



FINAL REPORT

ALTERNATIVE GOODS MOVEMENT TECHNOLOGY ANALYSIS

INITIAL FEASIBILITY STUDY REPORT WBS ID:160.10.60

Prepared for



Los Angeles County
Metropolitan Transportation Authority

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Prepared by:



2020 East First Street, Suite 400
Santa Ana, California 92705



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APPENDICES

- Appendix A Task 160.10.60 Alternative Goods Movement Technology Analysis, Draft Working Paper, Review of Alternative Zero-Emission Container Transport Technologies (without all Appendices)
- Appendix B Memorandum to Traffic and Forecasting Working Group July 15, 2008: Final Recommended Port Cargo Forecast and Rail Capacity Scenarios
- Appendix C Memorandum – Revised to Michael Fischer, Mark Jensen, Dave Levinsohn – Market Estimate for Alternative Container Transport Technology, October 1, 2008



EXECUTIVE SUMMARY

This Alternative Goods Movement Technology Analysis – Initial Feasibility Study Report provides a generalized definition of a system to move cargo containers to and from the Ports of Long Beach and Los Angeles, encompassing a range of alternative technologies. This definition will be used as a surrogate alternative technology, to evaluate the potential environmental impacts and benefits attributable to alternative technologies for the I-710 Corridor Project Environmental Impact Report/Environmental Impact Statement (EIR/EIS).

Two families of alternative technologies have been identified for the I-710 application: automated fixed-guideway systems and electric/battery trucks. Each family has been characterized in terms of guideway, propulsion, energy consumption, command and control, terminal interfaces, vehicles, switching, sorting and storage, system operations and system assurance. Many characteristics are shared among the families.

Potential alignments have been identified that traverse a north-south corridor from the Ports of Long Beach and Los Angeles (the Ports) to intermodal rail facilities within the I-710 study area. On the basis of the width required for the alternative technologies and space within these potential alignments, the I-710 alignment was used as the hypothetical location for the generalized alternative technology.

The demand for cargo container transportation by alternative technology was analyzed for the off dock-and near-dock markets, as well as for containers moving to and from destinations east of Los Angeles. All of these markets were quantified for 'Port Build' and 'Port No Build' scenarios, reflecting different degrees of investment in on-dock and near-dock intermodal facilities. Annual market demand under these scenarios was estimated to be from 2.3 to 3.1 million 40' cargo containers for the off-dock and near dock markets, and from 2.4 – 3.7 million 40' cargo containers for destinations east of Los Angeles.

Capacity requirements for the alternative technologies were calculated for the Ports and intermodal rail facilities based on trip generation data from the Ports and the productivity of existing equipment used to load and unload cargo containers. Ten alternative technology stations¹ incorporating from 31 to 37 station loading tracks were identified within the Ports. The same number of station loading tracks was assumed at the intermodal rail facilities, to balance the average flows in either direction via the alternative technology.

Capacity for the family of automated fixed-guideway was calculated via one equation for the Ports and intermodal facilities, and another equation for the line-haul segment. This was an

¹ A facility where cargo containers are either loaded or unloaded.



iterative process in which values for multiple independent variables were tried in the equations to derive a similar common expression for system container throughput. In response to the projected market demand, a system using ten-vehicle consists², via dual guideway within the Ports and intermodal rail facilities, and via quadruple guideway over the line haul³ segment was defined. The estimated capacity of the system at the Ports/intermodal rail facilities ranged from 4.7 – 11.3 million 40' cargo containers annually; while estimated capacity for the line haul portion of the alternative technology system ranged from 2.7 – 12.1 million 40' cargo containers annually.

In light of the apparent property requirements for deployment of an automated fixed-guideway technology on the ports and intermodal rail facilities, another potential technology alternative, electric/battery trucks, was defined. For the automated fixed-guideway alternative technology system, a typical two-track alternative technology station for loading and unloading containers has an approximate footprint of 2.9 acres; while a typical three-track alternative technology station has an approximate footprint of 3.1 acres. For a configuration to accommodate 30 stub tracks, approximately 36 acres of land would be needed. Therefore, a new technology of electric/battery truck was introduced that would interface with ports and rail terminals as conventional trucks do today, but would operate on a dedicated guideway subject to controls that safely optimize capacity. Such a technology does not exist as a commercial product today, but would incorporate characteristics of a range of existing freight and passenger technologies.

Trucks powered by electric motors could draw wayside electric power on the line-haul segment and operate on battery power at the ports and intermodal rail facilities. Individually-operated electric trucks would interface with existing container handling systems and would not otherwise consume limited capacity at either the ports or intermodal rail facilities. The capacity of the fixed line-haul segment, defined generally to be in the vicinity of I-710 between Ocean Boulevard and Washington/Bandini, was estimated to range from 12.1 – 20.0 million 40' cargo containers annually.

Deployment of an alternative technology system could take up to 8 years, and would involve a major commitment of local resources throughout specification, development, testing construction, commissioning and operation. For maglev and fixed-guideway technologies, capital costs are estimated to range from \$8.2 to \$11.3 billion (including design, construction management fixed facilities and vehicles) and from \$222 to \$367 million for the first year of operations and maintenance. For the electric/battery truck alternative, capital costs are estimated to range from \$3.8 to \$3.9 billion and from \$35 to \$40 million for the first year of operations.

² A consist is a group of vehicles operated as a unit.

³ Identified generally as adjacent to I-710 between Ocean Boulevard and Washington/Bandini.



1.0 INTRODUCTION

1.1 PURPOSE OF THE I-710 CORRIDOR PROJECT ENVIRONMENTAL IMPACT REPORT/ENVIRONMENTAL IMPACT STATEMENT (I-710 CORRIDOR PROJECT)

Interstate Highway 710 (I-710), the Long Beach Freeway, is a north-south interstate highway route that connects the City of Long Beach to the Ports and central Los Angeles, with connections with Interstate 405, State Route 91, Interstate 105, Interstate 5, State Route 60, and Interstate 10. I-710 is a principal route used by trucks transporting marine cargo containers from the Ports to near-dock (approximately 5 miles from the Ports) and off-dock (approximately 20 miles from the Ports) intermodal facilities, where they are loaded onto trains for shipment beyond the Los Angeles basin. Trucks also carry containers via I-710 and other regional freeways to other local and regional destinations, including warehouse and distribution centers and end users of the contents being shipped.

The growing population of trucks using I-710 to carry cargo containers from the Ports to inland destinations contributes to congestion of the highway and surface routes, and generates locally high levels of air pollutant emissions. The high ratio of heavy trucks to personal automobiles on I-710 further poses a considerable safety risk. These effects are felt keenly among the communities through which I-710 passes, whose residents are immediately subject to the health and quality of life impacts imposed by truck operations and emissions. The growth in population and employment that has occurred since I-710 was first constructed, and the growth in economic activities related to goods movement, both contribute to the worsening of congestion and air quality in the area.

In response to the concerns of the communities through which I-710 passes, a consortium of Los Angeles area transportation agencies is investigating means to provide the capacity needed in the I-710 Corridor to accommodate forecast passenger travel and goods movement, while addressing the public health, safety and quality of life of local residents. This study is in the initial stage of CEQA and NEPA documentation to evaluate a range of corridor alternatives, including potential applications of new container transportation technologies.

The purposes of the proposed I-710 Corridor Project are to:

- Improve air quality and public health;
- Improve traffic safety;
- Address design deficiencies;
- Address projected traffic volumes; and to



- Address projected growth in population, employment, and economic activities related to goods movement.

Among the alternatives being developed for consideration in the I-710 Corridor Project EIR/EIS process is one that would apply a new technology for container transport – to enable the diversion of cargo container traffic to a physically separate, non-polluting transport mode, reducing the local effects of container transport operations and emissions from trucks in particular.

1.2 PURPOSE OF INITIAL FEASIBILITY REPORT

The purposes of this Initial Feasibility Study Report (the Report) are to identify potential alignments for a container transport system that employs an alternative technology, and to define the technical characteristics of a generalized alternative technology system to transport cargo containers from the Ports to intermodal transfer points. The technology definition is based principally on information provided by proponents of new technologies, definitions of other technology applications (e.g. airport people movers, high-speed rail, electric buses and trucks), and forms of similar non-proprietary performance specifications.

While the Report states the characteristics of a generalized alternative technology in the form of performance requirements, these requirements are neither intended as the basis for system procurement, nor for the qualification of candidate technologies.

The overall aim of the I-710 Corridor Project EIR/EIS is to evaluate environmental impacts and benefits attributable to a range of alternatives. The Report does not imply a selection or preference of a specific alternative technology or product, but provides an objective definition of requirements for container transport systems in the service of particular markets. The characteristics of such a technology are derived from the performance requirements, to enable the evaluation of their impacts and benefits alongside those of other I-710 Corridor transportation alternatives. The Report thus provides generalized definitions of alternative technologies to move cargo containers to and from the Ports that can be evaluated on the basis of their market-responsive physical and operational characteristics.

Although the system described could be part of a broader regional network, the focus of the alternative technology concept specified in the Report is within the I-710 study area.

Given that it is technology-neutral, the Report defines criteria that represent the ‘outer boundaries’ of the characteristics of technologies for which data are available today, to enable quantification of the maximum environmental impacts and capabilities from the alternative technology’s footprint and operations. For example, the general specifications for an alternative



system guideway are defined by the maximum cross-sectional width, elevated structure height, footing size, and other characteristics derived from all the source information. Technologies that impose lesser impacts than this generalized surrogate could be available in the future.

1.3 BACKGROUND TO ALTERNATIVE TECHNOLOGY STUDY

During the summer of 2007, the Ports commissioned work on a review of alternative, 'zero-emission' transportation technologies that could be considered for application to the transportation of marine cargo containers within the Ports, and between the Ports and a near-dock intermodal facility less than 5 miles away. This 'Zero Emission Container Movement System' study, (ZECMS) completed by URS Corporation under subcontract to Cambridge Systematics, Inc., has been adapted for use as a reference document for this Report, and can be found in Appendix A.

The ZECMS study surveyed a broad range of alternative technologies for potential application to the near-dock intermodal market, or for circulation within either or both of the Ports. The information used to characterize each alternative technology was obtained directly from the alternative technology proponents, via telephone interviews and written responses. On the basis of this information, the consultant team evaluated the responsiveness of each alternative technology to a rudimentary service scenario, and the commercial readiness of each proponent to deploy their alternative technology in a revenue service demonstration project. The evaluations reflected:

- The responsiveness of each proponent to both the technical and commercial queries (i.e., Did the proponent provide complete and knowledgeable answers?);
- The assessed responsiveness of each proposed alternative technology to the scenario (i.e., Is the proposed solution plausible, proven, or based on existing applications?); and
- The assessed commercial capability of each proponent to develop, deliver and assure their proposed solution (i.e., Is this a viable commercial entity with a viable business plan?)

The findings of the study included aggregated numerical scores for a range of criteria, each scored on a fixed scale. While these aggregated scores resulted in an apparent ranking of technologies and proponents, they were not weighted to reflect the priorities and needs of an actual operating agency, nor do they indicate how these proponents could respond to an actual opportunity to deliver an operating system.

The study resulted in a categorization of candidate technologies into four general families:

- magnetic levitation systems,
- exclusive contact guideway systems (e.g. steel wheel/rail, rubber tire)



- retrofits to conventional rail, and
- Lighter-than-air systems.

It further assessed and scaled the readiness of proponents within each of those families to respond to a deployment opportunity.

Finally, the technical information obtained about these families of technologies provides input to the definition of the generalized alternative technology surrogate to be evaluated in the I-710 Corridor Project.

This review of alternative technologies was accomplished in three steps:

1. A **Preliminary Assessment**, based on telephone interviews with individual alternative technology proponents and their responses to a set of standard questions. (Preliminary Assessment of Alternative Technologies and Proponents – September 4, 2007).
2. A **Technical Inquiry** based on the written responses of individual proponents to a set of rudimentary standard performance requirements. (Technical Assessment of Alternative Technologies and Proponents – December 14, 2007).
3. A **Final Assessment**, combining the commercial information obtained via the Preliminary Assessment with the technical information obtained via the Technical Inquiry.

