

SCHEDULE 5C

HPTE ETCS Requirements



Colorado High Performance Transportation Enterprise - US 36 Managed Lanes Project – Toll Concession Project Schedule 5C Electronic Toll Collection System Requirements

Execution Version

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1.0 ELECTRONIC TOLL COLLECTION SYSTEM REQUIREMENTS

1.1 General Requirements

The Concessionaire shall design, develop and implement an Electronic Toll Collection System (ETCS) for the Managed Lanes.

The HPTE Phase 2 ETCS Requirements shall mean the requirements of HPTE set out in this Schedule 5C.

The Concessionaire will

- Take over the operation of the I-25 ETCS on the Effective Date,
- take over the operation of the Phase 1 ETCS on the Phase 1 Services Commencement Date *[in accordance with the provisions of Section 24 of the Contract]* and thereafter operate the I-25 ETCS and the Phase 1 ETCS as an integrated system; and
- develop, install and commission the Phase 2 ETCS and thereafter operate that with the I-25 ETCS and the Phase 1 ETCS as an integrated system.

1.2 Interoperability

It is a requirement that automatic vehicle identification systems used on all toll roads in the State are compatible with one another and that a vehicle owner shall not be required to purchase or install more than one device to use on all toll facilities.

See: CRS 42-4-1012(1)(d).

HPTE has determined that interoperability will be further defined to mean that if a customer has an account with the E-470 EXpressToll Service Center he will not be required to open a separate account for passage on any HPTE facilities.

2.0 PROJECT DELIVERY

The Concessionaire shall provide the services in accordance with the Electronic Toll Collection System Plan (ETCSP) for the Managed Lanes including an Electronic Toll Collection System (ETCS) design and the necessary approach, procedures, and methods for implementing a Managed Lanes ETCS. ETCSP consists of the components plans outlined in Sections 2.1 – 2.3 below. The Concessionaire will complete the preliminary ETCSP that has been submitted with the Proposal to assure it meets all of the requirements of this Schedule 5C and then resubmit to HPTE. After submission of the draft of the complete ETCSP, the Concessionaire and HPTE will meet and discuss each of the component parts of the plan. Based on the meeting(s) and any written feedback, the Concessionaire will make any required modifications which are necessary to achieve the requirements of this Schedule 5C.

HPTE's Acceptance of the ETCSP, which shall not be unreasonably withheld, will be a condition precedent to installation and acceptance of any ETCS on US36 Phase 2. Execution of the plans, as approved by HPTE, must fulfill the requirements in Sections 2.1 – 2.3 and shall be a condition of Service Commencement for the Full Services Commencement.

2.1 System Design and Project Management Plan

The Concessionaire's "System Design and Project Management Plan" must be Accepted by HPTE to be sufficient to clearly demonstrate how the Concessionaire will meet the ETCS design and operational criteria set forth in section 3.0 of this document.

2.2 ETCS Master Test Plan

The Concessionaire's "ETCS Master Test Plan" must be Accepted by HPTE to clearly delineate a sufficient the series of tests to demonstrate to HPTE that the ETCS performs to the minimum performance standards outlined in Table 5C-1 of this document.

2.3 ETCS Implementation Plan

The Concessionaire's "Implementation Plan" for the Phase 2 Managed Lanes ETCS must be Accepted by the HPTE as sufficient to demonstrate not only all aspects of implementation for the Phase 2 Managed Lanes but also provide specifics on how it will meet interoperability requirements (as stated in Section 1.2 of this document) and alleviate any disruption of service to customers by working seamlessly with the existing ETCS that is in operation on the I-25 Managed Lanes and Phase 1 Managed Lanes. Further, the Implementation Plan shall address the schedule and specific activities so that HOV Vehicles will be identified by transponders on the I-25 Managed Lanes, consistently with the requirement for the US36 Managed Lanes no later than upon the Phase 1 Services Commencement Date. This will address installation of necessary equipment at the tolling points in the current lane where HOV Vehicles "self-declare" on the I-25 Managed Lanes and any necessary signage changes.

