BUILDING TOMORROW’S CLEAN FREIGHT SYSTEM: THE POTENTIAL ZERO EMISSION FREIGHT CORRIDOR SYSTEM IN SOUTHERN CALIFORNIA

Sophie Hartshorn*
Senior Associate
Cambridge Systematics, Inc.
555 12th Street, Suite 1600
Oakland, CA, 94607
Tel: (510) 873-8700
Email: shartshorn@camsys.com

Annie Nam
Transportation Financial Planning and Goods Movement Division Manager
Southern California Association of Government
818 West 7th Street, 12th Floor
Los Angeles, CA, 90017
Tel:(213) 236-1827
Email: NAM@scag.ca.gov

Michael Fischer
Principal
Cambridge Systematics, Inc.
555 12th Street, Suite 1600
Oakland, CA, 94607
Tel: (510) 873-8700
Email: mfischer@camsys.com

Akiko Yamagami
Senior Regional Planner
Southern California Association of Government
818 West 7th Street, 12th Floor
Los Angeles, CA, 90017
Tel:(213) 236-1987
Email: yamagami@scag.ca.gov

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*Corresponding author

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ABSTRACT

The Southern California Association of Government’s (SCAG)’s 2012 Regional Transportation Plan (RTP) includes a “Regional Clean Freight Corridor System” as a regional highway strategy. This Clean Freight Corridor is a proposed system of dedicated truck facilities extending from the San Pedro Bay Ports to downtown Los Angeles along I-710, connecting to an east-west segment, and finally reaching I-15 in San Bernardino County. Concepts and operational details for this system have been evolving over the last decade, and the initial operating segment (I-710) is now in the environmental review stage. Current plans for this system will provide a platform for the introduction and adoption of zero- and/or near-zero emission technologies – including electrified trucks.

This paper focuses on planning analysis part of this clean freight corridor – the portion that would connect I-710 in the west of the SCAG region, and I-15 in the east of the region—henceforth known as the “East West Freight Corridor (EWFC)”. It summarizes the analytical and stakeholder outreach work completed since 2008 to advance the EWFC concept, including: a better understanding of markets served by the EWFC, the identification of non-freeway alignments that could help mitigate community impacts and create synergies with other public works projects, a better understanding of truck movement in the region and traffic impacts from an EWFC, and development of a plan for how the corridor could be used to help introduce new clean truck technologies to the region. Finally, it describes the process by which potential alignments for the EWFC were identified, screened, and analyzed, and summarizes the potential benefits of the current preferred corridor alignment.

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INTRODUCTION

The East West Freight Corridor is a proposed project that would eventually connect the planned dedicated truck facilities on I-710 with the planned dedicated truck facilities on I-15. As a concept, the EWFC has been discussed for more than 15 years in the SCAG region, including the 2008 SCAG Regional Transportation Plan (RTP) (9). The 2008 RTP discussed a potential dedicated truck facility along key regional highways, aligned to connect freight-intensive locations such as the San Pedro Bay Ports, warehousing and distribution centers, and manufacturing locations. The RTP also outlined the potential benefits of such a strategy in terms of reduced delay, reduced pavement deterioration on parallel routes, improved safety, and increased reliability. Recognizing these benefits, the 2008 RTP funded an initial corridor segment along the I-710 freeway, a total of 78 lane-miles (two lanes in each direction) of dedicated truck facilities. As of 2012, the I-710 segment of the freight corridor system is under development, and the Draft Environmental Impact Report / Draft Environmental Impact Statement was released for public comment on June 29, 2012 (5).

The EWFC, however, was only treated as a “cloud” concept in the 2008 RTP – an undefined area covering many potential highway alignments including I-210, I-10, SR-60, and SR-91(Figure1). This lack of specificity was intentional, since there were unanswered questions in 2008 about the feasibility of an EWFC. For example, there was concern by stakeholders about potential impacts, a lack of understanding of the different freight markets that could served by such a facility, and limited understanding of clean technology application.