Both components of the final assessment are therefore based on information provided by the alternative technology proponents themselves.

1.3.1 Preliminary Assessment

The Preliminary Assessment identified viable proponents and their technologies that could be considered for demonstration and deployment of an alternative zero emission container transport system. Fourteen proponents of alternative technologies were identified by the Ports or the consulting team, or identified themselves directly to the consultant team. The Preliminary Assessment reviewed the business capabilities of the proponents and the general feasibility of their alternative technology concepts as applied to container transport. The candidates are all cutting-edge technologies in the research and development stage, **none with a demonstration system currently operating in a practical or commercial application.**

In the Preliminary Assessment, the technical information was derived solely from telephone interviews with each technology's proponents. While the interview questions were



standardized, there were no standard scenarios or criteria as a basis for comparing the proponents' responsiveness.

1.3.2 Technical Inquiry

In a subsequent Technical Inquiry, proponents were invited to respond in writing to two hypothetical service scenarios, and to provide physical, operating, and estimated cost characteristics of their systems as applied to the scenarios. The responses to this inquiry enabled a more detailed assessment of each alternative technology's technical characteristics, as well as the stated capabilities of their proponents.

The Technical Inquiry gave proponents an opportunity to refine the information they had provided previously, and resulted in some changes in the technical comparison of the alternative technologies. Of the originally identified fourteen proponents, one did not respond to the Technical Inquiry, so the assessment considered thirteen of the fourteen originally identified alternative technologies.

1.3.3 Final Assessment

For the Final Assessment, the commercial information obtained via the Preliminary Assessment was combined with the technical information obtained via the Technical Inquiry. In the Preliminary Assessment, commercial and technical criteria were treated equally. While this convention was retained for the Final Assessment, there were simply more technical characteristics than commercial characteristics. The commercial and technical scores were therefore calculated separately and then normalized to percentages of the maximum possible score, resulting in an equal weighting of commercial and technical criteria.

The Final Assessment results indicated a natural break in the normalized scores at approximately the 70 percent threshold. Above this natural break, two alternative technology families, each represented by two alternative technology proponents, appear to offer both commercial and technical characteristics responsive to the Ports' service scenarios. These families are *magnetic levitation* and *exclusive contact guideway* systems.

Of the two categories not represented by alternative technologies scoring better than 70 percent, both may be considered to be non-responsive to the needs and objectives of the Project. *Retrofits to conventional rail* depend on the use of facilities already in use by the commercial freight railroads, which are unlikely to compromise their limited capacity for a demonstration of a new technology. *Lighter-than-air transport* would require an inordinate number of vessels to transport the anticipated volume of containers in the corridor, with tremendous visual and airspace congestion impacts.



The two families of alternative technologies identified for the Ports that appear to respond to the Port's needs and to the goals of the I-710 Corridor Project are *magnetic levitation* and *exclusive contact guideway* systems. These two families share technical characteristics that can be represented by a single generalized alternative technology surrogate – one that can be evaluated as an alternative for the I-710 Corridor Project as a general automated fixed-guideway alternative. The shared characteristics that enable the two families of alternative technologies to be represented as a generalized surrogate include:

- **Aerial (elevated) guideway**, typically using spans and columns for structural support. An underground configuration may be possible, but the guideway is *always* physically separated from conventional rail, street, highway or pedestrian traffic.
- **Fixed guideway** that both carries all vertical vehicle and payloads and provides lateral stability and guidance. This function may be met directly by physical contact or indirectly by electromagnetic levitation. Contact surfaces and structural elements may be steel, concrete, or other suitable durable materials. Vehicles will therefore never operate outside a definable 'dynamic envelope' as they move along the guideway.
- **Automated operation**, controlled by a central operating algorithm or algorithms (a step-by-step problem-solving procedure for solving a problem in a finite number of steps).
- **Electric power** for propulsion and all auxiliary purposes will be delivered to the guideway or vehicle from an outside (typically commercial) source, via a powered rail, wire or surface.

1.4 ADDITIONAL ALTERNATIVE TECHNOLOGY

After development of the first draft of this Report, in August 2008, the I-710 Project internal alternative technology team considered another family of technologies. In light of some of the impacts and uncertainties associated with automated fixed-guideway technologies, it was determined that a system employing electricity/battery-powered trucks on dedicated guideway with wayside traction power could deliver responsive capacity at lower cost than an automated fixed-guideway system. As this alternative is envisioned, electrically-powered trucks could draw power from an overhead catenary wire, third rail, or conductor embedded in the roadway, and could operate over the highway as conventional trucks do today, possibly in an automated system.

At the Ports and intermodal rail facilities, such electric/battery trucks could operate independently of the wayside traction power system, using internal auxiliary power units employing battery, flywheel, or some other energy storage technology. An electric/battery truck



alternative could be developed with characteristics drawn from electric trolley coach systems used in urban transit, electric trolley assist systems used in mining applications, and electric traction power systems used for rail passenger and freight transport. The potential capacity of an electric/battery truck system could be further enhanced by automated guidance technology that could enable ‘platoons’ of electric/battery trucks to operate as single virtual consists, at closer headways than safely possible with individually-operated vehicles with possibly more destination flexibility than a fixed-guideway system.

An electric/battery truck alternative could incorporate features and capabilities of the existing technologies illustrated in Figure 1.

**Figure 1
Electric/Battery Trucks**

| | |
|--|---|
| | <p>Battery Powered Trucks</p> |
| | <p>Trolley-Assist Trucks</p> |
| | <ul style="list-style-type: none"> ▪ Off-Board fast charger, 60% charge in 1 hour, full charge 4-6 hours. ▪ 60 miles on single charge unloaded; 30 miles loaded ▪ Loads up to 60,000 pounds. ▪ Model manufactured by Balcon Corporation. ▪ Prototype in demonstration by Port of Los Angeles <ul style="list-style-type: none"> ▪ Application in the mining industry throughout the world (Example: Barrick Goldstrike Mine, Nevada). ▪ Electric power is provided to the overhead lines via a roadside rectifier substation. ▪ Overhead lines and substations by major traction power suppliers (e.g. Siemens, Hitachi). ▪ Trucks equipped with pantographs or trolley poles |



Crystal Mover - Automated People Mover System (APM)

- Mitsubishi Heavy Industries, Ltd.
- Rubber tired system, third rail traction power.
- Latest development: battery powered line haul: recharges in stations.
- Utilizes a simple standard railway switching mechanism to guide the vehicles through junctions.
- Evolved from airport APM system as a more sustainable technology



Trolley Coach

- Buses powered primarily by electric motor
- Traction power from overhead wires (catenary).
- Trolley coach systems have no exhaust, run fairly quietly.
- Acceleration is quick because of rubber tires, sufficient power reserves to climb steep grades

This Report presents performance requirements that encompass technical characteristics of both the automated fixed-guideway and electric/battery powered truck systems into an advanced technology surrogate that may be evaluated as a generalized technology alternative for the I-710 Corridor Project.

1.5 SUMMARY ASSUMPTIONS

The following assumptions are extracted from throughout this report and are compiled here as a summary of the alternative technology definition:



1.5.1 General

- The alternative technology will be a zero-local-emissions system.
- The alternative technology will be procured via competitive solicitation by a public entity, in response to performance specifications of the system's physical characteristics, operations, systems assurance, maintenance and revenue.

1.5.2 Market Demand

- The alternative technology system as defined within the study area would serve some share of the projected 2035 near-dock and off-dock container markets.
- The alternative technology application within the study area could be expanded to serve a future larger regional network, including warehousing, distribution and intermodal facilities elsewhere in the Los Angeles Basin and in the Inland Empire.

1.5.3 Capacity

- The alternative technology would connect the Ports of Long Beach and Los Angeles in the south, and the Burlington Northern Santa Fe Railway's (BNSF) Hobart Yard and Union Pacific Railroad's (UPRR) East Los Angeles Transportation Center (Commerce Yard) in the North, both representative off-dock intermodal rail facilities.
- The combined capacities of container handling facilities at one end of the system will be equal to the combined capacities at the other end.
- Cargo containers will be loaded and unloaded at either end of the alignment with existing commercially available equipment that will load and unload containers as they are handled today.
- For every vehicle carrying a container in one direction, another vehicle carrying a container is moving in the other direction.
- The alternative technology system will be utilized at the Ports and intermodal rail facilities as a continuation of the alternative line-haul system for the I-710 Corridor.
- There will be no intermediate stops between the Ports and the intermodal rail facilities for the automated fixed-guideway alternative technology system.
- The total number of station loading tracks at both the ports and the intermodal rail facilities is based on port cargo growth scenarios by marine terminal.



- The number of station loading tracks is based on the ratios of:
 - (a) 20 lifts per hour per crane and
 - (b) one rail-mounted gantry crane per station loading track
- The alternative technology system will operate 21 hours per day, 7 days per week and 360 days per year.

1.5.4 System Configuration

- Conceptual layouts at the Ports and Intermodal Rail Yards are independent of arrangements of existing facilities at these locations.
- The desired cross-sectional right-of-way width is 82' to accommodate quadruple guideway, two guideways in each direction.
- The automated fixed-guideway system will be elevated, with the support structures located within and outside the available right-of-way, depending on the constraints of the corridor.
- The height of the guideway for the automated fixed-guideway will remain the same between the Ports and intermodal rail facilities and the line haul segment, except for portions where elevation is required.
- The guideway for electric/battery trucks will utilize the same design features of the I-710 freight corridor and will be at grade, except where elevation is required.
- The intermodal rail facilities being identified are the Hobart and East Los Angeles rail yards. Delivery of cargo containers will be evenly distributed between the two rail yards.
- The line haul system will have from 2 to 4 guideways; however a 4 guideway system is assumed to be an optimal configuration.
- The line segments within the Ports and Intermodal Rail yards will have 2 guideways; one inbound and one outbound.
- A typical 'station' has 2 or 3 "stub tracks" each sized to accommodate the unloading and loading of containers from and to 10 vehicles.
- Vehicles will operate as integral consists, physically or electronically coupled.
- Land is assumed to be available for the alternative technology stations at the Ports and intermodal rail facilities.



1.5.5 Technical Characteristics

- Power will be provided from the local electrical grid.
- The generalized fixed-guideway technology will be fully automated (driverless), under the control of an automated vehicle operations system and monitored by personnel.
- The generalized electric/battery truck technology will use manned operations on the Port and intermodal rail facilities, and may incorporate advanced control technology to enable platooning of multiple trucks on the line-haul segment.
- No human intervention will be required to secure the cargo containers to the vehicles.
- Cargo containers will not be stacked on the vehicles.
- A single vehicle on the system will carry no more than one 40'-53' cargo container or two 20' cargo containers.
- Vehicles in transit on the automated fixed –guideway system will more than likely be carrying a container but there may be times when operating in a consist it does not.
- Every vehicle transit from one end of the system to the other includes one loading and one unloading operation.
- The generalized automated fixed-guideway technology will incorporate guideway switches at all control points.
- Loading and unloading stations will use stub tracks, rather than loops.
- The terminal operations will use existing container sorting and storage facilities, exclusive of the alternative technology. Cargo containers will be sorted using current or available sorting systems and stored on terminal property as they are currently stored.
- Import and export cargo containers will be inspected by terminal operators before placement upon the alternative technology system or upon receipt from the alternative technology.
- Port yard facilities will continue to be operated and utilized for the movement of cargo containers by terminal operators and the terminal operators will continue to utilize their own container facilities.



- Automated fixed-guideway vehicles will be capable of pushing or pulling other, disabled vehicles to a maintenance facility or otherwise off the active revenue guideway.
- The system operating rules will be programmed into any automated vehicle operating system to assure the safety of operations of the automated fixed-guideway system.
- The operations and maintenance facility may be located at either end of the system.
- A maintenance road can be provided under the elevated guideway of the automated fixed guideway system.



