

WCC Goods Movement Webinar, June 2, 2015

Overhead Catenary System Demonstration Concept Overview



Agenda

- Overview of Catenary Demonstration
- Project Status
- Questions & Discussion

Catenary Hybrid-Electric Truck

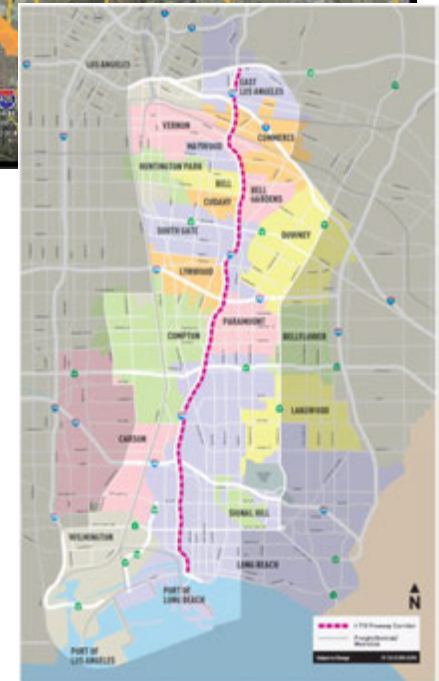
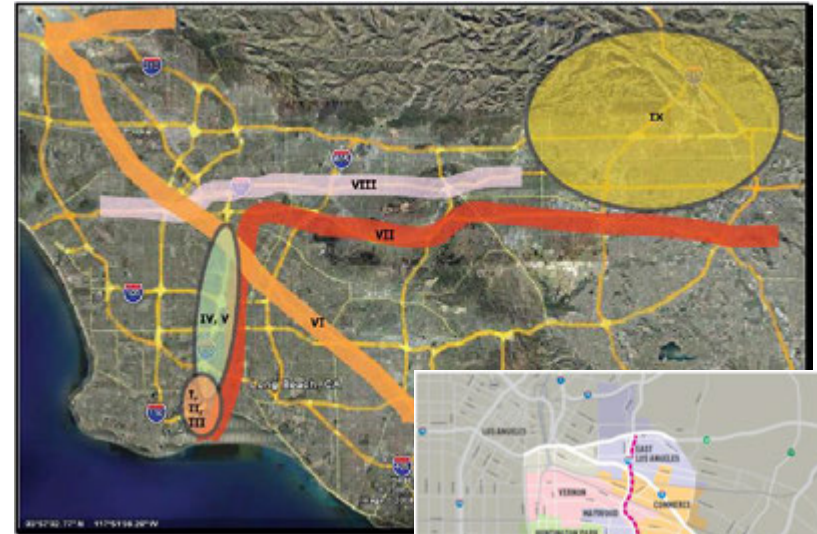


- Catenary hybrid-electric trucks can provide zero-emission cargo movement
- Limited all-electric range off catenary provides for zero-emission near-dock drayage
- Natural gas or diesel hybrid configurations can provide zero-emissions operation along catenary and low-emissions operation away from the ports
- Siemens technology allows for smooth connection and disconnection from system while truck in motion

- **Zero Emissions:** When connected to catenary, Truck is powered by overhead electric wires through pantograph connection
- **Sub-2010 EPA Emissions:** When not connected to catenary, Truck is driven by hybrid electric engine

An Expandable System

- Near term needs for zero-emissions drayage at ports can be addressed with modest infrastructure
- System can be expanded to regional levels - port system forms basis for extension into I-710 clean truck corridor, a 24 mile route that exceeds 40,000 truck trips per day
- Trucks ability to ingress and egress catenary allow for non-continuous system



1. Regional Electric Container Mover System described by Port of Long Beach in its 2008 Request for Concepts and Solutions for a Zero Emission Container Movement System.

Siemens Demonstration Project

- Designed to prove catenary truck concept in real-world drayage operations
- Catenary system
 - One mile length, both directions
 - Pole spacing similar to street lights (possibility of dual-use poles, but not existing poles)
 - DC power substation with remote monitoring
 - Test track for software & hardware adjustments
- Four demonstration trucks
 - Diesel hybrid, CNG hybrid, Battery-electric, and Future TBD platform



Catenary Truck Platforms

1. Volvo Diesel Hybrid
 - Major OEM partnering through existing DOE diesel hybrid development project
 - All-electric range capability (off catenary)
2. TransPower CNG Hybrid
 - Major OEM chassis
 - Project partners are OEM and local integrators
3. TransPower Battery-electric
 - Leveraging local integrator's current technology development
4. BAE Kenworth CNG Hybrid
 - Leveraging DOE project with catenary accessible hybrid