Since 2008, significant analysis, research, and stakeholder outreach has been completed to refine and advance the EWFC concept. Much of this work was conducted between 2008- 2012 as part of the SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy (11). Findings from this work will be the focus of this paper, specifically:

- Developing a better understanding of the markets served by an EWFC: Economic analysis revealed that industries such as manufacturing, warehousing and transportation / utilities provide the SCAG region with 2.9 million jobs (35% of total regional employment), and contribute almost $250 billion to the region’s Gross Regional Product (GRP) (34% of total regional GRP) (11).
- Mapping of these industries helped to link potential alignments to the businesses that they would serve.
• Identification of non-freeway alignments: Recognizing that many of the known highway alignments are contentious, “hybrid” alignments were developed that minimized the impacts to communities, and allowed the EWFC to be located near industrial land. These included a railroad-adjacent Right-of-Way, a US Army Corp of Engineers (USACE)/Los Angeles County Department of Public Works flood control channel, and a Southern California Edison (SCE) utility corridor.

• Better understanding of truck movements: Significant analysis focused on understanding the types of trucks that move on the region’s system. This analysis allowed for better market definition of the EWFC, as well as the quantification of benefits in terms of delay reduction, safety benefits, emissions reduction, and reduction in impacts to communities.

• Defined potential zero-emission technologies and quantified the potential emissions benefits: SCAG worked with the South Coast Air Quality Management District (SCAQMD), the California Air Resources Board (CARB) and other environmental partners to define the potential of the EWFC to serve as a catalyst for the development of a zero-emission truck corridor.

**FIGURE 1 The 2008 SCAG RTP Description of the East-West Freight Corridor**

![Map of the East-West Freight Corridor](image)

**BACKGROUND**

Much of the literature about dedicated truck facilities focuses on three different types of applications: 1) Multi-state or long haul corridors, 2) Urban corridors in areas of high truck activity, and 3) Truck bypasses and climbing lanes. As of 2012, very few examples of the first two types of truck facilities exist in the United States. However, they have been the focus of many studies, including the I-70 Dedicated Truck Lane (DTL) Study of the corridor through Illinois, Indiana, Missouri, and Ohio (3). The study included an extensive outreach process to stakeholders, coupled with economic, commodity flow, and environmental impact assessments. The major conclusions included: 1) There is a business case supporting the construction of DTLs; and 2) That DTLs have the potential to improve safety, reduce congestion, and benefit the regional economy.

A 2010 National Cooperative Freight Research Program (NCFRP) report provided a summary of methods by which to measure the benefits and the costs of dedicated truck facilities (6). Part of this study focused on the benefits of dedicated truck facilities in urban corridors, using the I-710/ SR-60 in...
Southern California, the Mid-City Freeway in Chicago, and others as case studies. This study found that the primary objectives of dedicated truck facilities in urban corridors include reduced congestion, safety benefits from the separation of truck and automobile traffic, improved travel times and reliability for trucks, and facilitating the implementation of new technologies including truck automation, truck electrification strategies and electronic toll collection (ETC).

However, not every study has concluded that truck lanes are a viable alternative. In 2008 the Georgia Department of Transportation researched the potential of a system of statewide truck lanes to address issues of congestion and safety (4). Though the study found considerable benefits of a truck lane strategy, it also concluded that these benefits would only accrue to a small population of transportation system users – i.e. the trucks using the dedicated facilities. Therefore, it found the strategy to be too cost prohibitive to be recommended as a general, statewide strategy.

Likewise, other reports have highlighted the negative health impacts to communities located along truck lanes- including a recent report from the Trade, Health and Environment Impact Project (12). This report found that residents along truck corridors bear a disproportionate burden of exposure to air pollution from goods movement activity, including elevated levels of particulate matter (PM) and elemental carbon. Elevated pollutant levels have been linked to numerous public health concerns- including asthma, reduced lung growth in children, heart disease, and lung cancer. The report also discusses the economic consequences of poor regional health, citing the California Air Resources Board figure that Southern Californians pay between $100 million and $590 million annually in health impact costs related to drayage truck (1).

CALSTART (an organization of public and private organizations dedicated to development of clean transportation technology) studied the potential to use clean technologies for cargo conveyance on the I-710 corridor (2). The study focused on the feasibility of, challenges to, and timeframe for potential solutions. It found that there are no major technological barriers to the implementation of a clean cargo conveyance technology; that small-scale demonstration projects could begin immediately; and that commercialization of proven designs could be achieved by 2035. In addition, the study recommended that the most feasible solution was a “dual mode” Hybrid Electric Vehicle (HEV), in particular if combined with an infrastructure power source such as catenary or in-road power supply. The study also found that the development of a viable business case and corridor market mechanisms are the most significant hurdles to implementation of a clean cargo conveyance technology.