2.0 BOUNDARIES AND POTENTIAL ALIGNMENTS

2.1 BOUNDARIES

Potential alternative technology alignments have been reviewed in an area parallel to the I-710 freeway, between the Ports of Los Angeles and Long Beach and the complex of intermodal rail facilities near the interchange of I-710 and I-5. The rail facilities at the northern end of the area are BNSF's Hobart Yard, located between East 26th Street and Washington Boulevard and I-710, and UPRR's East Los Angeles Transportation Center, or Commerce Yard, located between Noakes Street and East Washington Boulevard. These yards are logical hypothetical termini, being near the northern limit of the EIR/EIS study area, and serving a quantifiable market. They also comprise a logical point from which the system could be extended in the future to serve other longer-haul markets, such as the Inland Empire.

It is beyond the scope of this Report to identify potential alignments that extend further north or east. However, it is assumed that the alternative technology could be extended inland or connected to a regional freight movement corridor if alignments were identified and secured, environmental documents/clearances were prepared, permitting and approvals were secured and any other criteria needed for development of a major capital project in the State of California were met.

2.2 POTENTIAL ALIGNMENTS

Six potential alignments have been identified for the alternative technology system within the study area. All of the potential alignments start in the vicinity of the Ports and proceed north to the existing Hobart Yard as illustrated by Figure 2. Each alignment has its own advantages and limitations, including the width available for system right-of-way, the amount of property that would need to be taken for guideway and wayside structures, the proximity of existing and planned development, environmental sensitivities, circuitousness and gradients, and the compatibility of other existing and planned transportation uses.

- Potential alignment **UPRR** starts in the vicinity of the Ports of Los Angeles/Long Beach and the Union Pacific right-of-way and proceeds northeast to the intermodal rail yards. The alignment follows the Union Pacific Railroad corridor and is 18.5 miles in length.
- Potential alignment **Los Angeles River** starts in the vicinity of the Ports of Los Angeles/Long Beach and the Los Angeles River and proceeds north to the intermodal rail yards. The alignment follows the Los Angeles River and is 16.7 miles in length.



- Potential alignment **Alameda Corridor** starts in the vicinity of the Ports of Los Angeles/Long Beach and the Alameda Corridor right-of-way and proceeds northwest to rail tracks in the vicinity of 74th Street and the Alameda Corridor. The alignment then precedes easterly to the intermodal rail yards. The alignment follows the Alameda Corridor and is 18.9 miles in length.
- Potential alignment **Metro Blue Line** starts north of the Ports of Los Angeles/Long Beach and the Metro Blue Line right-of-way and proceeds in a northwesterly direction to rail tracks in the vicinity of 74th Street and the Alameda Corridor. The alignment then precedes easterly to the intermodal rail yards. The alignment follows the Metro Blue Line and is 19.2 miles in length.
- Potential alignment **Transmission Corridor** starts in the vicinity of the Ports of Los Angeles/Long Beach and the utility right-of-way and proceeds northeast to the vicinity of Eastern Avenue and Bandini Avenue. The alignment then proceeds west to the intermodal rail yards. The alignment follows the utility right-of-way and is 17.7 miles in length.
- Potential alignment **I-710 Corridor** starts in the vicinity of the Ports of Los Angeles/Long Beach and the I-710 and proceeds north to the intermodal rail yards. The alignment follows the I-710 interstate and is 15.8 miles in length.



Figure 2
Potential Alternative Technology Alignments





It is initially assumed that quadruple guideways (two in either direction) on elevated structure will be the basic line-haul configuration for an automated fixed-guideway system. A typical cross section of such a guideway structure (Section 4.2 – Guideway), indicating that right of way of 82’ in width would be necessary to accommodate the four-track structure, according to the data compiled in the Zero Emission Container Movement System study (ZECMS) performed for the Ports. A cross sectional width of 82’ is therefore used as an idealized case, both to maximize the capacity of the alternative technology system, and to define the alternative of greatest potential impact. This is less than the width determined for four dedicated truck lanes within the I-710 alignment. The cross sectional width of a typical section of the freight corridor is 94’ – 97’, broken down as follows:

Figure 3
Typical Cross Section of the I-710 Freight Corridor



The actual footprint of such an elevated guideway structure may be much smaller, depending on the size of the supporting columns and the span length of guideway beams.

Should an alternative concept incorporate dual guideway, either as a lower-capacity system, or to fit two dual guideways into separate rights-of-way, the requisite cross sectional width of each dual guideway would be approximately 40’.

An electric/battery truck alternative is assumed to require the same width as that calculated for the freight corridor.

The superimposition of conceptual elevated guideway structures upon potential rights-of-way is illustrated by figures in Section 4.2.

It is assumed that an alternative technology system for automated fixed-guideway would incorporate elevated guideway throughout the system to provide clearance over streets, ramps, railroads, and Port facilities. The guideway is assumed to be entirely exclusive, in view of structural and power distribution designs that do not permit crossing by automobiles, conventional rail, pedestrians, or any other modes.

It is also assumed that the electric/battery truck family, will utilize the design features of the freight corridor being developed for the I-710 corridor and remain at grade, except where elevation is needed.



It is assumed that wayside supporting systems, such as power, control and communication equipment, will be located either within or outside the available right-of-way, depending on localized constraints of the corridor.

While the I-710 freeway alignment is assumed to offer at least 82' of cross-sectional width within which an alternative technology system could be constructed, the other potential alignments have dimensional, jurisdictional or operational constraints:

- **UPRR:** Private right-of-way; minimum potential width of 50' for an alternative technology; stringent restrictions regarding the proximity of fixed structures and other modes to railroad operations
- **Los Angeles River:** Public right-of-way; minimum potential width of 150' for the alternative technology; potential local environmental protections, river modification, potential year-round maintenance issues, a limited construction season, and potential for placement of power equipment beyond the boundaries of the alignment.
- **Alameda Corridor:** Public right-of-way; minimum potential width of 50' for the alternative technology; potential restrictions regarding the proximity of fixed structures and other modes to railroad operations
- **Metro Blue Line:** Public right-of-way; minimum potential width 60' for an alternative technology; the most densely developed of the potential alignments
- **Transmission Corridors** Private right-of-way; minimum potential width of 60' for an alternative technology; traverses existing residential land uses

On the bases of initial visual inspection and review of aerial photography, it is assumed that a clear cross-section of approximately 82' in width may be developed within the I-710 freeway alignment for an alternative technology right-of-way and is used as the basis for evaluation in this study. The UPRR, Alameda Corridor, Metro Blue Line and transmission corridors appear to be constrained to less than 82' of available width. The Los Angeles River does appear to have more width available; however, it is assumed that new construction in the river may not be possible for environmental reasons or difficulties. Therefore, for this Report, the width available on the I-710 freeway alignment was utilized for the generalized alternative technology characteristics.

The actual selection and design of an alternative technology alternative would need to consider tradeoffs between system capacity and impacts to adjacent land uses. These tradeoffs are beyond the limits of this study, and would be the subject of detailed study of a specific alignment and technology.



2.3 TERMINAL CONFIGURATIONS

The market for an alternative container transport technology in the I-710 Corridor would encompass a mix of flows that currently comprise the near-dock and off-dock markets, as well as some proportion of containers transported between the Ports and destinations east of Los Angeles. Container traffic in these markets is generated by the majority of marine container terminals at both the Ports.

The operational interface between the hypothetical alternative technology and the Ports and intermodal rail facilities is the station at which containers are loaded and unloaded. The essential functions of an alternative technology station are assumed to be loading and unloading on stub tracks by rail-mounted gantry cranes, stopping, spotting, reversing, starting, and cross over between the stub tracks. For the purposes of the study, it is determined that the use of stub guideway at all loading and unloading stations will enable more efficient use of terminal property than will any loop configurations. The sizing of loading and unloading stations is discussed in Section 3.5.

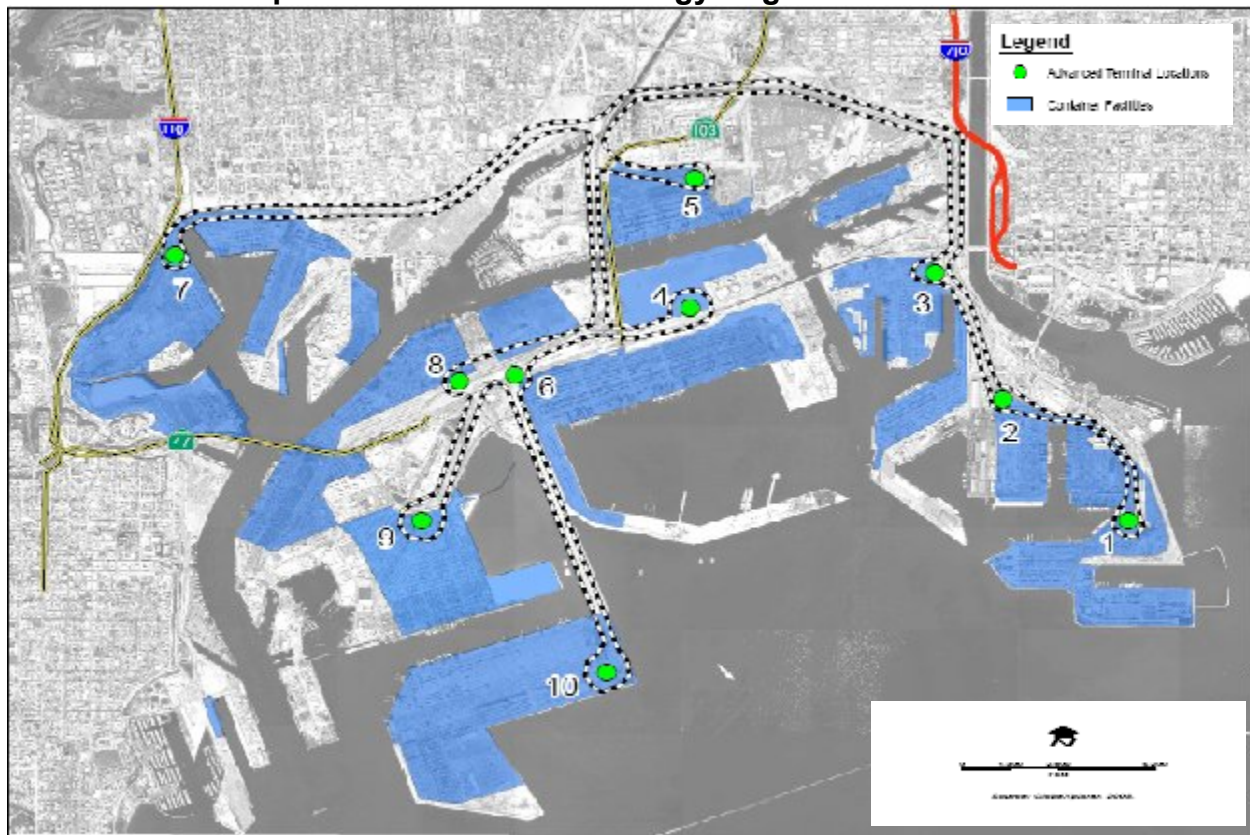
The arrangements of loading and unloading stations and guideway depicted for the Ports and intermodal rail facilities are purely hypothetical and do not reflect actual plans to deploy an alternative technology.

A hypothetical configuration for an automated fixed-guideway system on the Ports has been developed with input from Port staff and consultants, with particular regard to which marine terminals or groups of terminals could be served by alternative technology loading and unloading stations. This hypothetical layout incorporates ten loading and unloading stations, located to serve one or more marine terminals, with the intent of minimizing the system's impacts to other Port operations. It is assumed that the automated fixed-guideway system will be entirely elevated throughout Port property, to minimize impedance to other Port operations at grade level. It is further assumed that access to Terminal Island will be via a new crossing of the Cerritos Channel, no higher than a proposed new fixed crossing for State Route 47.