3.0 ETCS REQUIREMENTS

3.1 ETCS Requirements- General

The Concessionaire shall determine the ETCS equipment and systems needed to satisfy the ETCS functional requirements set forth in Section 3.2. The ETCS infrastructure shall accommodate safe and secure access to all ETCS components for maintenance and repairs.

3.2 Functional Requirements

The following is a list of the basic functional requirements that the Concessionaire's ETCS must meet

- Vehicle Occupancy and Classification
- Image Capture/License Plate Tolling
- Toll Pricing
- Transaction Processing
- Customer Service/Back Office Systems
- Citation Processing/Administrative Hearing Trip Building
- HOV Enforcement Technology
- Variable Toll Message Signs
- Reconciliation
- Reporting

3.2.1 Vehicle Occupancy and Classification

3.2.1.1 Vehicle Occupancy

Each vehicle that passes through a tolling point shall be classified by the ETCS. Vehicles that qualify as high occupancy vehicles ("HOV") are permitted to travel the Managed Lanes without a charge. The US36 Concept of Operations states that in order to receive the benefit of a toll-free trip it will be necessary for vehicles which qualify for HOV status to have a transponder which "declares" the HOV status. The Concessionaire will be responsible for designing an approach and system that assures that tolls are not charged to those vehicles which qualify for HOV status as further discussed in Section 3.2.8.

3.2.1.2 Non-Revenue Vehicles

Vehicles which are entitled to receive a transponder that classifies them as vehicles which may travel toll-free ("Non-Revenue") are specified in Schedule 16. Vehicles

traveling without an authorized non-revenue transponder assigned to them will be charged the appropriate toll.

Collectively HOV vehicles and Non-Revenue vehicles will be referred to as Non-Tolled Vehicles.

3.2.1.3 Vehicle Classification

The vehicle classification shall include the number of axles associated with the vehicle as determined by an automatic vehicle classification system. Any vehicle with greater than three axles that is charged a toll shall be charged a surcharge in addition to the toll.

3.2.2 Image Capture/License Plate Tolling

For transactions where a transponder is not detected in the vehicle at the time of the transactions, the system shall capture images of the vehicle's front and rear license plates. The system shall use Optical Character Recognition (OCR) software to attempt to identify the license plate number and jurisdiction of issue. These transactions will be passed to the Customer Service Center for image review and processing of License Plate Tolling bills.

3.2.3 Toll Pricing

For the US36 Managed Lanes, the system must be capable of assigning toll prices dynamically ("Dynamic Pricing Module"). It is acceptable that initially the ETCS shall assign tolls at each tolling point at toll rates based on time of day. The ETCS shall have the ability to calculate toll at each tolling point dynamically to maintain a minimum average speed of 45 mph in the Managed Lanes and shall be capable of meeting all requirements and constraints in relation to Toll Pricing set out in Schedule 16.

It is also a requirement that the Dynamic Pricing Module accommodate the ability for HPTE to use that functionality on other managed lanes throughout its system other than this project's Managed Lanes. It will be required that the dynamic pricing algorithms and approach to pricing be reviewed in depth with HPTE and that a separate copy of the Dynamic Pricing Module be provided for HPTE's use. If HPTE wishes to modify their copy of the Dynamic Pricing Module (HPTE DPM) to accommodate a variation in pricing calculations, they will be provided all necessary source code to accomplish those modifications on the HPTE DPM. HPTE will cooperate with the Concessionaire to make available information to the Concessionaire such data that is collected from the General Purpose Lane ITS equipment to assist in providing inputs for dynamically setting prices.

The system shall assign the toll due for each tolling point based on: (1) the designated toll for that tolling point (2) whether the vehicle is a vehicle which owes a toll ("Tolled Vehicle") or a Non-Tolled Vehicle and (3) classification as determined by the automatic vehicle classification system in the lane (assessment of the surcharge for vehicles greater than three axles).