In all, there are valuable findings in literature on the potential benefits and disbenefits of dedicated truck facilities, and studies about the potential for using clean cargo conveyance technologies. However, very little work exists that evaluates both issues in tandem- i.e. the potential of developing a truck-only facility with the express purpose of transitioning it to a clean technology corridor. Recognition of these shortcomings, and issues, is what drove the EWFC analysis throughout the SCAG Comprehensive Regional Goods Movement Plan and Implementation Strategy. From the outset, the goal was to determine if a strategy exists that can maximize the potential benefits of a dedicated truck facility, while minimizing the impacts to communities and the natural environment.

REGIONAL NEED FOR AN EAST-WEST FREIGHT CORRIDOR (EWFC)

An ideal candidate for the EWFC alignment would support mobility for key industries, efficiently serve goods movement markets, alleviate regional congestion, increase the safety of the traveling public, and contribute to sustaining regional economic health. In addition, it must be acceptable to neighboring communities, and advance the region’s environmental goals – including meeting the US Environmental Protection Agency Transportation Conformity goals (14). Finally, it would not conflict with other major regional projects being planned, including the California High Speed Rail (CAHSR) project, the Gold Line light rail extension, and other potential new infrastructure and operational developments. It is unlikely that any alignment of an EWFC would satisfy all of these criteria. However, in order for any EWFC to be feasible, it must satisfy as many of them as possible.

To these ends, much of the analytical work focused on evaluating the potential benefits and drawbacks of an EWFC under several different potential alignments. This evaluation involved a rigorous, 5-step assessment that culminated in the identification of a preferred alignment for further study. This process is illustrated in Figure 2 and described more in the following sections.
FIVE-STEP PROCESS TO IDENTIFY A PREFERRED ALIGNMENT

FIGURE 2 The Five-Step Process to Identify a Preferred Alignment

Step 1: Definition of the Ideal Characteristics for the EWFC
This involved discussions with numerous regional freight stakeholders to define the characteristics of an ideal EWFC as summarized above.

Step 2: Identification of the Highway and Non-Highway Alignments for the EWFC
This included highway corridors such as I-210, I-10, SR-60, SR-91 and I-605. It also included a Southern California Edison (SCE) utility Right-of-Way (ROW) and a Union Pacific Railroad (UPRR)-adjacent facility. These facilities are identified in Figure 3.

Step 3: Relative Comparison of Corridors Against Initial Screening Criteria.
The potential corridors were evaluated against three screening criteria: 1) proximity to current and future markets (manufacturing and warehousing facilities located within a five mile buffer), 2) Their ROW feasibility and constraints (including steep gradients, and the presence of significant residential property along the corridor), and 3) Corridor operational characteristics including the volume of trucks carried and the incidence rate of truck-involved accidents. The results of this initial screening are shown in Table 1 below:

Table 1 Results of Initial (Step 3) Screening Process

<table>
<thead>
<tr>
<th>East-West Corridor</th>
<th>Market</th>
<th>ROW</th>
<th>Traffic</th>
<th>Outcome</th>
</tr>
</thead>
</table>

TRB 2013 Annual Meeting Paper revised from original submittal.
### Impacts

<table>
<thead>
<tr>
<th>Initial Corridors Under Consideration</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>I-210</td>
<td>O</td>
<td>N/A</td>
</tr>
<tr>
<td>I-10</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>SCE Alignment</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>SR-60</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>UPRR</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>SR-91</td>
<td>●</td>
<td>N/A</td>
</tr>
</tbody>
</table>

- **I-210**: Does not satisfy criteria of serving current and future markets. **Dropped from consideration following criteria #1.**
- **I-10**: Similar benefits as the strategies along SR-60 or the San Jose Creek Channel, but with significantly more impacts to residential areas. **Dropped from consideration following criteria #1 & #2.**
- **SCE Alignment**: Constraints analysis revealed very steep grades and challenging terrain. **Dropped from consideration following criteria #2.**
- **SR-60**: Certain portions performed well enough to be advanced as hybrid alignments.
- **UPRR**: Certain portions performed well enough to be advanced as hybrid alignments.
- **SR-91**: Certain portions performed well enough to be advanced as hybrid alignments.

