many variations, such as:

- *Strict axle count*. If a passenger car is two-axle, a three-axle vehicle pays 1.5 times that rate, a four axle vehicle pays 2 times the rate, etc.

- *N-1 Vehicle class.* In this system, commercial vehicles are charged a ratio of the passenger car rate based upon the N-1 formula. Thus a 3-axle truck would pay <3-1> or 2 times the passenger car rate.

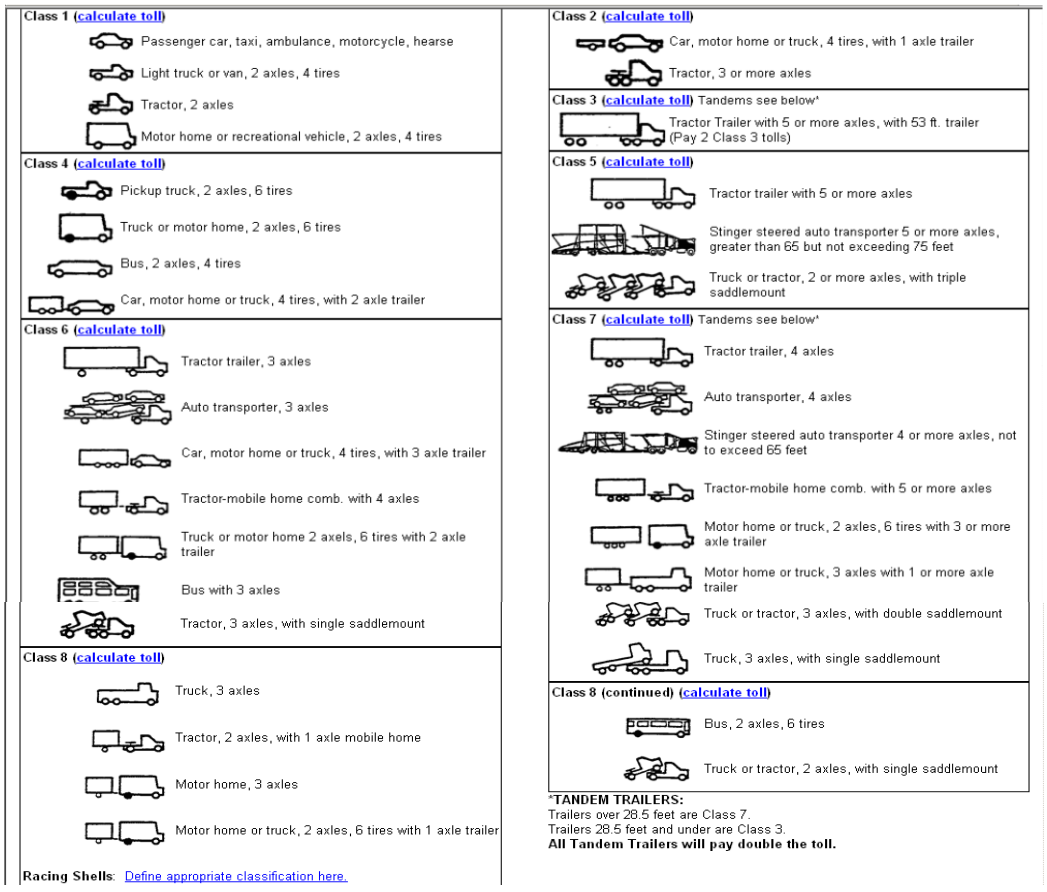
These resulting axle count toll structures are shown in Figure 2.

Figure 2 - Axle Count Tolling Structures



In the visual delineator system, each vehicle class has a visual picture, to allow the collector to identify the toll rate for the vehicle. When the systems started in the 1950s, truck traffic was composed primarily of 3- and 4-axle vehicles, and it was relatively easy to define each vehicle. Starting in the 1990's, the number of tandem trailer and other combinations of truck categories exploded; special toll rates were established based upon vehicle use as an incentive for industrial development. The best example of this is the rate applied to auto transports. The New York State Thruway Authority now has more than 40 separate vehicle classes (see Figure 3).

Figure 3 - NYSTA Current Toll Classifications



With the advent of Electronic Toll Collection (ETC), many agencies are moving to a pre-processing declaration of vehicle type that is encoded in the ETC tag. Plaza lane and/or back office activity is required to read the tag and compare the vehicle description of the declared vehicle to what information is noted in the lane. For example, a vehicle is declared to be a 4-axle tractor-trailer, but registers as a 5-axles as it passes the ETC read zone. The vehicle may then be charged the rate for the extra axles based upon the additional costs for that larger vehicle type; each agency applies its own policy with regard to such axle count discrepancies.

Vollmer Associates has undertaken several vehicle classification studies for operating toll roads. These studies, performed in close coordination with the staff of the sponsoring agencies, tend to recommend a height-and-axle system, that is, there is one rate per axle below a certain height, and a separate rate per axle for vehicles above that height. A major advantage of this system is that reliable detectors for both height and axles are readily available, and it is easy to coordinate with an ETC based system. A major disadvantage is dealing with Recreational Vehicles (RVs) at toll facilities that discriminate by vehicle purpose. Most RVs would break the height threshold and be charged the commercial vehicle rate. The RV problem extends to most electronic detection systems, and RV owners are an outspoken lobbying force.