Whether a customer travels through one tolling point and exits the Managed Lanes system or travels through consecutive tolling points without exiting the Managed Lanes system, the toll charged at each tolling point shall be the rate that is displayed on the sign displaying the toll rates ("Variable Toll Message Sign" (VTMS)) at the immediately preceding that tolling point as further discussed in Section 3.2.9. If a customer passes a VTMS and the rate increases prior to their passing through the tolling point, the Customer must be charged a toll that is equal to, or less than, the toll that was displayed on the VTMS.

3.2.4 Transaction Processing

3.2.4.1 EXpressToll (Automatic Vehicle Identification) Transactions

The ETCS shall create a single transaction per vehicle at each tolling point where a transponder is detected in the vehicle. At a minimum, the following information shall be associated with the transaction:

1. Date and time
2. Location
3. Transponder ID
4. Vehicle category The default will be to Tolled Vehicle unless HOV status declared on multi-position transponder or the transponder shows a Non-Revenue status
5. Axle count of vehicle as determined by automatic vehicle classification system
6. Toll amount due and heavy (over three axle) vehicle surcharge if applicable
 - a. Non-Tolled vehicles should have the capability of being flagged in order for Concessionaire to avoid incurring processing costs.

The system should be configured such that all transactions are routinely transmitted to the Customer Service Center no more than 24 hours from the time the transaction is recorded.

In the event the Customer Service Center is the EXpressToll Service Center, the information submitted will be in compliance with the Interface Control Document attached as Appendix 5C-1 or as subsequently updated by E-470

3.2.4.2 License Plate Tolling (LPT) Transactions

The ETCS shall create a single transaction per vehicle at each tolling point where a vehicle is detected but no transponder is detected in the vehicle. The system should capture a front and rear image of the license plate to identify the vehicle. The system shall be capable of reading the license plates through OCR to meet the requirements of Table 5C-1. At a minimum, the following information shall be associated with the LPT transaction:

1. Date and time
2. Location
3. Image set associated with the transaction (both front and rear image of the vehicle)
4. Vehicle Category based (assumed Tolloed Vehicle for all LPT transactions)
5. Axle count of vehicle as determined by automatic vehicle classification system
6. Toll amount due and LPT surcharge, plus heavy vehicle surcharge if applicable

All transactions shall be transmitted to the Customer Service Center no more than 24 hours from the time the transaction is recorded. In the event the Customer Service Center is the EXpressToll Service Center, the information submitted will be in compliance with the Interface Control Document attached as Appendix 5C-1 or as subsequently updated by E-470

3.2.5 Customer Service/Back Office Systems

The Concessionaire must meet or exceed all Customer Service Center/Back Office functionality that is currently provided by the E-470 EXpressToll Service Center. The Concessionaire must clearly demonstrate to HPTE (at a detailed level) that any proposed system(s) will meet the functionality levels being provided E-470 at that time. The overall functionality which must be addressed in the Customer Service Center includes, at a minimum, the following:

1. Complete call center functionality and tracking of all performance statistics
2. Interoperability with the EXpressToll Service Center
3. Prepaid transponder accounts
4. Prepaid or post-pay License Plate Tolling accounts
5. Image review
6. Creation, tracking and payment of License Plate Tolling billings including second notices and collections.
7. Creation of transponder accounts, ongoing account management and customer inquiry responses through a call center
8. Fulfillment and distribution of transponders.