<table>
<thead>
<tr>
<th>Potential corridor alignment strongly satisfies (or is impacted by) this criterion.</th>
<th>Potential corridor alignment somewhat satisfies (or is somewhat impacted by) this criterion.</th>
<th>Potential corridor alignment neither satisfies nor is impacted by this criterion.</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>●</td>
<td>○</td>
</tr>
</tbody>
</table>

### Step 4: Creation of New “Hybrid” Alignments that Minimize Community Impacts

This initial screening process revealed that the most acceptable alignments may include non-highway facilities, such as the UPRR ROW or similar parallel infrastructure. Therefore, several new “hybrid” options were designed, including portions of highway and non-highway alignments (Figure 3). The San Jose Creek Alignment is included in each of these hybrid options. This alignment was identified by City of Industry staff during discussions about planned improvements to the SR-60/SR-57 interchange. San Jose Creek is a flood control channel managed by the Los Angeles County Department of Public Works and the U.S. Army Corps of Engineers. Construction of the EWFC above the creek would create opportunities to make much needed improvements to the channel (reconstruction and rehabilitation) during the EWFC construction.

It is recognized that any preferred option - and the San Jose Creek Channel - will require additional engineering studies to come up with the most feasible configuration for the connection. However, the following “hybrid” alignments underwent significant analysis to determine their feasibility in Step 5:

- UPRR-adjacent to San Jose Creek Channel to SR-60;
- UPRR-adjacent to San Jose Creek Channel, terminating at SR-57;
- SR-60 to San Jose Creek Channel to SR-60;
- SR-91 to I-605 to San Jose Creek Channel to SR-60; and
Step 5: Modeling of Five Remaining Corridor Alignments

The SCAG Heavy Duty Truck (HDT) Model was employed to model the impacts of each of the five remaining corridor alignments. The HDT model is integrated with the SCAG regional travel demand model and allows for the analysis of the impacts of planned truck projects on three classes of trucks. The model has several major components:

- **Internal model** – intra-regional truck trips are estimated based on trip generation rates and separate distribution models for eight different land use/industry types. The model can be run in a way that tracks the truck traffic generated by each of these land use types. This feature allowed for the analysis of what goods movement markets – since the model can report the number of trucks on a particular alignment that are generated by manufacturing or warehouse activities.

- **External model** – inter-regional truck trips are estimated based on commodity flow data and can also be tracked as a separate truck class in the model.

- **Intermodal model** – truck trips to/from intermodal yards are estimated separately.

- **Port model** – A detailed model of truck trips to/from the Ports of Los Angeles and Long Beach are tracked by the model along with trips from logistics service providers who serve this traffic.

Using this model, each alignment was evaluated for its performance against several Measures of Effectiveness (MOEs): Vehicle-Miles Traveled (VMT), Vehicle Hours Traveled (VHT), and vehicle hours of delay were calculated for all trucks, heavy-heavy trucks (over 30,000 lbs. gross vehicle weight), and autos. In addition, the model was used to determine the percentage of truck lane users who served different goods movement markets as a way of determining what industries benefit from truck lanes. MOEs were calculated for an “influence area”, a region that includes all of the...
EWFC alignments and I-710 and I-15, and is therefore the region most likely to be impacted by the development on an EWFC. Results of the modeling analysis include the following benefits:

- **Mitigation of Future Truck Traffic**: Truck traffic is projected to grow significantly on all existing east-west freeway segments, causing increased congestion and longer delays to trucks and general traffic on existing routes. The construction of the EWFC would increase capacity to accommodate the projected growth in truck activity. The corridor's traffic mitigation impacts would be significant, as some segments of the EWFC are forecast to carry between 58,000 and 78,000 trucks per day in 2035 — trucks that would no longer be using capacity shared with autos.

- **Reduction in Regional Delay**: The EWFC is projected to result in substantial delay reduction for both trucks and autos. Within the influence area, all traffic is expected to experience a reduction of approximately 4.3 percent, with heavy-duty trucks seeing a nearly 10 percent decrease. This reduced delay would provide demonstrable travel time savings as well as reduce emissions from idling vehicles on congested roadways.