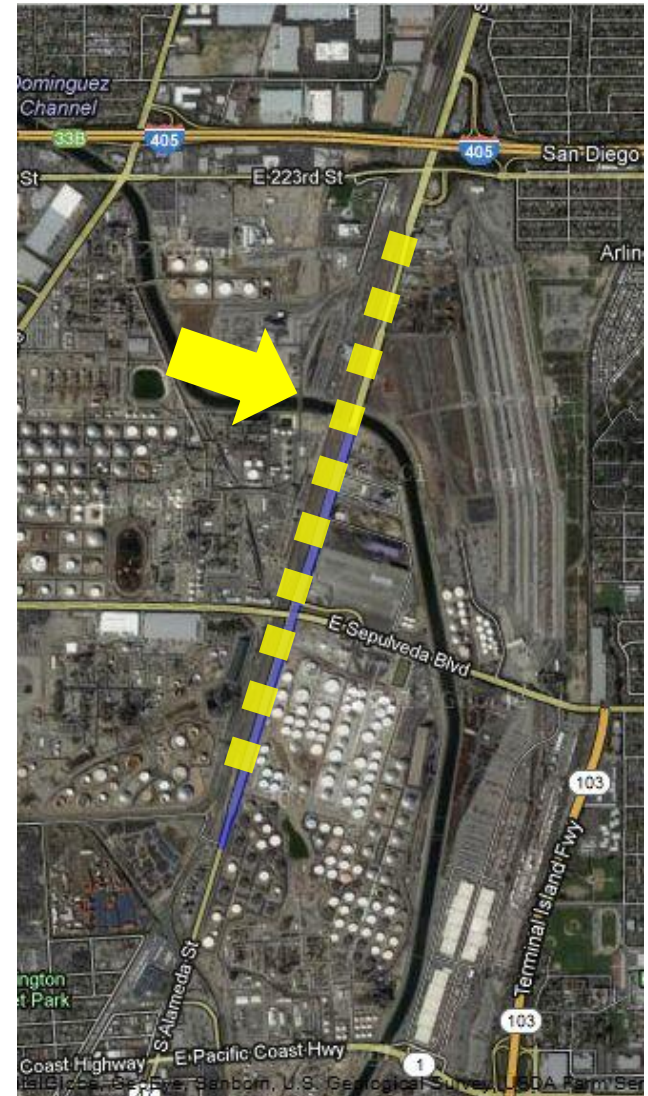
Catenary Demonstration Sites



- Site requirements include:
 - 1 mile continuous length
 - Sufficient ROW both sides
 - Space for substation
 - Avoid bridges, trees, shops
 - Available utility service
- Considered numerous sites:
 - Santa Fe Ave, Carson
 - Alameda St, Wilmington
 - TI Freeway – South
 - Sepulveda, Wilmington
 - Alameda St, Carson
 - Navy Way, POLA
 - TI Freeway – North

Demonstration Location

- Approximately one mile along Alameda Street in the city of Carson
- Current route for north-bound trucks to warehouses and 405



Infrastructure



- Infrastructure consists of:
 - Poles and supports for catenary lines in each direction
 - Lanes can be shared with other vehicle traffic
 - Sub Stations, approximately one per mile

Infrastructure

- DC Substation with ~750 VDC output
- Self-contained and portable
- Designs approved and in use by LADWP and SCE
- 1.5 MVA capacity more than sufficient for demo
- Can be remotely monitored



Project Timeline

	2013	2014	2015	2016
Infrastructure	Design	Permitting (CEQA)	Construction	Demonstration
Volvo Trucks		Vehicle Pantograph Integration	Development & Testing	Demonstration
TransPower Trucks	Component & System Design	Vehicle Build	Testing	Demonstration

- Catenary system development
 - Design: Completed
 - CEQA: Completed, permitting in progress
 - Construction: Ground breaking started in March 2015
 - Vehicles are being designed and modified in parallel with system construction
- One year demonstration and data collection begins November, 2015 (completed in 2016)

Siemens Project Costs

Funding Source	Amount	Percent
CEC	\$3,000,000	22
METRO	\$2,000,000	15
Port of Long Beach	\$2,000,000	15
China Shipping Settlement	\$4,000,000	30
SCAQMD	\$2,500,000	18
Total	\$13,500,000	100

TransPower Project Costs

Funding Source	Amount	Percent
EPA	\$500,000	16
TransPower	\$564,908	18
SCAQMD	\$2,117,887	66
Total	\$3,182,795	100

Project Goals & Objectives

- Promote the implementation of zero emission goods movement technology
- Demonstrate the most viable technology for future regional zero emission corridor
- Prove out:
 - Catenary system and truck interface using various system architectures operating on the catenary
 - Vehicle regenerative braking and battery charging through the catenary
 - Vehicle and system electrical loads