9. Automated account management or creation through the web or phone
10. Credit card payment processing for transponder replenishment, license plate tolling or citations through call center, website or Interactive Voice Response
11. Check payment processing
12. Ability to charge, collect and track surcharges and administrative fees

3.2.6 Citation Processing and Administrative Hearing

3.2.6.1 Citation Processing

Any ETCS provided by the Concessionaire must, at a minimum, meet the level of functionality provided at that time by the E-470 Customer Service Center for Citation Processing. The required functionality must seamlessly create citations on behalf of HPTE for License Plate Tolling transactions. Citations will only be created after License Plate Tolling transactions have gone unpaid for the period set in the HPTE Toll Policies. All citation processes must assure that the customers have been given the statutorily required notices advising of tolls due. The ETCS shall also have functionality to seamlessly create citation notices for transponder transactions where the account is delinquent (negative). The ETCS shall also track any toll citations issued by the Colorado State Patrol or other law enforcement entities. The ETCS shall include at least the following information associated with violation transactions, as may be modified by HPTE Toll Policies or statute:

1. Date and time of transaction
2. Tolling location of transaction
3. Transponder ID (if applicable)
4. License plate number and enforceable image (if LPT)
5. Vehicle classification as recorded by automatic vehicle classification system
6. Toll amount due (including surcharge amount if applicable)

Further, the ETCS shall have the functionality to seamlessly reassign citation transactions to an active transponder account in the event the citations were incorrectly issued to an existing customer.

3.2.6.2 Administrative Hearing

Any ETCS provided by the Concessionaire must, at a minimum, meet the level of functionality provided by the E-470 Customer Service Center for Citation Processing. The ETCS shall have the functionality to manage an Administrative Hearing process as provided in C.R.S 43-4-808 (1) (d) and the corresponding rules adopted by HPTE

if the E-470 Administrative Hearing services are not utilized. Any such Administrative Hearing process will be under the direct supervision of the HPTE.

3.2.7 Trip Building

The ETCS shall create one transponder transaction or license plate toll transaction per tolling point. Unless the Concessionaire can demonstrate a cost effective alternative, to minimize costs, if the EXpressToll Service Center is used, the functionality will be required to combine the transponder transactions into a trip transaction ("Trip") that will be sent to the EXpressToll Service Center for processing. It is also expected that the ETCS have the capability to flag transactions for Non-Tolled Vehicles so they will not be submitted to the Customer Service Center.

If it is necessary for data from multiple toll points to be correlated to create a Trip for transponder transactions, the Concessionaire shall perform all of the work required to assemble a complete Trip and providing a sufficient description to indicate the number of tolling points passed and the cost for each. If data does not exist to support travel through a tolling point, the Concessionaire may not create Trips for unsubstantiated activity.

3.2.8 HOV Enforcement Technology

The ETCS must communicate Non-Tolled Vehicle declaration data to enforcement personnel. The Concessionaire must clearly specify the intended process. The data shall be adequate and sufficient to enable enforcement personnel to distinguish between vehicles declared as HOV and SOV.

The ETCS may use a variety of methods to communicate vehicle occupancy declaration data to enforcement personnel. Examples include (1) the use of beacon lights, located at the enforcement zone, to indicate previous Customer declaration actions, (2) the use of Personal Digital Assistant (PDA) or similar technology by enforcement personnel to receive Customer declaration data from the ETCS, (3) the use of an automated occupancy detection system (to the extent it complies with existing law), and (4) manual, visual enforcement at the declaration zones. At a minimum, beacon lights to indicate HOV status will be used in conjunction with the Colorado State Patrol, these have been included in the Phase 1 DB Contract. HPTE may also approve other means of enforcement.

3.2.9 Variable Toll Message Signs

It will be the responsibility of the Concessionaire to communicate the correct toll rates to the Advance Toll Message Signs (VTMS). As indicated in Section 3.2.3, the toll charged at each tolling point is based upon the rate that is displayed on the sign displaying the toll rates VTMS at the immediately preceding that tolling point. The ETCS provided must include an audit that validates that the toll charged each Customer is no more than the toll displayed on the VTMS prior to the tolling point.

3.2.10 Reconciliation

It will be the responsibility of the Concessionaire to include in its ETCS a comprehensive reconciliation capability that tracks all transactions from initiation through final disposition.