- **Impacts on Parallel Routes**: The EWFC is projected to draw significant volumes of truck traffic away from parallel routes, easing congestion and creating capacity for other vehicles on general purpose lanes. Estimates indicate that the EWFC could reduce daily traffic on portions of SR-60 (between 42–82 percent), I-10 (up to 33 percent), SR-91 (up to 19 percent), I-210 (up to 17 percent), and major regional arterials (up to 21 percent).

- **Mobility Benefits for Critical Markets**: The EWFC would offer considerable benefits to regional businesses and industries served by the numerous clusters of warehousing and manufacturing facilities near the route. Portions of the recommended potential EWFC lie within a five-mile radius of 52 percent of the region’s warehousing square footage and 27 percent of regional manufacturing employment.

- **Reduction of Truck-Involved Accidents**: The EWFC offers the potential to reduce truck-involved crashes as a result of the separation between trucks and other vehicles. Safety analysis revealed that several existing east-west corridors have high rates of truck-involved crashes, including segments of SR-60, SR-91, and I-10. Over a five-year period, the average of truck-involved crashes on SR-60 between I-605 and SR-57 sees 10 to 15 truck crashes per mile on an annual basis. A short segment near the intersection of SR-60 and SR-57 had an average of 20 to 30 crashes per mile annually.

- **Preservation of Jobs and Income**: Increasing congestion is making Southern California a less attractive place to do business, threatening jobs and the region’s economy. The EWFC delivers a transportation system with greater capacity and less congestion in support of industries that depend on efficient freight movement throughout the SCAG region.

- **Reduction of Harmful Emissions**: The EWFC provides an opportunity to reduce harmful pollutants through the use of zero- and/or near-zero -emission technologies for freight transportation. Although the technology to be used will be determined as the market evolves, the EWFC offers a significant opportunity to catalyze development, deployment, and commercialization of zero- and/or near-emission technologies for freight transportation. *(Detail is provided in a subsequent section of this paper).*

**CURRENT ALIGNMENT FOR FUTURE RESEARCH**

The culmination of this five-step process was the selection of a preferred alignment for additional research. The preferred corridor concept would connect to the north end of the I-710 and roughly parallel the Union Pacific Railroad Los Angeles Subdivision before following a route adjacent to SR-60 just east of SR-57. This alignment is shown in Figure 4, and the modeled benefits of this alignment are shown in Table 2. The potential use of two non-roadway routes provides an opportunity to move the facility away from neighborhoods and closer to the industrial activities that it would serve.

Utilizing a right-of-way of approximately 100 feet, the bi-directional corridor would be restricted to truck traffic and have limited ingress/egress points. In the future, this East-West Freight Corridor would be a catalyst for the use of zero-and/or near-emission truck technologies, improving air quality.
for communities near the corridor and throughout the region. However, this is a preliminary alignment, and requires more engineering and planning work to advance.

**FIGURE 4 Potential Alignment for the EWFC**

![Potential Alignment for the EWFC](image)

<table>
<thead>
<tr>
<th>Modeled Benefit</th>
<th>Performance of the Preferred Alignment</th>
</tr>
</thead>
</table>
| Mobility        | • Truck delay reduction of approximately 11%  
                  • All traffic delay reduction of approximately 4.3%  
                  • Reduces truck volumes on parallel general purpose lanes (between 42% and 82% on SR-60) |
| Safety          | • Reduced truck / automobile accidents (up to 20-30 per year on some segments) |
| Environment     | • 100% zero-emission truck utilization removes 4.7 tons of NO\textsubscript{x}, 0.16 tons of PM\textsubscript{2.5}, and 2,401 tons of CO\textsubscript{2} daily. |
| Community       | • Preferred alignment has least impact on communities (via the use of the San Jose Creek Channel)  
                  • Removes traffic from other freeways  
                  • Eventual use of Zero-emission technology (ZET) - reduces localized health impacts |
IMPLEMENTING A ZERO-EMISSION FREIGHT CORRIDOR STRATEGY

Implementing zero- or near-zero emission technology is a critical action for several reasons. For one, the region faces a major challenge as it tries to meet future National Ambient Air Quality Standards for ozone and PM$_{2.5}$. The inability to meet these standards could lead to serious regulatory sanctions and loss of critical transportation funding in addition to harmful health effects. Developing a strategy that actively promotes zero-emission goods movement would allow the region to realize the economic benefits of freight movements while minimizing negative side effects to communities and the environment.