Project Goals & Objectives

- Determine costs
 - Catenary system construction costs/mile
 - Operating costs
 - Integration of pantograph per truck costs
 - Electric fuel - kWh/mile costs
- Determine system owner and operator
 - Establish business case
 - Identify business drivers and financial metrics
 - Analysis of costs, benefits and risks

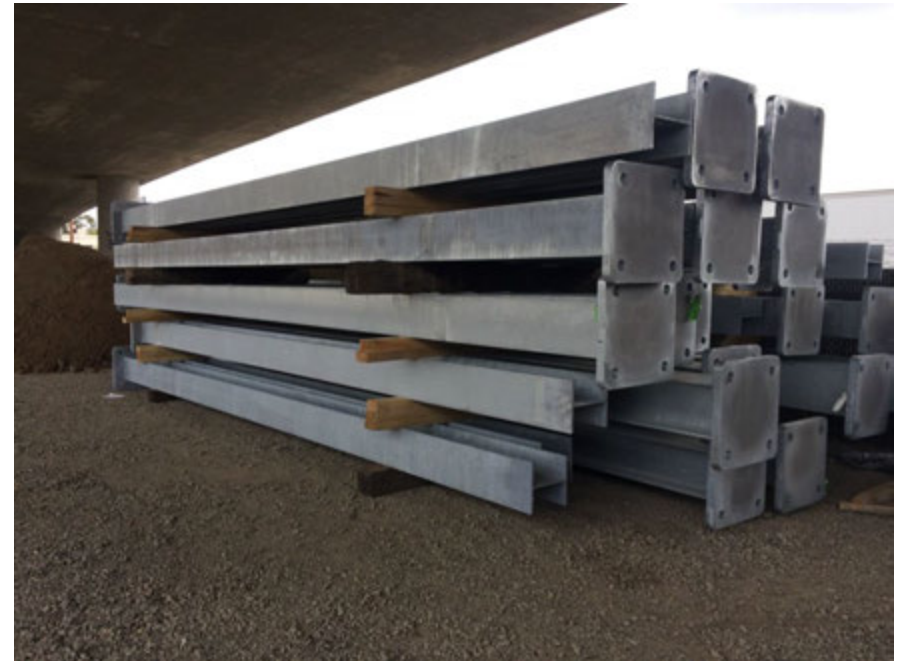
Project Status: June 2015

- **Traction Power Supply/Substation**
- Equipment manufacturer complete
- All major equipment installed in the substation
- Completed final wiring interconnections
- Completed factory acceptance testing
- TPS being shipped to site



Project Status: June 2015

- **OCL**
- Manufacturing of assemblies and components continues
- First assemblies ready for shipment and starting deliveries to the site
- First set of poles delivered to site



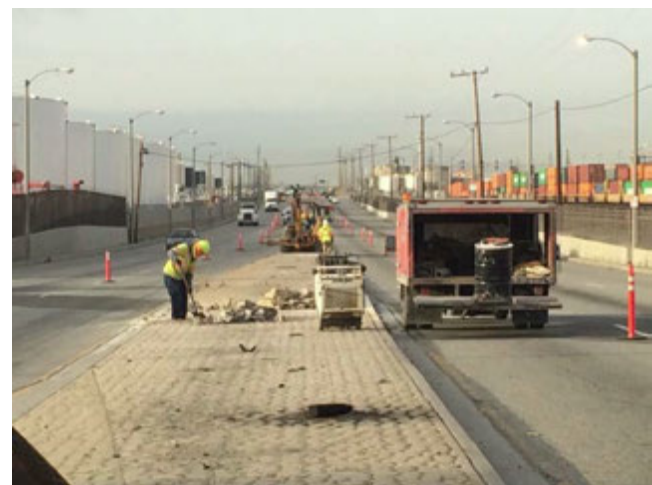
Project Status: June 2015

- **Pantograph**
- Assembly of the first PAN completed
- Software programming successfully tested in Gross Dolln
- Engineered and ordered the mechanical blocker for pantograph
- Shipped truck cabin components for the first TransPower truck
- Volvo truck shipped, en route, from US to Sweden



Project Status: June 2015

- **Civil Works**
- Test track paved
- CCTV installed at Central Test Facility
- Test track and mainline OCS foundations potholed
- Ready to drill and pour test track OCS foundations
- Ready to drill and pour mainline OCS foundations
- Confirmed Alameda median demolition requirements with Carson inspector



Future Project Milestones

- Test track completed in August 2015
- TransPower trucks use test track for final development work
- Demonstration on Alameda begins November 2015
- Volvo truck completed March 2016
- Demonstration complete November 2016



QUESTIONS - DISCUSSION



South Coast
AQMD