3.2.11 Reporting

The ETCS shall have the ability to report on, at a minimum, the following information:

1. Transponder usage
2. License Plate Tolling usage and billing statistics
3. HOV transactions/utilization
4. Non-revenue transactions by category
5. Collection rate
6. Citations issuance
7. Traffic volume in Managed Lanes by hour
8. Required federal reporting as further detailed in Appendix 5C-2.

4.0 ETC SYSTEM PERFORMANCE REQUIREMENTS

The ETCS performance requirements set forth in Table 5C-1 shall apply at all times and throughout a vehicle speed range of 1 to 100 mph, with the exceptions of classification and image capture, for which the stated tolling performance requirements shall be achieved for a speed range of 5 to 100 mph. ETCS performance requirements shall apply to all vehicles regardless of vehicle spacing.

The ETCS shall be designed such that it will meet an annual performance audit to verify that ETCS reliability and accuracy has not degraded over time and the ETCS continues to satisfy the functional and performance requirements. The performance audit will be based on (1) the analysis of previous year-to-date transaction and maintenance data and (2) controlled tests, using statistically significant test samples, conducted by using test vehicles. HPTE may, at its own expense choose to perform ad hoc operational testing as part of the performance audit.

TABLE 5C-1 ETCS Performance Requirements

Reference	Description	Requirement	Measurement
ETCS-PR-1	Vehicle detection	The ETCS shall record a transaction for 99.99% of the vehicles that pass through a Tolling Point.	The total number of transactions recorded in the system expressed as a percentage of the number of vehicles passing through an individual toll collection point ("Tolling Point").
ETCS-PR-2	Vehicle transactions	The ETCS shall create a transponder transaction or license plate toll transaction for 99.97% of the transactions recorded by the ETCS passing through a Tolling Point.	The total number of transponder and license plate toll transactions, expressed as a percentage of the total number of vehicles recorded passing through the Tolling Point. <i>A maximum of one transponder or license plate toll transaction per recorded vehicle.</i>
ETCS-PR-3	License plate image reliability	For license plate transactions, at least 99.00% the license plate images shall be human-readable and contain images from which both plate number and issuing jurisdiction can be discerned.	The license plate image reliability success rate is defined as the number of readable plate images in which both plate number and jurisdiction of issue are discernible and can be converted unambiguously to text by an operator, expressed as a percentage of the total number of plate images that Concessionaire is required to obtain (excluding plate images for ineligible vehicles).
ETCS-PR-4	Vehicle classification with transponder present	For all transactions, where a transponder is present, the system shall correctly classify 99.95% as either SOV or HOV.	Transactions correctly classified as SOV or HOV where a transponder is detected in the vehicle expressed as a percentage of total transactions where a transponder is detected in the vehicle.
ETCS-PR-5	Vehicle classification with no transponder present	For all transactions, where is transponder is not present, the system shall correctly classify 99.95% as SOV and a license plate toll transaction shall be	Transactions correctly classified as SOV where no transponder is detected in the vehicle expressed as a percentage of total transactions where no transponder is detected in the vehicle.

created.

ETCS-PR-6	Automatic vehicle classification	The ETCS correctly classifies transactions with 3 or more axles correctly 99.97% to ensure proper surcharge in the managed lanes.	Transactions classified correctly expressed as a percentage of total transactions recorded in the managed lanes.
ETCS-PR-7	HOV beacon	The HOV beacon will activate for 99.99% of the transactions where a transponder is detected and is classified as HOV	The total number of times the HOV beacon is activated as a percentage of transactions where a transponder is detected in the vehicle set in HOV position.

Ineligible vehicles are those for which a license plate tolling image is obtained and cannot be reliably read by the human eye due to one or more of the following conditions:

- a) The vehicle either has no license plate or it is not mounted in the legally required position
- b) The license plate is covered by excessive dirt or snow rendering it unreadable
- c) The license plate is damaged, bent or broken rendering it unreadable
- d) The license plate is blocked by an object carried by the vehicle (such as a plate frame, overhanging cargo, or a trailer towing ball)