Gateway Cities Technology Program – Executive Summary

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Prepared for: Gateway Cities Council of Governments
Los Angeles County Metropolitan Transportation Authority

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INTRODUCTION

The Gateway Cities Transportation Strategic Implementation Plan referred to here as the “Gateway Cities Technology Program,” was sponsored by LA METRO and the Gateway Cities COG, to provide detailed technical guidance and preliminary design information on seven key technology areas related to ITS and zero emission technologies. This program builds on earlier efforts, including the Gateway Cities ITS Implementation Plan for Goods Movement study (2012), the I-710 Draft EIR/EIS, previous Calstart zero emissions vehicle research and USDOT connected vehicle and freight ITS research.

The Gateway Cities Technology Plan for Goods Movement study created a wide ranging program and details how technology can be leveraged to improve and make goods movement more efficient in the Gateway Cities and the larger Los Angeles County region. This program is comprised of six initial, separate but interrelated projects; focusing on traveler information, traffic management infrastructure, and safety/enforcement, as well as private sector drayage and terminal management technologies. The Figure below illustrates the overall concept.

The purpose of this document is to provide both an executive summary-level overview of the activities and findings of the technology program areas and various studies, and a program planning-level input to LA METRO and the Gateway Cities COG, that will support planning for future development and deployment of the technologies.
BACKGROUND

Encompassing the geographic study area outlined in Figure 1, the technologies addressed are focused on two sets of transportation infrastructure and their associated operators and users:

- **The I-710 Corridor and the future I-710 dedicated truck lanes facility.** In relation to technology, the primary focus here is on the future planned improvements to the I-710 freeway that will result in the deployment of an 18-mile separated (from the general purpose lanes) Freight Corridor. This corridor will be a limited access facility for zero emission trucks only, and is envisioned to be able to eventually support commercial connected vehicle semi-automation, and automation, technologies. This corridor will consist of two-lanes in each direction (i.e. four lanes total), and is currently planned to be a tolled facility.

- **Gateway Cities key freight freeways and arterials.** This infrastructure encompasses the network of freeways and key arterials in the Gateway Cities region that are essential for goods movement in and out of the ports, and between intermodal facilities. The applicable roadways that were assessed include the I-170 (existing facility), I-110, and SR-47 freeways; and the following arterial corridors: Alameda St., Garfield/Cherry, Bandini Blvd to 37th St., Del Amo Blvd, Manchester Ave./Firestone Blvd., Pacific Coast Highway, Slauson Ave., and Washington Blvd.

The primary users of these facilities – the trucking/freight companies, and the travelling public – are the focus of the benefits of the transportation technologies addressed under this program. Reduced travel times, more reliable travel times, increased throughput – and the associated air quality benefits that these translate to – provide the driving purpose behind this program. Additionally, significant improvements in safety, reductions in fuel usage, and other operational efficiency gains, will significantly benefit the private sector and the public.
Figure 1. Gateway Cities Technology Program Study Area

Legend
- Interstate Highways
- US Highways
- State Highways
- Port of Long Beach
- Port of Los Angeles
- Port of Los Angeles
- Study Area
- Supporting Roadways
TECHNOLOGY PROGRAM AREAS

The Gateway Cities Technology Program is based on the following seven program areas. For each of these areas, the title of the specific project reference documentation that was developed by the Cambridge Systematics team is also provided.

1. ITS Development for the I-170 Freight Corridor
   - Gateway Cities I-710 ITS Infrastructure Report
   - Initial Concept of Operations for the I 710 Zero Emissions Freight ITS Corridor

2. Truck Automation Systems Development for the I-710 Freight Corridor
   - Truck Autonomous Connected Commercial Vehicles Test Plan
   - Initial Concept of Operations for the I 710 Zero Emissions Freight ITS Corridor

3. Zero Emission Vehicles Program Development for the I-710 Freight Corridor
   - Technologies, Challenges and Opportunities: I-710 Zero-Emission Freight Corridor Vehicle Systems

4. Freight-Centric Traveler Information for the Gateway Cities Region
   - Freight Focused Traveler Information System – GoFreight: Initial System and Functional Requirements

5. Arterial Smart Corridor Development for the Gateway Cities Region
   - Arterial Smart Corridor Projects: Final Report

6. Freeway Smart Corridor Development for the Gateway Cities Region
   - Freeway ITS Gap Assessment: Final Report

7. Truck Enforcement Network System Development for the Gateway Cities Region
   - TBD – draft final report currently being complete

These reports can be accessed and downloaded from the Gateway Cities Council of Governments web-site.