The sizes and distribution of loading and unloading stations have been determined via an iterative process summarized in Section 3 of this Report. The total number and capacity of loading and unloading tracks is a function of the forecast 2035 container traffic that would be served by the alternative technology, and of the average productivity of existing container handling equipment, the number of vehicles in a consist (train), and the rate at which consists can be dispatched on the line-haul segment. Loading and unloading stations have been hypothetically sized and distributed throughout the Ports according to the relative volumes of traffic forecast to for the marine terminals that would be served by the alternative technology.

It is envisioned that the alternative technology system would connect the Ports alternative technology stations (see Figure 4) and proceed onto the truck ramps located at Ocean Boulevard and I-710 for northbound traffic and at Anaheim Street and I-710 for southbound traffic.

Figure 4
Conceptual Alternative Technology Alignments within Ports



Since it is assumed that flows of containers will be equal in both directions, the same loading and unloading capacity is assumed to be required at the intermodal rail facilities located at the end of the corridor. As in the case of the Ports, the sizing, distribution and configuration of loading and unloading stations have been determined on the basis of the relative capacities of the two intermodal rail facilities. It is, however, assumed that the loading and unloading stations at the intermodal rail facilities need not be dedicated to specific destinations, as in the case of those at the Ports. Containers unloaded from the automated fixed-guideway system at the intermodal rail facilities will be drayed to points where they will be loaded on trains or temporarily stored. Figure 5 provides a conceptual alignment to the Hobart and East Los Angeles intermodal rail facilities.



**Figure 5
Conceptual Alternative Technology Alignments
within the Intermodal Rail Facilities**



An electric/battery truck alternative would interface with the Ports and the intermodal rail facilities in similar fashion to the way conventional trucks operate now. The electric/battery trucks would use the I-710 freight corridor and the proposed truck ramps, would move through the Ports and intermodal yards on their own individual auxiliary power, and would be loaded and unloaded by existing container handling equipment and inside the Ports or railyards as is currently done for diesel trucks.



3.0 MARKET DEMAND AND CAPACITY

3.1 MARKET DEMAND ASSUMPTIONS

The market demand assumptions presented in this section depict a potential future containerized freight market, some portion of which may be diverted from trucks to an alternative technology. They do not represent demand forecasts or system capacity criteria for a planned new technology application.

Corresponding to the length of the I-710 Corridor in the study area, (approximately 16 miles, from an assumed boundary at the Ports to the intermodal rail facilities) and the market analysis, it is assumed that the alternative technology system would serve some share of the projected 2035 **near-dock** and **off-dock** rail intermodal container markets demand, with no intermediate stops between the northern and southern termini of the system.

Additional market demand assumptions include:

- The on-dock market will continue to be served by rail and is therefore not included in the analysis.
- In addition to the combined current near-dock and off-dock rail intermodal markets, the alternative technology application within the study area may also be considered part of a future larger regional network that may be used to transport containers to regional warehousing, distribution and intermodal facilities elsewhere in the Los Angeles Basin and in the Inland Empire.

3.2 MARKET DEMAND ANALYSIS – OFF DOCK AND NEAR DOCK

The total off-dock and near-dock intermodal rail markets estimated for potential service by the alternative technology are shown in Table 1. This information is derived from analysis conducted for the I-710 Corridor EIR/EIS Initial Feasibility Analysis task (Appendix B), and will also be used as a reference point for the alternative technology application. In support of the initial Feasibility Traffic Analysis, 2035 total cargo container trip demand markets have been established for the following three future port development scenarios:

- Port No Build, low on-dock rail capacity, and no new near-dock facilities (SCIG is not built and ICTF is not expanded)
- Port Build, high on-dock rail capacity, and no new near-dock rail facilities (SCIG is not built and ICTF is not expanded)



- Port Build, high on-dock rail capacity, and new near-dock rail facilities (SCIG is built and ICTF is expanded)

An observed average ratio of 1.85 is used to equate twenty foot equivalent units (TEUs) to equivalent numbers of 40' cargo containers, such that a single standard 40' container is equivalent to 1.85 TEUs. Applying this conversion factor to the container demand scenarios depicted in Table 1, the container market demand that could be served by an alternative goods movement technology within the I-710 Corridor ranges from 2.3 to 3.1 million 40-foot cargo containers annually.

**Table 1
Market Analysis – Off Dock and Near Dock**

| Port No Build | TEU Annual (millions) | 40' Cargo Container Equivalents Annual (millions) |
|----------------|-----------------------|---|
| Off Dock Rail | 4.4 | 2.38 |
| Near Dock Rail | 1.4 | 0.76 |
| Total | 5.8 | 3.13 |

This scenario assumes no additional rail facilities at the Ports, no construction of the Southern California Intermodal Gateway (SCIG) and no additional capacity at the Intermodal Container Transfer Facility (ICTF)

| Port Build No SCIG and ICTF | TEU Annual (millions) | 40' Cargo Container Equivalents Annual (millions) |
|-----------------------------|-----------------------|---|
| Off Dock Rail | 2.9 | 1.57 |
| Near Dock Rail | 1.4 | 0.76 |
| Total | 4.3 | 2.33 |

This scenario assumes additional rail facilities at the Ports but no construction of the Southern California Intermodal Gateway (SCIG) and no additional capacity at the Intermodal Container Transfer Facility (ICTF)

| Port Build with SCIG and ICTF | TEU Annual (millions) | 40' Cargo Container Equivalents Annual (millions) |
|-------------------------------|-----------------------|---|
| Off Dock Rail | 0.0 | 0.00 |
| Near Dock Rail | 4.3 | 2.32 |
| Total | 4.3 | 2.32 |

This scenario assumes additional rail facilities at the Ports, construction of SCIG and additional capacity at ICTF

Assuming that the cargo containers that comprise this market demand are transported from the Ports 360 days per year, continuously for 21 hours of each operating day, the annual container throughputs calculated in Table 1 for each market demand scenario equate to the hourly average container through port ranges shown in Table 2. However, if the days and hours of operations vary, the numbers will change.



Table 2
Market-Equivalent Container Throughput –Off Dock and Near Dock

| Scenario | 40' Cargo Container Equivalents Annual (millions) | Calculated Average Throughput (100% market share) | Calculated Average Throughput (100% market share) |
|----------------------------------|--|--|--|
| Port No Build No improvements | 3.13 | 414 Containers / Hour | 8,694 Containers / Day |
| Port Build No SCIG and ICTF | 2.33 | 308 Containers / Hour | 6,472 Containers / Day |
| Port Build With SCIG and ICTF | 2.32 | 307 Containers / Hour | 6,444 Containers / Day |

3.3 MARKET DEMAND ANALYSIS – EAST OF LOS ANGELES

Additional research was conducted on the potential market for cargo containers that could travel east of Los Angeles (see Appendix C). This is a market that could be served by the alternative technology system; however please note that the system described in this Report is not being “sized” to this additional market but the information is being provided to provide a sense of the market beyond the market identified in Section 3.2.

The three future port development scenarios of Port No Build, Port Build – No SCIG and ITCF and Port Build – with SCIG and ITCF are still being utilized, along with the conversion factor of 1.85 TEU to 40’ cargo container.

Applying this conversion factor to the container demand scenarios depicted in Table 3, the container market demand for East of Los Angeles that could be served by an alternative goods movement technology ranges from 2.4 to 3.7 million additional 40-foot cargo containers annually.



Table 3
Market Analysis – East of Los Angeles

| Port No Build | TEU Annual (millions) | 40' Cargo Container Equivalents Annual (millions) |
|---|----------------------------------|--|
| Total | 4.5 | 2.4 |
| <i>This scenario assumes no additional rail facilities at the Ports, no construction of the Southern California Intermodal Gateway (SCIG) and no additional capacity at the Intermodal Container Transfer Facility (ICTF)</i> | | |
| Port Build No SCIG and ICTF | TEU Annual (millions) | 40' Cargo Container Equivalents Annual (millions) |
| Total | 6.8 | 3.7 |
| <i>This scenario assumes additional rail facilities at the Ports but no construction of the Southern California Intermodal Gateway (SCIG) and no additional capacity at the Intermodal Container Transfer Facility (ICTF)</i> | | |
| Port Build With SCIG and ICTF | TEU Annual (millions) | 40' Cargo Container Equivalents Annual (millions) |
| Total | 6.8 | 3.7 |
| <i>This scenario assumes additional rail facilities at the Ports, construction of SCIG and additional capacity at ICTF</i> | | |

Assuming that the cargo containers that comprise this market demand are transported via the alternative technology system 360 days per year, continuously for 21 hours of each operating day, the annual container throughputs calculated in Table 3 for each market demand scenario equate to the hourly average container through port ranges shown in Table 4. However, if the days and hours of operations vary, the numbers will change.

Table 4
Market-Equivalent Container Throughput – East of Los Angeles

| Scenario | 40' Cargo Container Equivalents Annual (millions) | Calculated Average Throughput (100% market share) | Calculated Average Throughput (100% market share) |
|----------------------------------|--|--|--|
| Port No Build No improvements | 2.4 | 317 Containers / Hour | 6,667 Containers / Day |
| Port Build No SCIG and ICTF | 3.7 | 489 Containers / Hour | 10,278 Containers / Day |
| Port Build With SCIG and ICTF | 3.7 | 489 Containers / Hour | 10,278 Containers / Day |



3.4 MARKET DEMAND ANALYSIS – APPLICATIONS AND ASSUMPTION

These equivalent container throughput averages are used in Section 3.5 below to assess the ability of a range of alternative technology system configurations and operating scenarios to serve the forecast 2035 market demand for both the Ports off dock and near dock, and the east of Los Angeles markets.

To relate calculated market throughput to the capacity of an alternative container transport technology, the following assumptions are made that will be applied to the evaluation of alternative technology system capacity in Section 3.3 of the Report:

- Calculated throughput represents an equal distribution of export and import traffic, and is therefore distributed equally over both directions of travel.
- Each individual 40' container equivalent represents an individual vehicle on the system.
- Every vehicle in transit on the system will be carrying a container either empty or loaded.
- For every vehicle loaded with a container moving in one direction, another vehicle, carrying either a loaded or empty container, is moving in the other direction.

These assumptions are used to define the system of greatest capacity.

3.5 SYSTEM CAPACITY

3.5.1 Automated Fixed-Guideway Alternative

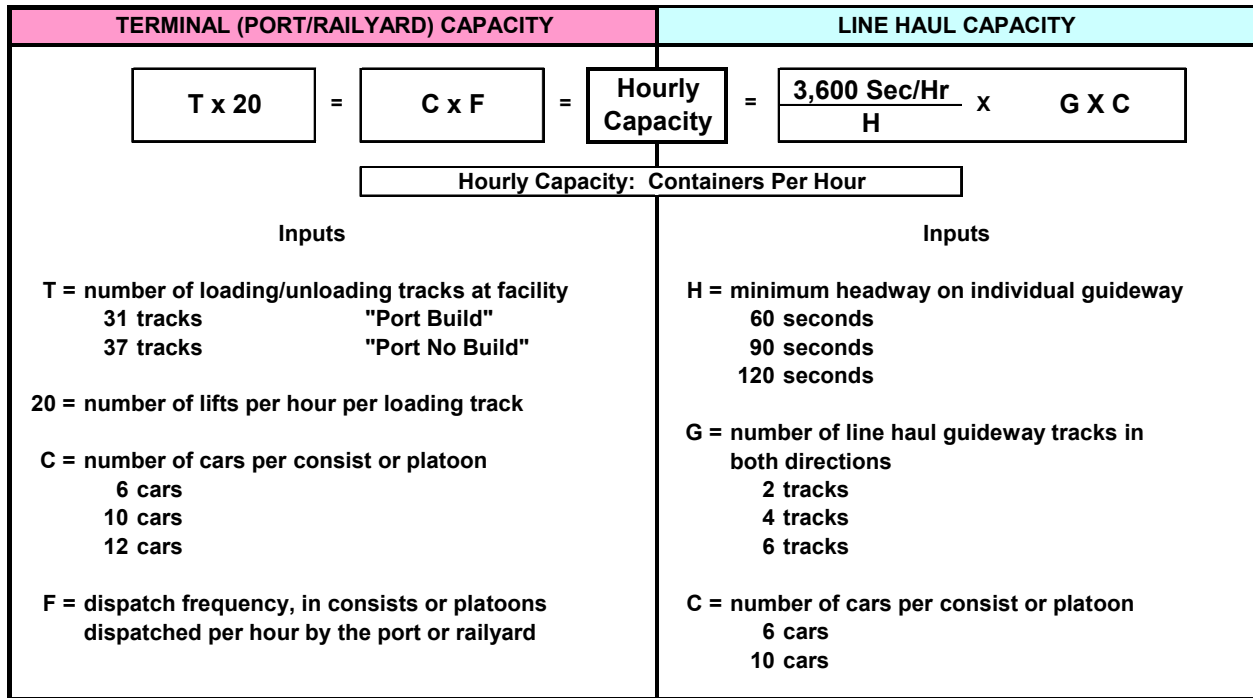
The capacity for the automated fixed-guideway family of technologies is determined as a combination of capacity for the alternative technology stations at the Ports/intermodal rail facilities and for the line haul portion of the alternative technology system.