Review of Potential Zero-Emission Technologies

Work performed during the Comprehensive Regional Goods Movement Plan and Implementation Study assessed the potential of a range of zero or near-zero technologies to work as part of a dedicated clean truck facility such as the EWFC (11). Zero-local-emissions alternative technologies were reviewed for an electric-engine/battery truck technology that could both:

- Operate on a dedicated guideway, drawing electric-traction power from overhead catenary, third-rail, embedded linear-induction motor, or some other fixed distribution system, and charging their individual energy storage devices; and
- Operate off the dedicated guideway, drawing power from internal energy storage devices.

Several truck applications were reviewed to identify any attributes of the technology that could be suitable for the movement of line-haul container freight in a zero-local-emissions truck application. The technologies that were evaluated included an electric / diesel engine battery truck, an electric bus, a linear synchronous motor (truck application), and electromagnetic induction (truck application). A high level screening was conducted to determine the degree to which these configurations could meet a basic set of system requirements, including the ability of each technology to maintain existing terminal / freight facility operations, to enter and exit the freight corridor seamlessly, and to produce zero emissions from combustion.

The findings of this evaluation show that there do not appear to be any current commercially available electric-engine/battery truck technology in a zero-local-emission application to transport cargo containers to distribution centers or other end-points in the Los Angeles Basin. However, three basic technology configurations were identified that were the most responsive to the technological review, and are the leading potential zero-emission technologies to advance for further study. These three technologies are summarized in Table 3 below.
<table>
<thead>
<tr>
<th>Technology</th>
<th>Description</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>100% Battery Truck</strong></td>
<td>A truck whose prime mover is an electric motor, powered by on-board electric batteries or other energy storage devices. Batteries could be re-charged from the electric grid when the truck is out of service, or during operation from regenerative braking. Rapid-charging battery technology could extend the range of the truck.</td>
<td>Would operate on battery power both on and off of the freight corridor, thus producing zero local emissions. These trucks would not require any specialized infrastructure on the freight corridor, and would not impact existing operations. They would operate like standard truck and therefore have the ability to enter and exit the freight corridor seamlessly.</td>
</tr>
<tr>
<td><strong>Electromagnetic Induction + Battery Truck</strong></td>
<td>A truck that receives electric traction power either part-time or full-time by electromagnetic induction from a contactless linear power distribution system embedded in the roadway. Power pickup equipment on the electric vehicle collects electricity from the embedded power supply and distributes the power to drive the electric motor or to on-board battery storage. This truck would use electromagnetic induction for power while operating on the freight corridor, and would use battery power while operating off the freight corridor.</td>
<td>Would receive power from an embedded power source while on the freight corridor, and operate on battery power while off the freight corridor, thus producing zero local emissions. These trucks would be contactless; there would be no physical contact between the truck and the power source embedded within the pavement of the freight corridor. This would allow for the free movement of the trucks while operating on the freight corridor, thereby not impacting existing terminal/freight facility operations and freight corridor operations. The trucks would enter and exit the freight corridor seamlessly.</td>
</tr>
<tr>
<td><strong>Overhead Catenary System + Battery Truck</strong></td>
<td>A truck that receives traction power part-time or full-time from overhead electrical wires via pantographs or trolley poles. This truck would operate using an overhead catenary system to deliver power to the electric motor, while recharging the battery on the vehicle. This type of truck would use the overhead catenary system for power while operating on the freight corridor, and would use battery power while operating off the freight corridor.</td>
<td>Would receive power from an overhead catenary line while operating on the freight corridor, and would operate on battery power while off the freight corridor, thus producing zero local emissions. Although this does still require some contact with a power source, it does not have the safety issues, nor does it have the infrastructure restrictions that would be associated with a third-rail-powered system.</td>
</tr>
</tbody>
</table>
Air Quality Benefits from Zero-Emission Technologies – Assuming 100% Zero-Emission Vehicles

The primary benefits of a zero-emission technology would be a decrease in local emissions, based on a reduction of standard trucks in the study area. Since all of the electric/battery truck options are assumed to achieve zero local emissions, the emissions benefits of the three technology options would likely be the same. The emissions estimates are based on typical South Coast Air Quality Management District standards for heavy-duty trucks (33,000 pounds to 60,000 pounds). Emission calculations are based on the most conservative (highest) Emissions Factors 2007 (EMFAC) model (J1).