Each of the following seven pages provides a one-page summary of these seven technology program areas. For each summary, key information is provided in the following areas:

- **Objectives** – what are the goals of the technology; what was the analysis focus?
- **Methodology** – what analysis or planning processes were utilized?
- **Findings/Results** – what did the report(s) conclude or determine?
- **Next Phase** – what activities should be developed in the next phase?
- **Schedule** – what is the phased schedule for the Next Phase activities?
### ITS Development (I-170 Freight Corridor)

#### Reference Documentation
- Gateway Cities I-710 ITS Infrastructure Report
- Initial Concept of Operations for the I-710 Zero Emissions Freight ITS Corridor

#### Methodology
- Develop the system requirements and the resultant impacts on the roadway, right-of-way, easements, operations and maintenance areas, and other items that would need to be taken into consideration in the future development of final design level documents.

#### Objectives
- The primary objective is to define the ITS infrastructure that would be required for the future I-710 Freight Corridor to operate
  - To support multiple standard freeway ITS applications (e.g. freeway management, traveler information)
  - To support future truck automation (e.g. “platooning”) developments
- The results of this effort serve as the direct input to the I-710 Utility Design Contractors, from which they will incorporate the ITS infrastructure into the design of the South, Central and Northern I-710 segments

#### Findings/Results
- Infrastructure and equipment specifications for:
  - Connected Vehicle (DSRC 5.9 GHz) System
  - Automated Tolling
  - Changeable Message Signs
  - Closed Circuit Television (CCTV)
  - Mainline Fiber Communication and Power

#### Next Phase Plan (2014-2015)
- Scope components for next phase:
  - Technical coordination with the 710 Utility Design Teams, including refinement of ITS requirements for the Freight Corridor
  - Technical monitoring and national-level stakeholder engagement (e.g. OEM’s, USDOT) associated with DSRC 5.9GHz V-V and V-I Connected Vehicle technologies
- Deliverables: I-710 Freight Corridor ITS Requirements by Segment (completed in cooperation with I710 Utility Design Teams)

#### Schedule

<table>
<thead>
<tr>
<th>2014</th>
<th>2016</th>
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</table>

- Coordination & Rqmts. Refinement with 710 Design Teams
- DSRC, Related Technologies and USDOT Programs Monitoring/Engagement
- Final detailed design to be completed in coordination with I-710 final design
TRUCK AUTOMATION SYSTEMS DEVELOPMENT (I-710 FC)

**Reference Documentation**
- Truck Autonomous Connected Vehicles Test Plan
- Initial Concept of Operations for the I-710 Zero Emissions Freight ITS Corridor

**Objectives**
- Develop a Test Plan for testing commercial vehicle automation concepts, based on the use of ITS Connected Vehicle technologies
- Initial Proof-of-Concept Testing at the Fontana Speedway in 2015:
  - Incorporating up to six intermodal trucks (of differing makes)
  - DSRC 5.9GHz devices, and associated truck platooning V-V hardware and software
- Leverage national OEM experience and USDOT ongoing programs

**Methodology**
- Implemented best practices for technology Test Plans development
- Developed testing scenarios, test functions, system test flowcharts, component testing approach
- Assessed test configuration, resources, schedule, risks, stakeholders, and exit criteria

**Findings/Results**
- Test Plans scenario outlines developed for:
  - Multiple intermodal truck configurations using DSRC and Connected Vehicle “V-V” “truck platooning”
  - Automated Zero Emission credentials check using Connected Vehicle “V-I”
  - Assess the ability of trucks to merge successfully onto the Freight Corridor, join/enter and un-join/leave truck platoon
  - Assess and test methods for shifting back and forth between automated and manual control of commercial vehicles.

**Schedule**

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th>2016</th>
</tr>
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<tbody>
<tr>
<td>Planning</td>
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<tr>
<td>Systems Engr.</td>
<td></td>
<td></td>
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<td>Lab Testing</td>
<td></td>
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<tr>
<td>Track Testing</td>
<td></td>
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<tr>
<td>Evaluation</td>
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</tbody>
</table>

- Subsequent Operational Testing Program on Terminal Island Freeway in LA/LB in 2016-17