The line haul section of the system is located between the Ports and off-dock intermodal rail facilities and would generally be adjacent to I-710 between Ocean Boulevard and Washington/Bandini.

The capacity for the alternative technology system can be expressed as an equation (Figure 6).



**Figure 6
Capacity Equations**



The variables used as inputs to these equations are defined as follows:

- **T (Number of loading and unloading tracks):** The total number of stub-ended tracks within all loading / unloading stations at the ports. The same number is assumed for the intermodal rail facilities.
- **Lift:** An individual movement of a container on or off the alternative technology. Within the ports or the intermodal rail facilities, each vehicle of the alternative technology is assumed to experience two lifts.
- **G (Guideways):** The number of one-directional curvilinear fixed structures that support and guide vehicles in their movement from one place to another. Depending on the technology, guideway may incorporate features of the traction power, train control, communications, and security systems, as well as utilities.
- **C (Number of vehicles per consist or platoon):** A consist is a coupled group of vehicles. A platoon is a group of vehicles not physically coupled but operated as a single unit through the system.



- H (Headway): The elapsed time between one consist or platoon and the next on a section of guideway. Headways may also be expressed for multiple guideways in a single direction.

First, the capacities of the station section of the alternative technology system are determined, and then the capacity of the line haul section of the system. The line haul portion of the alternative technology system needs to meet or exceed the capacity of the stations located at the Ports and the intermodal rail facilities in order to achieve operational efficiencies of the alternative technology system.

The following assumptions are used for the capacity analysis:

- Each individual 40' container equivalent represents an individual vehicle on the system.
- Calculated throughput represents an equal distribution of export and import traffic, and is therefore distributed equally over both directions of travel.
- Vehicles in transit on the system will more than likely be carrying a container in a consist. Unloaded vehicles may be maintained within a consist in order to free up a guideway.
- Every vehicle transit from one end of the system to the other therefore includes one loading and one unloading operation.
- For every vehicle carrying a container in one direction, another vehicle carrying a container is moving in the other direction.
- There will be a constant flow of containers that need to be transported on the alternative technology system.

These assumptions are used to define the system of greatest capacity, and of greatest potential impact.

3.5.1.1 Station Capacity – Automated Fixed-Guideway

1. Number of Loading and Unloading Station Tracks

Ports – To serve the Ports, it is estimated that a total of 31 to 37 stub loading and unloading station tracks (See Table 5) are necessary to serve the estimated market. Each loading and unloading station will be served by dual guideway; one in-bound and one out-bound. Based on the Ports' High Growth and Low Growth Throughput and Trip Generation Model for Existing



Terminals, the 'Port No Build' scenario would require an estimated 37 stub tracks and the Port Build scenario would need an estimated 31 stub tracks.

As identified earlier in this Report (Figure 4), ten alternative stations have been identified for the Ports. Each of the alternative technology stations will require a different number of stub tracks depending on the demand forecast for container cargo. Table 5 identifies the number of stub tracks per alternative technology station identified at the Ports.

**Table 5
Estimated Alternative Technology Stations at the Ports**

| Alternative Technology Station | Port No Build | Port Build |
|--------------------------------|---------------|------------|
| 1 | 3 | 3 |
| 2 | 5 | 5 |
| 3 | 4 | 2 |
| 3 | 2 | 2 |
| 5 | 3 | 5 |
| 6 | 7 | 7 |
| 7 | 3 | 4 |
| 8 | 3 | 3 |
| 9 | 2 | 0 |
| 10 | 5 | 0 |
| Total | 37 | 31 |

Intermodal Rail Facilities - To accommodate the ten potential Port alternative technology stations, the same number of stub tracks will need to be provided at the intermodal rail facilities. In Table 6, the estimated number of stub tracks per intermodal rail facilities for the Port No Build and Port Build scenarios is provided. It is assumed there is a 50/50 split of container demand between the two intermodal rail facilities; and the East Los Angeles rail yard will accept 40' cargo containers.

**Table 6
Estimated Alternative Technology Stations at the Intermodal Rail Facilities**

| Intermodal Rail Facility | Port No Build | Port Build |
|--------------------------|---------------|------------|
| Hobart | 19 | 16 |
| East Los Angeles | 18 | 15 |
| Total | 37 | 31 |



2. Lifts per Hour

A factor of 20 lifts per hours is used for this analysis. A lift is a movement to either to load or unload a cargo container from a vehicle. To both load and unload a cargo container from any vehicle would equal two lifts. The rate of 20 lifts per hour is a conservative estimate based on current capacity of existing loading and unloading equipment.

3. Number of Vehicles per Consist

The number of vehicles per consist (analogous to a train) varies from 6 to 12 vehicles.

4. Frequency

For the purpose of 'matching' port and rail facility productivity to that of the line-haul guideway, frequency is treated as the dependent variable of the capacity calculation for the Ports and intermodal rail facilities, and ranges from 35 to 70 seconds for every consist to be dispatched. If the minimum practical headway for the line haul segment is assumed to be 90 seconds for any individual guideway, then multiple guideways must be provided in each direction.

3.5.1.2 Line Haul Capacity – Automated Fixed-Guideway

1. Headway

A range of headways, from 60 to 120 seconds, is used to depict a range of system capabilities and capacities. Headways of ninety seconds are common among urban rail transit systems. Freight rail systems normally operate at longer headways due to safety considerations. Sixty seconds is a hypothetical headway that is utilized for this analysis solely to illustrate what capacity might be attainable were the technology capable of achieving it.

2. Number of Guideways

The number of guideways is limited by the cross sectional area of the right-of-way. For the purposes of this analysis, it is assumed that either dual guideway (one in each direction), or quadruple guideway (two in each direction) or a triple guideway (three in each direction) will be attainable, depending on the corridor alignment and the characteristics of the technology. Certain technologies may be able to accommodate traffic in either direction on a guideway, potentially enabling increased capacity in a given direction in response to short-term demand. This analysis, however, considers the generalized cases of either one to three guideways per direction.

3. Number of Vehicles Per Consist (Unit of Dispatch)



Given that each vehicle is assumed to carry a single 40' container, the 'Unit of Dispatch' – the number of vehicles assembled and moved through the system as a complete, individual unit - is assumed to range from consists of six to twelve vehicles, each fully loaded or unloaded, dispatched and controlled as complete individual units.

3.5.1.3 Station Capacity Analysis – Automated Fixed-Guideway

The following table (Table 7) is an analysis of the estimated station capacity at either the Port or intermodal rail facilities. The number of station stub tracks at either the ports or the rail facilities ranges from 31 to 37, depending on the demand scenario. Using 20 lifts per hour, varying the vehicles in a consist length of 6 – 12, and varying the headway, achievable capacity ranges from 4.7 million to 5.6 million containers (40') per year.

To further analyze the potential capacity of other configurations, the number of lifts per hour has been increased to 30 and headways have been decreased. This results in an estimated capacity of 7 million to 11 million cargo containers per year. However, the headways that such configurations generate are shorter than those achieved by any existing automated control system to date.



**Table 7
Station Capacity (Port/Intermodal Rail Facility) – System Variations
(40’ Containers, Two-Guideway System)**

| System Variables - Terminal | | | | System Capacity (containers) | | | Capacity / Market Demand | | + East of Los Angeles / Transload | |
|-----------------------------|--------------------------|---------------------|---|------------------------------|----------------|-----------------|-----------------------------|--------------------------|-----------------------------------|---------------|
| | | | | | | | | | Port Build | Port No Build |
| T: Number of Station Tracks | Lifts per Hour per Track | C: Cars per Consist | F: Dispatch Frequency (Seconds/Consist) | Hourly Capacity | Daily Capacity | Annual Capacity | % of Port No Build Scenario | % of Port Build Scenario | Port Build | Port No Build |
| | | | | | | | | | 3,658,000 | 2,443,000 |
| 31 <i>Port Build</i> | 20 | 6 | 35 | 620 | 13,020 | 4,687,200 | 150% | 201% | 5,988,000 | 5,573,000 |
| | | 10 | 58 | | | | | | | |
| | | 12 | 70 | | | | | | | |
| 37 <i>Port No-Build</i> | 20 | 6 | 29 | 740 | 15,540 | 5,594,400 | 179% | 240% | 5,988,000 | 5,573,000 |
| | | 10 | 49 | | | | | | | |
| | | 12 | 58 | | | | | | | |

Terminal scenarios with more terminal (loading and unloading) tracks, more cars per consist, and more cranes per terminal track

| | | | | | | | | | | |
|----------------------------|----|----|----|-------|--------|------------|------|------|------|------|
| 31 <i>Port Build</i> | 30 | 10 | 39 | 930 | 19,530 | 7,030,800 | 225% | 302% | 126% | 117% |
| | | 12 | 46 | | | | | | | |
| 37 <i>Port No-Build</i> | 30 | 10 | 32 | 1,110 | 23,310 | 8,391,600 | 268% | 360% | 151% | 140% |
| | | 12 | 39 | | | | | | | |
| 40 | 20 | 6 | 27 | 800 | 16,800 | 6,048,000 | 193% | 260% | 109% | 101% |
| | | 10 | 45 | | | | | | | |
| | | 12 | 54 | | | | | | | |
| | | 10 | 45 | | | | | | | |
| 50 | 20 | 6 | 22 | 1,000 | 21,000 | 7,560,000 | 242% | 324% | 136% | 126% |
| | | 10 | 36 | | | | | | | |
| | | 12 | 43 | | | | | | | |
| | 30 | 10 | 24 | 1,500 | 31,500 | 11,340,000 | 362% | 487% | 203% | 189% |
| | | 12 | 29 | | | | | | | |

3.5.1.4 Line Haul Capacity Analysis

The following table (Table 8) is an analysis of the estimated line haul capacity of the automated fixed-guideway alternative technology family. The number of line haul guideways ranges from 2 to 4, depending on the demand scenario. Varying the headway from 120 seconds to 60 seconds, consist lengths of 6 – 12; the achievable capacity ranges from 2.8 million to 12.1 million containers per year.