There are a few toll facilities with very simple vehicle classification systems. The Dulles Greenway in northern Virginia has one rate for passenger cars, and one rate (2 times the passenger car rate) for commercial vehicles. A similar 3-class system is used on the Toronto 407 project

Mass Transit/Buses. Although clearly not freight, most mass transit vehicles are tolled consistently with the rates for commercial vehicles of a similar size. For example, in the NYSTA classifications shown above, 3-axle buses are classified as Class 6, the same as 3-axle trucks. There has been a trend to provide discounts for commuter buses, consistent with public policy of increasing vehicle occupancy, usually in conjunction with an ETC program.

Loyalty Discounts.

It has been common for toll facilities to provide discounts for either frequent users or for residents of neighborhoods near the toll facility. Discounts are generally modest (10% to 20%), but there are examples of extreme discounts. On the Hatem Bridge in Maryland, the cash passenger car fare is $5.00, while the annual cost of an Automatic Vehicle Identification (AVI) sticker is $5.00; thus a daily commuter would pay about 1 cent per trip. Interestingly, only about 85% of eligible patrons take advantage of this 99.9% loyalty discount.

There are a few examples of resident discounts, usually applied on toll bridges connecting islands to mainland; for example, the Grand Island Resident permits in the Buffalo, NY area, Sanibel Island Causeway in Florida, and the Staten Island, NY discount on the Verrazano-Narrows Bridge. There are no comparable resident programs for bridge crossings between two states.

Electronic Toll Collection (ETC) Discounts

The first ETC system, the Dallas Tollway, added a $.05 surcharge onto the $.50 base toll for the "privilege" of using the ETC payment. Since that time most other agencies provide a discount for using ETC. Typically, when tolls are raised, the ETC rate is either not changed or increased at a lesser rate, as an incentive to raise ETC usage. The discounts are typically 10% to 20%, and may also be combined with loyalty or resident discounts.

Toll Escalation.

Virtually all toll facilities in the US have had toll increases over their economic lives, but only in the last decade is it common to apply consistent toll increases as part of a new project. Currently, virtually every new toll facility assumes a toll schedule of increasing rates (typically with rate

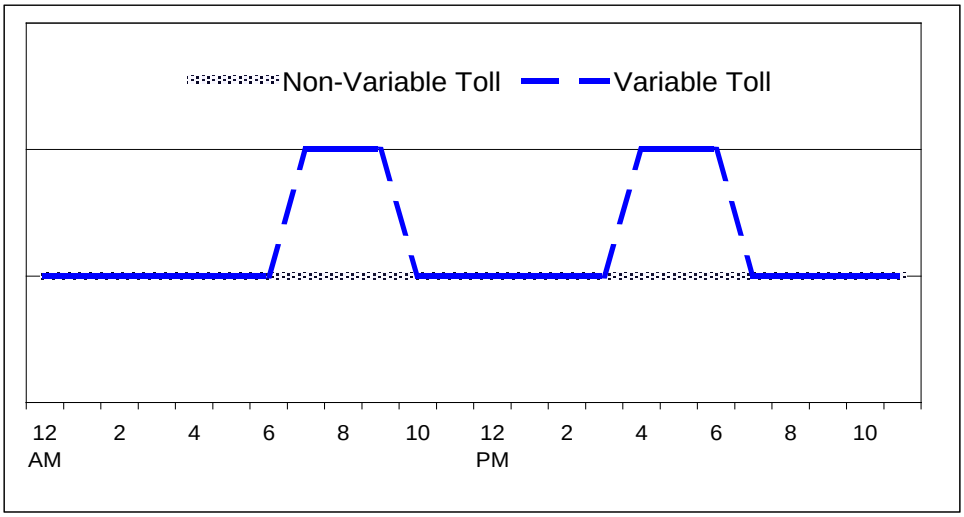
increases every 3 to 5 years) throughout the forecast period for the bonds supporting the financing of the project.

Differential by Time of Day

In the past decade, differential pricing strategies have been increasingly popular. Originally termed "congestion pricing", "value pricing", and "variable pricing", they attempt to set rates based upon the value of the trip to the driver, with typically higher tolls during the AM and PM commuter hours.

The purpose of variable pricing is to use price incentives and disincentives to change the pattern of driving, generally focused on reducing the peak nature of traffic during commuter hours. The time of passage can be hourly, day-of-the-week, overnight or any other period of time that meets the specific goals of the program. Toll rates are set so that they are higher during peak commuter periods and lower at other times as an incentive for travelers that have the option to travel at times other than the peak-period.