**Next Phase Plan (2014-2016)**
- Two scope components for Prototype Testing:
  - Project Management and Evaluation (PM&E) Consultant – technical guidance of test; performance evaluation of testing
  - Development, Testing and Integration (DT&E) Contractor – systems engineering and hardware/software testing
- Deliverables: Detailed Test Plan, Physical Test Track and Configuration, Vehicles (6 to 8 trucks), In-Vehicles Equipment, Evaluation Equipment and Data Collection, Test Results
ZERO EMISSION VEHICLES PROGRAM DEVELOPMENT

**Reference Documentation**
- Technologies, Challenges and Opportunities: I-710 Zero-Emission Freight Corridor Vehicle Systems

**Methodology**
- Assessed drayage truck regional duty cycles, based on industry survey:
<table>
<thead>
<tr>
<th>Statistic</th>
<th>Units</th>
<th>Near Dock</th>
<th>Local</th>
<th>Regional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Speed</td>
<td>MPH</td>
<td>6.6</td>
<td>6.8</td>
<td>20.6</td>
</tr>
<tr>
<td>Maximum Speed</td>
<td>MPH</td>
<td>40.6</td>
<td>46.5</td>
<td>58.5</td>
</tr>
<tr>
<td>Distance</td>
<td>Miles</td>
<td>5.61</td>
<td>8.71</td>
<td>49.02</td>
</tr>
<tr>
<td>Stops</td>
<td>Number</td>
<td>30</td>
<td>40</td>
<td>34</td>
</tr>
<tr>
<td>Miles/Stop</td>
<td>Number</td>
<td>0.19</td>
<td>0.22</td>
<td>1.44</td>
</tr>
<tr>
<td>Max. Acceleration</td>
<td>MPH/sec</td>
<td>4.45</td>
<td>3.45</td>
<td>6.85</td>
</tr>
<tr>
<td>Max Deceleration</td>
<td>MPH/sec</td>
<td>5.35</td>
<td>4.10</td>
<td>7.30</td>
</tr>
<tr>
<td>% idle</td>
<td>Percent</td>
<td>50%</td>
<td>60%</td>
<td>22%</td>
</tr>
</tbody>
</table>

- Assessed ZE truck technology options which can meet duty cycles (based on drayage user needs)
  - Technology must provide 50 miles minimum range
- Implemented classic business case assessment
- Evaluated multiple configurations; assessed tradeoff

**Objectives**
- Conduct research to evaluate Zero-Emission (ZE) truck technologies – focus on five technologies that could be applied to Class 8 drayage trucks:
  - Dual-Mode Hybrid Electric Vehicle
  - Dual-Mode Plug-in Hybrid Electric Vehicle
  - Range Extended Electric Vehicle with Engine
  - Range Extended Electric Vehicle with Fuel Cell
  - Battery Electric Vehicle
- Determine which meet the needs of the I-710 corridor project and drayage users
- Conduct Business Case assessment for technology alternatives

**Findings/Results**
- ZE drayage trucks can be developed, tested, validated and produced by the 2025 target
  - Positive business case assuming timely and targeted incentive support and infrastructure deployment
  - These trucks can be designed to meet the key performance requirements for port drayage operations, including range, power & duty cycle
- Recommended stages for commercialization:
  1) 2014-16 – Develop the Capabilities: initial testing
  2) 2017-18 – Expand Out the Nodes: first deployments; pre-production of ZE drayage Trucks
  3) 2019-22 – Down-Select: Pre-Commercial ZE Drayage Assessment/Validation; infrastructure siting
  4) 2020-25 – Commercial ZE Drayage Production, Deployment Ramp-Up: industry produces vehicles

**Next Phase Plan (2014-2018)**
- Technology development – trucks/infrastructure
  - OEM’s and infrastructure providers on prototypes and evaluate ZE and drayage trucking performance aspects of prototypes
- Oversee demonstration Programs of ZE trucks and infrastructure
- Validate Business Case; Operational Model
  - Better data, complete ROI, ownership modes, lifecycle cost, formal information sharing with OEM’s, define the I-710 ZE operational model
- Build Supporting Markets and Market Structure
  - Define demand for ZE trucks; work with regulators to develop approaches for incentivizing deployment

**Schedule**

<table>
<thead>
<tr>
<th>Schedule</th>
<th>2014</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tech Development</td>
<td></td>
<td></td>
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<tr>
<td>Demonstrations</td>
<td></td>
<td></td>
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<tr>
<td>Business Case Validation</td>
<td></td>
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<tr>
<td>Operational Model</td>
<td></td>
<td></td>
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<tr>
<td>Market Assessment</td>
<td></td>
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<tr>
<td>Regulatory Assessment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Freight-Centric Traveler Information (GC Region)