**Table 8
Line Haul Capacity – System Variations**

| System Variables - Line Haul | | | System Capacity (containers) | | | Capacity / Market Demand | | Capacity / Market Demand | |
|------------------------------|--------------------------|---------------------|------------------------------|----------------|-----------------|--------------------------|------|--|------------------|
| Number of Guideway Tracks | Headways (Seconds) Track | C: Cars per Consist | Hourly Capacity | Daily Capacity | Annual Capacity | Operating Schedule | | Off-Dock / Near-Dock | |
| | | | | | | hours / day | 21 | Port Build | 2,330,000 |
| | | | | | | | | + East of Los Angeles / Transload | |
| | | | | | | | | Port Build | 3,658,000 |
| | | | | | | | | Port No Build | 2,443,000 |
| | | | | | | | | Port Build | 5,988,000 |
| | | | | | | | | Port No Build | 5,573,000 |
| hours / day | | | days / year | | | 21 | | 360 | |
| | | | | | | Port Build | | 2,330,000 | |
| | | | | | | Port No Build | | 3,130,000 | |
| | | | | | | | | | |
| 2 | 120 | 6 | 360 | 7,560 | 2,721,600 | 87% | 117% | 49% | 45% |
| 2 | 90 | 6 | 480 | 10,080 | 3,628,800 | 116% | 156% | 65% | 61% |
| 2 | 120 | 10 | 600 | 12,600 | 4,536,000 | 145% | 195% | 81% | 76% |
| 2 | 60 | 6 | 720 | 15,120 | 5,443,200 | 174% | 234% | 98% | 91% |
| 2 | 120 | 12 | 720 | 15,120 | 5,443,200 | 174% | 234% | 98% | 91% |
| 4 | 120 | 6 | 720 | 15,120 | 5,443,200 | 174% | 234% | 98% | 91% |
| 2 | 90 | 10 | 800 | 16,800 | 6,048,000 | 193% | 260% | 109% | 101% |
| 2 | 90 | 10 | 800 | 16,800 | 6,048,000 | 193% | 260% | 109% | 101% |
| 2 | 90 | 12 | 960 | 20,160 | 7,257,600 | 232% | 311% | 130% | 121% |
| 4 | 90 | 6 | 960 | 20,160 | 7,257,600 | 232% | 311% | 130% | 121% |
| 2 | 60 | 10 | 1,200 | 25,200 | 9,072,000 | 290% | 389% | 163% | 152% |
| 4 | 120 | 10 | 1,200 | 25,200 | 9,072,000 | 290% | 389% | 163% | 152% |
| 4 | 90 | 10 | 1,600 | 33,600 | 12,096,000 | 386% | 519% | 217% | 202% |

Taken on its own, the optimum capacity for the line haul segment appears to be attained with a system of two guideways, operating ten-car consists at headways of ninety seconds. However, a two-guideway system does present operational issues such as limited means to recover from disruptions. With a two-guideway system, if one track is not available or a vehicle breaks down and the guideway becomes non-operational for a period of time, this leaves one guideway to handle the demand. While the system will have the ability to recover from disruptions, single tracking or the use of one guideway, will impact the ability to move cargo containers. The use of a four-guideway configuration allows for redundancy in the system and enables the system to meet the forecasted daily demand while increasing the reliability and recoverability of the system.

3.5.2 Electric/Battery Truck Alternative

The effective capacity of a roadway system is determined by such attributes as the number of lanes, shoulder widths, exits and entrance points, maximum grade, lane width, etc. For the I-



710 project, the maximum capacity of the freight corridor is estimated for planning purposes to be 840 container trucks per lane, per hour.

For the electric/battery truck alternative technology family, it is assumed that the electric/battery truck would navigate within the Ports and the intermodal rail facility using existing roadways and would not require special alternative technology stations to pick up or drop off cargo containers. The electric/battery truck family would utilize the I-710 freight corridor for travel to and from the Ports.

The system variables for the electric/battery family are number of lanes and hours of operation.

3.5.2.1 Number of Lanes

The number of lanes will be determined by the availability of right-of-way. The proposed I-710 freight corridor will have four travel lanes but for this analysis, two and four lanes of traffic were assessed.

3.5.2.2 Hours of Service

The electric/battery truck family is assumed to operate the same number of hours as the automated fixed-guideway system of 21 hours per day, seven days per week and 360 years per year. However, for this analysis, the hours were varied from 21 hour per day to 24 hours per day. It was assumed that with a truck based freight corridor, some terminal operators may take advantage of the roadway system to operate longer hours.

3.5.2.3 Capacity

These two variables of lanes and hours of service were used to identify the system with the greatest capacity. Table 9 illustrates the capacity for the electric/battery truck family.



**Table 9
Capacities of Typical Freight Guideway Configuration**

| Freight Guideway Capacity | System Variables | | System Capacity (containers) | | | Off Dock / Near Dock (CSI) | | East of Los Angeles (Tioga) | | |
|-------------------------------------|------------------|--------------------|------------------------------|--------|------------|--------------------------------|--------------------------|------------------------------|--------------------------|-----------|
| | | | | | | Port No Build | 3,130,000 | Port No Build | 2,443,000 | |
| | | | | | | Port Build | 2,330,000 | Port Build | 3,658,000 | |
| | | | | | | Combined Numbers (CSI + Tioga) | | | | |
| days per year | | | | | | 360 | Port No Build | 5,573,000 | Port Build | 5,988,000 |
| Maximum Capacity of Typical Freight | Lanes | Hours of Operation | Hourly | Daily | Annual | Capacity/Demand Market Share | | Capacity/Demand Market Share | | |
| | | | | | | % of Port No Build Scenario | % of Port Build Scenario | % of Port No Build Scenario | % of Port Build Scenario | |
| 840 | 2 | 20 | 1,680 | 33,600 | 12,096,000 | 386% | 519% | 217% | 202% | |
| 840 | 2 | 21 | 1,680 | 35,280 | 12,700,800 | 406% | 545% | 228% | 212% | |
| 840 | 2 | 22 | 1,680 | 36,960 | 13,305,600 | 425% | 571% | 239% | 222% | |
| 840 | 2 | 23 | 1,680 | 38,640 | 13,910,400 | 444% | 597% | 250% | 232% | |
| 840 | 2 | 24 | 1,680 | 40,320 | 14,515,200 | 464% | 623% | 260% | 242% | |
| 840 | 4 | 20 | 3,360 | 67,200 | 24,192,000 | 773% | 1038% | 434% | 404% | |
| 840 | 4 | 21 | 3,360 | 70,560 | 25,401,600 | 812% | 1090% | 456% | 424% | |
| 840 | 4 | 22 | 3,360 | 73,920 | 26,611,200 | 850% | 1142% | 478% | 444% | |
| 840 | 4 | 23 | 3,360 | 77,280 | 27,820,800 | 889% | 1194% | 499% | 465% | |
| 840 | 4 | 24 | 3,360 | 80,640 | 29,030,400 | 927% | 1246% | 521% | 485% | |

In operation similar to that of conventional trucks but on a dedicated roadway, an electric/battery alternative technology system would offer capacity in excess of the forecast demand for the combined off dock, near dock, and east of Los Angeles markets; ranging from 12 – 29 million containers (40') annually, depending on the system variables. As additional lanes of traffic are added or hours of operation are increased, the ability to respond to the combined market increases. In addition, if vehicle guidance and control systems are developed to allow for closer spacing of electric/battery trucks without compromising safety, the ability to respond to the combined markets further increases.



4.0 ALTERNATIVE TECHNOLOGY CHARACTERISTICS

This section of the Report presents general design and performance characteristics of an alternative technology application, to define a surrogate alternative for evaluation in the environmental assessment, and to articulate required capabilities responsive to the Purpose and Need of the I-710 Corridor Project.

For the two families of alternative technology systems (automated fixed-guideway and electric/battery trucks), a majority of the characteristics are the same; where there are variations, the distinct characteristics of the family are identified.

The principle applied throughout this section is to define the system of greatest capacity and of the greatest potential impact to be analyzed via the NEPA/CEQA process. The actual impacts from the application of a selected new technology may then be scaled back, if appropriate, to that technology's characteristics.

For example, the surrogate alternative defined here incorporates a quadruple guideway (2 per direction) for the line haul to maximize the capacity of the system, with a hypothetical width of 82' for the automated fixed-guideway and 94' – 97' for the electric/battery truck alternative. Should an actual new technology be selected that responds to the demand market with a fewer guideways or a smaller right-of-way width requirement, the actual impacts of that technology would be less than those estimated for the surrogate.

4.1 GENERAL SYSTEM DESCRIPTION

4.1.1 Ownership and Maintenance of the System

The alternative technology system is assumed to be owned by a public entity, responsible for operations and maintenance of the system. The public entity owner may contract for operations and maintenance.

4.1.2 Right-of-Way Ownership

The alignment may be located in the I-710 right-of-way or along other transportation, utility or other corridors in the study area, and ranges from 16 to 20 miles in length. Depending on the characteristics of an actual technology, it is assumed that, regardless of the technology selected, property acquisitions will be necessary to accommodate the requirements of the guideway, the locations and sizes of fixed wayside facilities, and relocations of existing infrastructure.



4.1.3 Automated/Manned Operation

4.1.3.1 Automated Fixed-Guideway

The operation of the system will be entirely automated for the automated fixed-guideway system. Operations will be monitored at a single operations center to be staffed at all times.

4.1.3.2 Electric/Battery Truck

The electric/battery truck family would utilize existing truck drivers to operate their vehicles much like a conventional truck. The electric/battery trucks would operate in a manned operations mode; however there are potential ITS vehicle guidance and control applications on the dedicated truck lane that may allow for the trucks to operate in a platoon fashion.

4.1.4 Acoustic Noise and Ground-Borne Vibration

The alternative technology system will not exceed the following limits for acoustic noise and ground-borne vibration:

- Noise – 72 dBA from 50' of the centerline of the alignment (lowest noise level of a fixed-guideway transit sources include commuter rail, rail rapid transit, light rail transit, automated guideway transit, monorail, and magnetically levitated vehicles).
- Ground-Borne Vibration – 72 VdB from 50' of the centerline of the alignment (based on vibration levels of all residential and land uses where people sleep such as hotels and hospitals and at the threshold of residential annoyance of frequent events such as a rapid transit system).

These noise and vibration criteria are based on the Federal Transit Administration Noise and Vibration Impact Assessment, May 2006. The Federal Railroad Administration references the Federal Transit Administration noise and vibration impact assessment procedures in specifying improvements to conventional passenger rail lines and stationary rail facilities and horn noise assessment.

4.1.5 Electro-Magnetic Interference.

The electrical equipment and power distribution infrastructure of the system will be shielded such that no electro-magnetic interference will be emitted.

4.1.6 All Weather Operation

The alternative technology system will operate in a humid, salt environment with all types of weather, including wind, rain, and lightning.

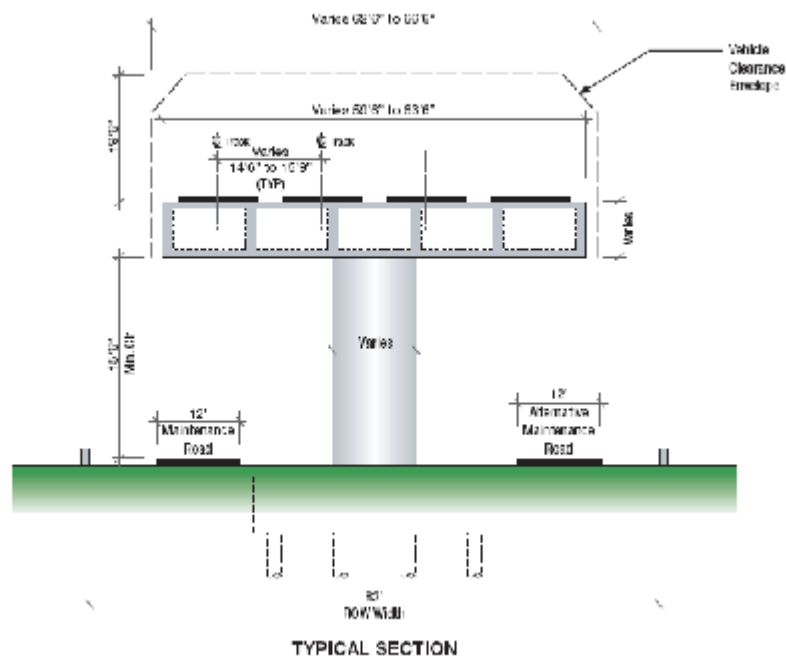
4.2 GUIDEWAY

4.2.1 Automated Fixed-Guideway Alternatives

4.2.1.1 Typical Guideway – Line Haul

The cross-section shown in Figure 7 represents a concept for elevated quadruple guideway, support structure and access roadways, illustrated as it would fit within the available width within the I-710 freeway right-of-way. The access roadway underneath the guideway will facilitate construction and maintenance of the system. It is not meant to be a roadway available to the general public. The guideway and access roads will be separated from adjacent land uses by security fencing or some other physical barrier.