Figure 4 – Variable Pricing by Time of Day



Other terms used in this context include: congestion pricing, road pricing, market-based pricing, congestion tolling, incentive pricing, and peak-hour tolling. Variable pricing can also be used to encourage car-pooling or even use of alternate facilities. Some of the existing facilities using incentive pricing include: New York State Thruway Tappan Zee Bridge Corridor, Highway 407 in Toronto, SR 91 in California, and I-15 in San Diego

Variable pricing became a popular concept for consideration upon the advent of ETC, which allows ready changes in toll rates. The process of applying variable pricing to cash toll rates has proven to be extremely problematic. Specific issues relate to the time when the cash rate changes creating opportunity for toll collector fraud. Time changes also cause confusion with motorists. It is very unlikely that any two clocks will show the same time, which may result in the toll collectors

becoming the arbiters with the patrons as far as the time of day and when the patron actually reached the toll collection queue. High variations in toll rates can cause erratic motorist behavior with drivers speeding or slowing to beat the clock on toll rates.

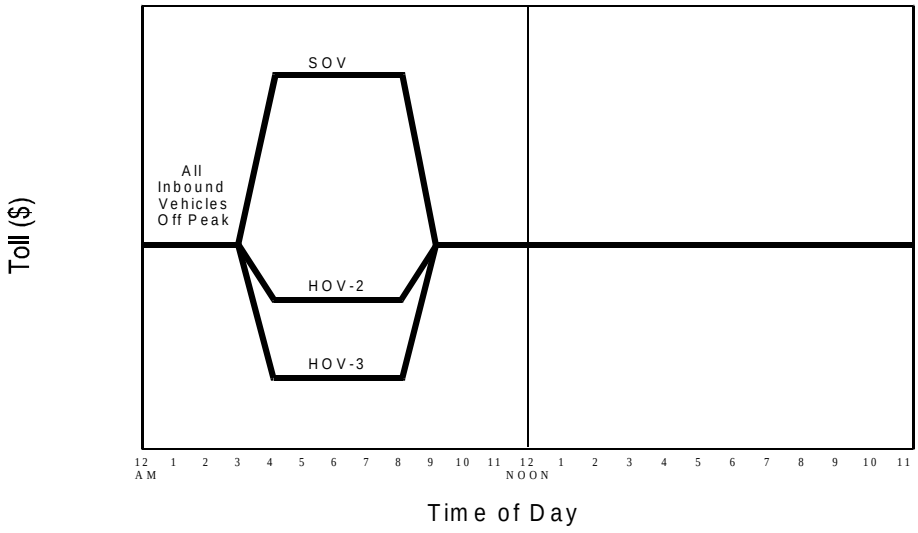
Most successful implementations have maintained the "cash" rate to eliminate these issues and applied the incentives to the ETC toll rates. By using the ETC rates, it is possible to smooth the transition period by changing toll rates in small increments and thus eliminating the speed up slow down activities. The use of ETC also eliminates the potential for toll collector fraud.

HOV Discounts.

Many regions of the country have established policies to encourage the formulation of car pools in order to increase the average occupancy of vehicles so that fewer vehicles will be on the roads at peak hours. The policy measures include HOV lanes, and where possible, HOV discounts on toll facilities. HOVs often are allowed to travel free, as part of the overall carpool policy in a region.

HOV discounts are often paired with time of day pricing to further encourage the formulation of car pools. The HOV Incentive Tolls figure below shows the relationship between single occupancy vehicles and HOVs with tolling differentials for two or three people in the vehicles.

Figure 5 – Congestion Pricing HOV Incentive Tolls



HOT lanes (**H**igh **O**ccupancy **T**oll Lanes) are an example of this combined strategy, in this case allowing SOVs to use HOV lanes for a price. The SR 91 Express Lanes are the most well known, and perhaps most effective, HOT lanes. The peak hour pricing is the highest rate per mile in the US (63 cents per mile, eastbound 4 to 6 p.m. weekdays). HOVs are not charged on SR 91 Express Lanes except from 4pm to 6 p.m. weekdays, and then at a 50% discount.

Differential by Vehicle Class and by Time of Day

There are only a few cases where time of day pricing has been applied to commercial vehicles. One example is the Tappan Zee Bridge crossing the Hudson River, where congestion at peak commuter hours led to a policy of significant peak hour increase for commercial vehicles to discourage their trips during the commuter period.

Uniform Toll Rate for All Vehicles with or without Time of Day Differential

There is no major toll facility in the US that uses uniform tolling for vehicle classes. This is primarily due to the recognition that commercial vehicle drivers inherently value toll facilities more than passenger vehicle drivers, and that the greater size of commercial vehicles contribute disproportionately to the wear-and-tear of the roadway.

RECOMMENDATIONS.

Based upon the objectives identified for this study, and common practices on toll facilities in the US, it is recommended that the toll policy for the I-5 and I-205 Columbia River crossings include the following elements:

- Vehicle class rate differentials
- Time of day pricing
- Electronic Toll Collection
- HOV pricing, and
- Toll escalation

It is recommended that the base toll rate be established by estimating the amount of toll revenue that could be collected annually versus the relative capital program to be supported by the tolls, and policy variations off this base case be tested to respond to the region's fiscal and policy needs.