**Reference Documentation**
- Collection of Data Inputs
- Dissemination of Traveler Information

**Objectives**
- METRO and others to provide reliable traveler information to its freight constituents who live, work, and do business in the Gateway Cities and Greater Los Angeles regions
- Provide a single point source for comprehensive drayage traveler information
- Improve drayage operational efficiency
- Reduce congestion on freeways and arterials
- Mitigate drayage impacts on air quality
- Provide information on truck enforcement
- Coordination with other traveler information services

**Methodology**
- Followed Systems Engineering best practices in developing a formal system/functional requirements document that can support near-term deployment
  - Functional requirements; data inputs & integration; outputs and interfaces; operational requirements; non-functional requirements; development plan.

**Findings/Results**
- Provides comprehensive system requirements specification that can utilized in the near term by METRO to proceed with deployment
- Detailed specification developed for the five primary GoFreight subsystems:
  - Data Integration Engine
  - Data Dissemination Subsystem
  - GoFreight Webpage
  - GoFreight Interactive Voice Response
  - GoFreight Mobile Application
- GoFreight will be able to receive/transmit from:
  - USDOT FRATIS
  - I-710 ZE Freight Corridor ITS (V2V or V2I)

**Next Phase Plan (2014-2016)**
- Recommend deployment of GoFreight by an IT contractor in 2016
  - IT development contract cost is estimated at a $3.2 million cost (also $1.2M in annual O&M)
- Scope components for next phase:
  - Stakeholder communications and outreach – refine specific user requirements
  - Work with METRO to develop detailed IT contractor scope
  - Support IT Contractor procurement, kickoff and initial technical review

**Schedule**

<table>
<thead>
<tr>
<th>Outreach/User Rqmts.</th>
<th>2014</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT Contractor Scope</td>
<td></td>
<td></td>
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<tr>
<td>IT Contractor Process</td>
<td></td>
<td></td>
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<tr>
<td>IT Initial Tech Review</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Schedule assumes that IT Contract would be awarded in the first quarter of 2015
Prioritization Methodology for Ranking Arterial Smart Corridor Projects

ARTERIAL SMART CORRIDOR DEVELOPMENT (GC REGION)

Reference Documentation

- Arterial Smart Corridor Projects: Final Report

Objectives

- Reduce recurrent intersection delay and improve travel time reliability and information, fuel consumption, and emissions on designated truck route arterials through cross-jurisdictional signal coordination and updated signal controllers and systems
- Generate data to support real-time traveler information to drivers and freight operators
- Generate data for ongoing performance measurement/management of the regional arterial network
- Improve incident detection and management on arterials

Methodology

- Traditional “Gap Assessment” – gaps identified on major freight arterials in the Gateway Cities
- Output – Arterial Smart Corridors for Advancement:

<table>
<thead>
<tr>
<th>North-South</th>
<th>Southern Endpoint</th>
<th>Northern Endpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alameda Street</td>
<td>Harry Bridges Blvd</td>
<td>6th Street/Whittier Blvd</td>
</tr>
<tr>
<td>Garfield Ave/Cherry Ave</td>
<td>Anaheim Street</td>
<td>6th Street/Whittier Blvd</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>East-West</th>
<th>Western Endpoint</th>
<th>Eastern Endpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandini Blvd</td>
<td>I-110</td>
<td>Garfield</td>
</tr>
<tr>
<td>Del Amo Blvd</td>
<td>I-110</td>
<td>I-710*</td>
</tr>
<tr>
<td>Manchester Ave/Firestone Blvd</td>
<td>I-110</td>
<td>I-605</td>
</tr>
<tr>
<td>Pacific Coast Hwy</td>
<td>I-710*</td>
<td>I-605</td>
</tr>
<tr>
<td>Slauson Ave</td>
<td>I-710*</td>
<td>I-605</td>
</tr>
<tr>
<td>Washington Blvd</td>
<td>I-110</td>
<td>I-605</td>
</tr>
</tbody>
</table>

Findings/Results

- Recommended technologies: adaptive signal control, detection, closed-circuit television (CCTV) cameras, changeable message signs (CMS), fiber communications network
- Complete surveillance coverage, allowing CCTV to see every part of the corridor
- Arterial CMS placed at key decision points
- For existing signals, new cabinets, controllers and associated software would be replaced
- Multi-jurisdictional cooperation and technical integration will be essential to the success of this concept – “Operation Green Light” in Kansas City can serve as a benchmark