**Figure 7
Typical Line Haul Quadruple Guideway Cross Section**



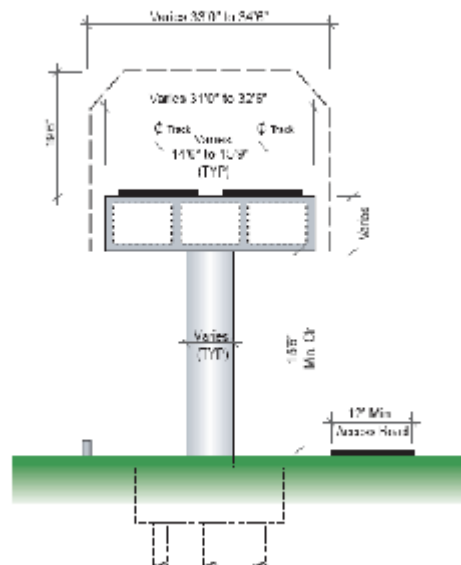
Elevated structure supporting four guideways will be installed over the entire line-haul segment (the portion of the system between the Ports and the intermodal rail facilities) of the alignment to

maximize system carrying capacity within the right-of-way width constraint of 82'. For general capacity calculations this is assumed to equate to two guideways in either direction of transport. Individual technologies may employ the available guideway differently to optimize their capabilities in response to specific demand cases and operating scenarios, including emergencies and system faults.

4.2.1.2 Typical Guideway – Ports and Intermodal Rail Facilities

The typical height of the alternative technology guideway at the Ports and intermodal rail facilities is the same as the line haul guideway height (Figure 8). This height allows trucks and a reach stacker front-end loaded to pass under the guideway. At specific locations, the guideway may need to be further elevated to accommodate loading and unloading equipment, navigable water, etc., but this is site specific and beyond the scope of this Report.

Figure 8
Typical Port/Intermodal Guideway Cross Section



Depending on the specific location, the following clearances would be needed:

- 23.5' for double stacked railcars
- 16.5' for a top pick front-end loaded



- 38' for a side pick front-end loaded
- 56 – 90' for rubber tired gantry cranes
- 185' for navigable water to avoid ships.

4.2.1.3 Vertical Clearance

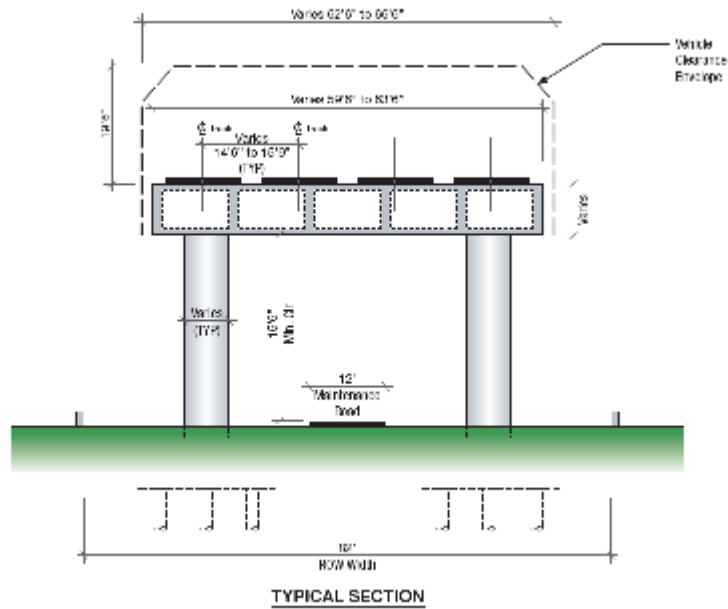
A minimum vertical clearance of 15.6 feet will be maintained from the bottom of the guideway support structure to the maintenance road underneath. This minimum vertical clearance is shown in Figure 7 and is provided to facilitate access to the alternative technology stations located at the Ports or intermodal rail facilities..

4.2.1.4 Guideway Support Structures

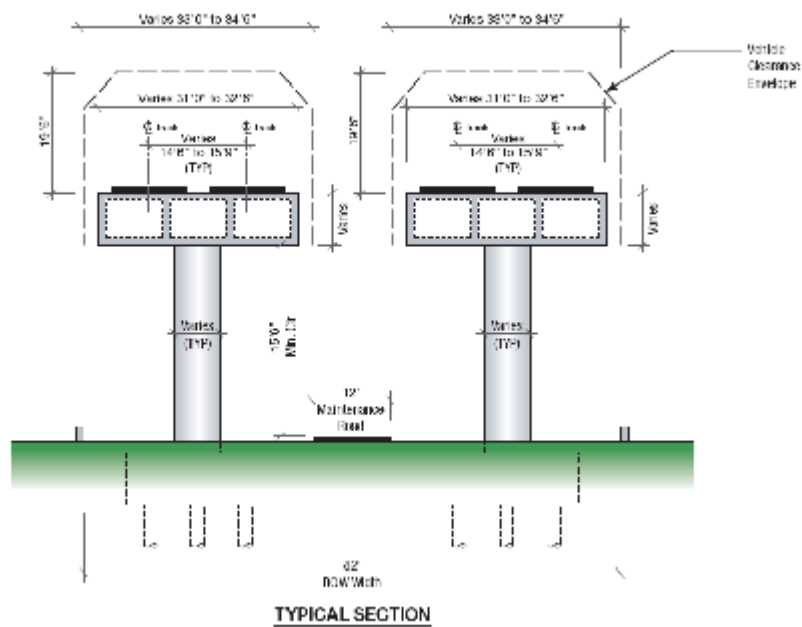
Guideway support structures will be designed to achieve throughput capacity over the range of soil and foundation conditions found throughout the potential alternative technology corridors. Support structures will at a minimum satisfy the latest Caltrans design requirements for an elevated structure within the freeway right-of-way. Additional requirements for the support structure may be required with respect to operability of the system after a seismic event.

Multiple structure support types may be required to deal with the challenges of specific locations. Figures 9 and 10 illustrate alternative configurations that may be used. A cross section for dual guideway, should it be employed anywhere in the system, is represented by one of the two structures illustrated in Figure 9. Detailed design will be needed to develop the actual solutions for localized cases.

**Figure 9
Straddle Bent Quadruple Guideway Cross Section**



**Figure 10
Dual Column Quadruple Guideway Cross Section**





Column sizes and spans may vary in order for the system to be economically and operationally efficient and to fit within the available right-of-way width. Standard guideway lengths and spans will be used wherever appropriate with the ability to bridge over constraints and sensitive areas. Typical columns will be spaced approximately every 100'; however for long spans over waterways, railroads or roadways, these spans may range in length of 170' to 250' depending on the site.

Guideway support structures may be constructed of concrete, steel or a hybrid system and may be factory built.

4.2.1.5 Power Distribution

Power will be provided either to a powered guideway (e.g. linear induction motor or maglev) or to powered vehicles (e.g. traction motors) via electrified third rail, wire, or another power distribution system specific to the proposed technology

4.2.1.6 Maximum Grade

The alternative technology system should be able to climb and descend at least a 10 percent grade.

4.2.1.7 Constructability

Staging areas may need to be secured and the sites are dependent upon the alignment selected. It is presumed that the alignment is aerial and if the spans are factory built, the footprint for construction could be minimized. In addition, the maintenance roads underneath the guideway could be used for construction of the alternative technology system. However staging areas will need to be secured prior to construction.

4.2.1.8 Seismic Stability

The guideway will need to meet the latest Caltrans seismic standards for aerial structures, or greater, to ensure the operability of the system after a seismic event.

4.2.1.9 Maintenance Road

A maintenance road, secure from public access, will be located under the elevated guideway.

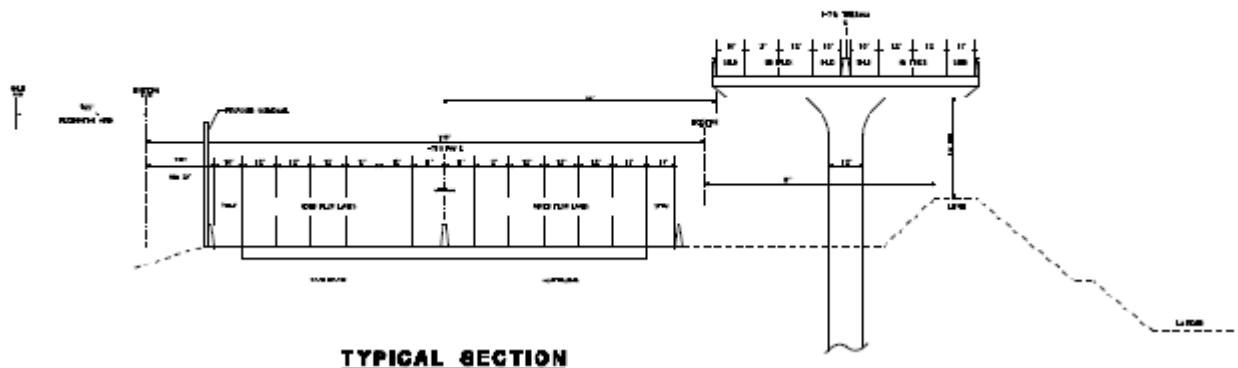
4.2.2 Electric/Battery Truck Alternative

4.2.2.1 Typical Guideway

The cross-section shown in Figure 11 represents a concept for the freight corridor with truck lanes. The freight corridor will typically fit within the available I-710 freeway right-of-way and is proposed to be at grade for a majority of the alignment, but may need elevated alignments adjacent to the I-710 and at some locations over I-710 in the median. Figure 11 represents an elevated section.

The freight corridor will be separate from the general purpose lanes with a physical barrier and the adjacent land uses by security fencing or some other physical barrier.

**Figure 11
Truck Guideway Cross Section**



4.2.2.2 Vertical Clearance

There may be locations where the freight corridor will need to be elevated to provide clearance over obstacles.

4.2.2.3 Power Distribution

Power will be provided either to a powered guideway (e.g. electricity, or linear induction motor) or to powered vehicles (e.g. traction motors and/or batteries) via electrified third rail, wire, or another power distribution system specific to the proposed technology.



4.2.2.4 Maximum Grade

The alternative technology system should be able to climb and descend at least a 6 percent grade.

4.2.2.5 Constructability

Material staging sites will be dependent upon the alignment selected. Staging areas will need to be secured prior to construction.

4.2.2.6 Seismic Stability

The guideway will need to meet the latest Caltrans seismic standards for aerial structures, or greater, to ensure the operability of the system after a seismic event.

4.3 PROPULSION

4.3.1.1 Propulsion System

Power for traction, levitation (if employed by the technology) and auxiliary systems will be delivered to either active guideway or for transmission to powered vehicles from the local electric grid, using an electrified third rail, a power rail or catenary wire, a linear synchronous motor, or another power distribution system specific to the proposed technology. Power distribution cables and equipment will be contained within the right-of-way and will be shielded from interference with or by adjacent sources and uses.

4.3.1.2 Energy Sources

Energy will be provided from the local electric power grid. The power distribution system will enable recovery during braking of vehicle kinetic energy, and its conversion to electric power for re-distribution to the alternative technology system or the local grid.

4.3.1.3 Power Hardware

Grid electrical power will be supplied to the alternative technology system at power substations located on the ground and within the right-of-way. Substations will receive power from the electrical grid and transform it into useable power using such equipment as convectors or invertors. The number, capacity, and spacing of these substations will be able to sustain



prolonged continuous system operation at the lesser of 150 percent of the required operating throughput or 110 percent of the system's maximum achievable throughput.

Additional wayside installations may be necessary to operate the traction power system, including feeder locations, control of power sectionalization, etc. These additional facilities may be co-located with the power substations. Substations will be secured from trespassers.

Power will be distributed longitudinally from substations to the guideway or any other wayside traction power installation via cables running within or immediately adjacent to the guideway/freight corridor. Traction power distribution will be accomplished vertically by cables affixed to or within structural columns for aerial sections.