EMFAC emission rates are estimated based on projected truck fleet penetration for the Southern California region. Fleet penetration refers to the estimated number of trucks by truck model year that are being used in the Southern California truck fleet. Currently, many of the trucks are older-model year trucks, which generally emit higher levels of criteria pollutants than newer trucks. The EMFAC model assumes the average pollutant levels for the fleet penetration of that year. In future years, EMFAC takes into account future fleet penetration levels, which assume that older, high-pollutant-emitting trucks will be replaced with newer, less-pollutant-emitting trucks; and as older, higher-polluting trucks are replaced each year, the average emissions from each truck also decrease.

Table 4 shows the emission reductions calculated in 5-year increments for the years 2020, 2025, 2030, and 2035.

Converting a dedicated truck facility to zero-emissions technology will take time. Therefore, the SCAG 2012 RTP/SCS outlines a four-phased action plan for 2012 – 2035. This phased approach allows for the continued development of appropriate technologies, key demonstration projects, the identification of funding sources, and the gradual commercialization of successful zero-emission technologies. The ultimate goal is the full deployment of appropriate zero-and near-zero-emission trucks for a substantial amount of regional freight transportation needs.
Table 4 2025-2035 Vehicle Emissions Reduction (Tons per Day) as a Result of EWFC Truck dedicated Facility, Assuming 100 Percent Clean Trucks (II)

<table>
<thead>
<tr>
<th></th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NOx</td>
<td>PM$_{2.5}$</td>
<td>CO$_2$</td>
<td>NOx</td>
</tr>
<tr>
<td>Light Heavy-Duty Trucks (LHD)</td>
<td>346,577</td>
<td>0.1</td>
<td>0.003</td>
<td>100</td>
</tr>
<tr>
<td>Medium Heavy-Duty Trucks (MHD)</td>
<td>195,611</td>
<td>0.2</td>
<td>0.016</td>
<td>157</td>
</tr>
<tr>
<td>Heavy Heavy-Duty Trucks (HHD)</td>
<td>1,404,496</td>
<td>3.6</td>
<td>0.111</td>
<td>1,482</td>
</tr>
<tr>
<td>Total</td>
<td>1,946,684</td>
<td>3.8</td>
<td>0.131</td>
<td>1,739</td>
</tr>
<tr>
<td>Percent of 2035 SCAB HDV Total</td>
<td></td>
<td>5.4%</td>
<td>4.8%</td>
<td>3.4%</td>
</tr>
</tbody>
</table>
CONCLUSIONS

SCAG is committed to building a clean freight system to the maximum extent possible. As such, the 2012 RTP/SCS includes a “Regional Clean Freight Corridor System” as a regional highway strategy. The region’s understanding of a portion of this system, the “East West Freight Corridor (EWFC), was enhanced through work completed during SCAG’s Comprehensive Regional Goods Movement Plan and Implementation Study (11). Specifically, the work included:

- Developing a better understanding of the markets served by an EWFC, including quantification of the economic benefits of regional goods movement industries;
- The identification of non-freeway alignments for the EWFC, which allowed for fewer impacts to SCAG’s communities;
- Contributed to a better understanding of truck movements on the region’s system, and quantified potential benefits of an EWFC in terms of delay reduction, safety benefits, emissions reduction, and decreased impacts to communities; and
- Defined potential zero emission technology technologies and quantified the potential emissions benefits from 100% adoption of zero-emission technology on the EWFC.

The SCAG 2012 RTP/SCS suggests phasing in a zero-emission technology between 2012 – 2035, allowing for the gradual development of technology, pilot projects, the identification of funding sources, and the gradual commercialization of the technology. Currently, the SCAG region is advancing the zero-emission concept with initiatives at the Ports of Los Angeles and Long Beach through their Technology Advancement Program (TAP) and recent initiatives for our regional zero emission collaborative and potential demonstration projects.

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