Next Phase Plan (2014-2016)

- Future deployment arterial smart corridors is significant in scope -- covering 77 miles, 270 intersections, 107 CCTV’s and 23 CMS’s
  - It would be a significant regional undertaking spanning multiple jurisdictions, with a $29 million cost, plus $500K in annual O&M
- Scope components for next phase:
  - Develop and form regional coalition of the jurisdictions – this would serve as an agent of the COG to lead and manage the program
  - Develop charter, program plan, system requirements, outreach activities and RFP’s for the deployment of the system

Schedule

```
<table>
<thead>
<tr>
<th>2014</th>
<th>2016</th>
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</thead>
<tbody>
<tr>
<td>Initial Outreach</td>
<td>Parked</td>
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<tr>
<td>Chartering Workshop</td>
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<tr>
<td>Initial Coalition Meetings</td>
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<tr>
<td>Develop System Rqmts.</td>
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<tr>
<td>Develop Program Plan</td>
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<tr>
<td>Develop Scope(s)</td>
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<tr>
<td>Program Mgmt. Support</td>
<td></td>
</tr>
</tbody>
</table>
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- Contracts for engineering firms to deploy arterial corridors to be implemented in 2016 to 2020
**Freeway Smart Corridor Development (GC Region)**

**Reference Documentation**
- Freeway ITS Gap Assessment: Final Report

**Objectives**
- Fill in technology gaps and expand ITS system to support improved information for freight users
  - This project will supplement current ITS in Gateway Cities region freeways to support comprehensive ITS data being available for all goods movement-critical freeway segments
- Reduce congestion and improve reliability on key freeway freight and other freeway routes
  - Additional detection sites and traffic monitoring will allow for Caltrans to more quickly identify incidents and congestion and deploy applicable response plans
- Provide improved traveler information to users on incidents, congestion, and alternative routes

**Methodology**
- Traditional “Gap Assessment” – ITS gaps identified on major freeway in the Gateway Cities
- Example Output – Planned Deployments on I-110 between I-5 and SR-91:

<table>
<thead>
<tr>
<th>Device</th>
<th>Units</th>
<th>Capital</th>
<th>Life</th>
<th>O&amp;M</th>
<th>Annualized</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detector – In Pavement</td>
<td>0</td>
<td>$20,000</td>
<td>7</td>
<td>$2,000</td>
<td>$5,210</td>
<td>$0</td>
</tr>
<tr>
<td>Detector – Roadside</td>
<td>0</td>
<td>$15,000</td>
<td>7</td>
<td>$1,500</td>
<td>$3,908</td>
<td>$0</td>
</tr>
<tr>
<td>CCTV</td>
<td>0</td>
<td>$50,000</td>
<td>7</td>
<td>$5,000</td>
<td>$13,025</td>
<td>$0</td>
</tr>
<tr>
<td>CMS - Overhead</td>
<td>2</td>
<td>$225,000</td>
<td>10</td>
<td>$22,500</td>
<td>$48,877</td>
<td>$450,000</td>
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<tr>
<td>CMS - Roadside</td>
<td>0</td>
<td>$175,000</td>
<td>10</td>
<td>$17,500</td>
<td>$38,015</td>
<td>$0</td>
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<tr>
<td>Ramp Meter</td>
<td>5</td>
<td>$35,000</td>
<td>7</td>
<td>$3,500</td>
<td>$9,118</td>
<td>$175,000</td>
</tr>
</tbody>
</table>

**Findings/Results**
- The Gap Assessment determined that ITS is required for deployment on certain segments along the I-110, I-710 (current configuration) and the Terminal Island Freeway.
- Recommended technologies: vehicle detection, closed-circuit television (CCTV) cameras, changeable message signs (CMS), ramp meters, fiber communications
- Complete surveillance coverage, allowing CCTV to see every part of the freeways
- ITS will become part of the Caltrans network of freeway management in Southern California

**Next Phase Plan (2014-2016)**
- The next phase of this project is recommended to be a direct handoff from LA METRO to Caltrans
- It is recommended that Caltrans deploy the ITS equipment on I-110, I-710 (current configuration) and the Terminal Island Freeway
- The capital cost estimate of the overall program is approximately $4.5 million, with an annualized cost of just over $1 million

**Schedule**
- Schedule for deployment TBD by LA METRO and Caltrans based on available funding, programming and contracting.
**TRUCK ENFORCEMENT NETWORK SYSTEMS DEV. (GC REGION)**

This section is still under development – will be included in final version.