4.3.1.4 Power Sectionalization

At a minimum, it will be possible to de-energize portions of the guideway's propulsion system, both remotely from a central control point and locally at the smallest required section of the traction power control system. Power sections will be identified separately for each parallel guideway section, and at a minimum provide for sectionalization between each control point (where vehicles may terminate, move from one parallel guideway to another, or move between double and single guideway sections). Power section lengths will not exceed 5 minutes' travel time at normal system operating speed.

4.3.1.5 System Efficiency

Power loss from equipment, cables and the distribution line will be less than 5 percent between the outside (commercial) power supply and the point at which power is provided to moving vehicles.

4.3.1.6 Overload Protection

Power equipment will be able to withstand both a 20 percent overload for 1 minute and a 50 percent overload for 10 seconds, whichever is worse.

The power sub-stations will be equipped with surge protection to prevent transient voltages that originate either inside or outside the power distribution system.

4.3.1.7 Fault Protection

The alternative technology system will have a 100 percent back up system to protect the overall system from a short duration power fault.



4.3.1.8 Power Redundancy

The alternative technology will have at least two outside (commercial) source systems over separate lines from separate generation points to each substation so that system disturbances or storms will not affect the system.

Redundant power equipment will be located within the power substations to prevent a loss of power to the alternative technology system from the failure of either outside (commercial) source or a single-point failure between the outside source and the distribution of power from the substations.

4.3.1.9 Relationship To Public Utility Facilities

The alternative technology system and particularly the propulsion system (power substations) may be equipped with harmonic compensators to prevent harmonic distortion from flowing back to the utility company.

4.4 ENERGY CONSUMPTION

4.4.1 Automated Fixed-Guideway Alternative

On the basis of the characteristics of technologies being developed for this application and information provided by alternative technology proponents, peak power expenditure for operation of a single loaded vehicle could be no more than 1 megawatt (MW), during vehicle acceleration. It is assumed that when vehicles are cruising they will expend 0.75 MW, and during low speeds at the terminal ends of the system they will expend 0.05 MW.

Peak power expenditure will be determined by taking into account the number of vehicles accelerating, cruising and in the loading and unloading areas during periods of operations at system capacity.

Assuming that approximately 7 percent of the vehicles are accelerating or braking, 60 percent are cruising and 33 percent are loading or unloading, and depending on the capacity factors identified in Section 3.5, energy consumption ranges from 3.1 to 6.3 million megawatts per year for the optimal line haul system of two guideway, 90 second headway, 10 car consist (3.1 million megawatts) to four guideway, 90 second headway and a ten-car consist (6.3 million megawatts), respectively. One megawatt, equivalent to 1 million watts, can meet the power needs of about 1,000 people.



4.4.2 Electric/Battery Truck Alternative

On the basis of characteristics of current battery operated trucks and electric trolley buses, based on the projected demand for terminal operators at the Ports and current usage of 4.8 kwh per mile of operations (service) for an electric trolley bus, the energy consumption for the family of electric/battery truck ranges from .7 – 1.0 million megawatts per year.

4.5 COMMAND AND CONTROL

4.5.1 Automated Fixed-Guideway Alternative

4.5.1.1 Automated Vehicle Operations System

The alternative technology system will be a fully automated (driverless) system, under the control of an automated vehicle operations system.

The automated vehicle operations system will include a centralized supervisory control capability to monitor and manage the alternative technology system, with overall supervisory control of vehicle movements and the traction power system. The following functions will be provided by the centralized supervisory control:

- Suspension of movement authority by direction for each segment of fixed guideway between control points, and the subsequent restoration of that authority.
- Suspension of movement authority for each vehicle on the system, and the subsequent restoration of such authority.
- Development and execution of a general plan of service operations (e.g. frequency and vehicle consist) on a time-of-day (prescheduled) basis or as defined by operations management personnel.
- Real-time presentation of the status of all system elements (e.g. vehicles, control points, guideway and traction power sections).
- Periodic and on-request current status reporting of vehicles and/or the guideway (if available).
- Emergency management.
- Control of voice and data communications.

Vehicle and traction power control functions may be distributed among the centralized supervisory control system, wayside elements and on-board systems. Collectively, the



automated vehicle operations system will provide the following functionalities at or above levels presently available with present automatic block signal or communications-based train control technology presently in service in the United States.

- Continuous safe vehicle separation for all in-service vehicles over all the fixed guideway system, with the possible exception of prescribed areas for vehicle maintenance.
- Continuous overspeed protection and automatic vehicle stop protection respecting the location and real-time status of all other vehicles in the system, restrictions on operations imposed from the Centralized Supervisory Control and the status of all control points, power sections, guideway sections and wayside elements that can establish a need to respect a safe vehicle braking profile.
- 'Failsafe' automatic vehicle stop protection for loss of automated vehicle operations functionality and other detectable conditions that represent a safety risk.

At all times, the automated vehicle operations system will maintain the correct location, direction, and speed of all vehicles. Vehicle tracking will be redundant, with the intent of no single points of failure impacting operations.

4.5.1.2 Tracking of and Communication with Vehicles

Vehicles will be tracked at all times within the alternative technology system. Tracking can occur by:

- Embedding radio frequency tags in the guideway and placing readers on the vehicles and transmitting the information to the automated vehicle operations system.
- Installing a global positioning system device on the vehicle that radios back its position to the automated vehicle operations system.
- Using active receivers on the vehicles and passive transponders along the guideway, informing the automated vehicle operations system the location of all vehicles.
- Using on board radar to monitor the vehicle position and use a wireless system to communicate the information to the automated vehicle operations system.
- Installing a radio frequency link in the vehicle and guideway that communicates with the automated vehicle operations system regarding the location of the vehicle.

Redundant communication systems will be incorporated into the alternative technology system to eliminate single point failures from impacting the system, such as two independent communication systems or a back up to the main communication system.



In addition to being tracked for location, the automated vehicle operations system will monitor the 'health' of each vehicle and identify conditions that may impact operations to operations staff via the centralized supervisory control system.

4.5.1.3 Anti-Collision System or Other Safety Features

The automated vehicle operations system will include anti-collision software to track vehicles and provide commands to vehicles such as slow or stop to avoid collisions.

Front and rear proximity sensors can be installed on the vehicles to allow for a redundancy in collision avoidance.

4.5.2 Electric/Battery Truck Alternative

Electric/battery trucks will be operated by truck drivers and if existing tracking systems for trucks are utilized by terminal operators, they will continue to be utilized. There are potential ITS automated vehicle control applications that may enable trucks to operate in platoon on the dedicated lanes. This may be a future enhancement.

4.5.3 Intrusion Detection

The alternative technology guideway and facilities will be demonstrated to be secure from intrusion, through such measures as:

- Fencing of the guideway.
- Fencing of the columns at ground level.
- Installation of motion detectors and incorporating the detectors into the automated vehicle operations system.
- Installation of a closed circuit television system with remote controlled cameras and a monitoring system that utilizes software to detect intrusion.
- Visual observation of the guideway via closed circuit television by security personnel.

Remote security cameras and intrusion detection systems will cover 100 percent of the line haul guideway and alternative technology stations for the automated fixed-guideway alternative since the electric truck family does not require alternative technology stations.



4.6 TERMINAL INTERFACES

4.6.1 Automated Fixed-Guideway Alternative

The system termini, where containers are loaded and unloaded from the vehicles, will be configured with stub tracks, according to the capabilities and limitations of the proposed technology and availability of suitable property. All terminal loading and unloading operations will be performed by wayside fixed or mobile equipment. The system will be designed and operated to make the most efficient use of wayside equipment and minimize terminal dwell times.

Loading and unloading stations will distribute vehicles from two or three stub tracks via guideway switches or other guideway features to individual lengths of dual guideway on which they may be loaded or unloaded by wayside equipment. Whereas stub track stations may use property more efficiently than loops, they require reversing, switching, queuing and distribution decisions, with higher operating complexities, such as additional switches, switching times, operational logic of building a consist at the stub terminal, etc and costs.

The determination of terminal configuration will be determined by the system developer, according to the best use of terminal space and system capacity; however a typical port/intermodal rail alternative technology station is identified in this section.

4.6.1.1 Loading And Unloading Of Cargo Containers

Cargo containers will be loaded and unloaded at either end of the alignment with existing technology top-loaders, straddle cranes, and/or overhead gantry cranes that will load and unload containers much like they are handled today. The alternative technology will not introduce new loading and unloading equipment; existing equipment should function with an alternative technology system. It is assumed there will be one rail mounted cranes per stub track at each of the alternative technology stations.

4.6.1.2 Alternative Technology Stations

The alternative technology system will interface with existing Port terminal operators at ten potential alternative technology stations as indicated in Section 2.3 and the intermodal rail facilities of Hobart and East Los Angeles as indicated in Section 2.3. Figure 12 identifies the alternative technology system within the I-710 corridor.

1. Typical Alternative Technology Station

At a typical alternative technology station, there will be two or three stub tracks that can accommodate ten 40' cargo containers per stub track (see Figures 13 and 14). Switches will be provided to allow for vehicle consists to move onto either guideway. The stub tracks will accommodate import and export containers. Areas where trucks to load and unload cargo containers are identified.

Figure 13
Schematic of Typical Port/Intermodal Rail Alternative Technology Station with Two Stub Tracks

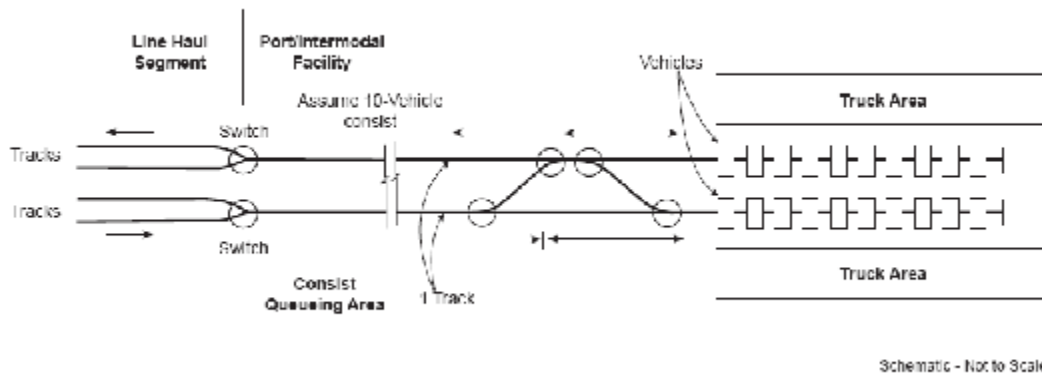
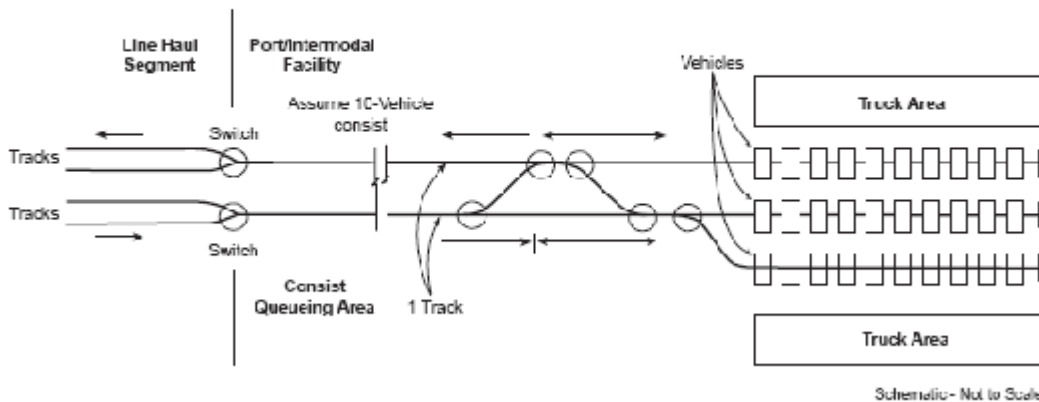


Figure 14
Schematic of Typical Port/Intermodal Rail Alternative Technology Station with Three Stub Tracks





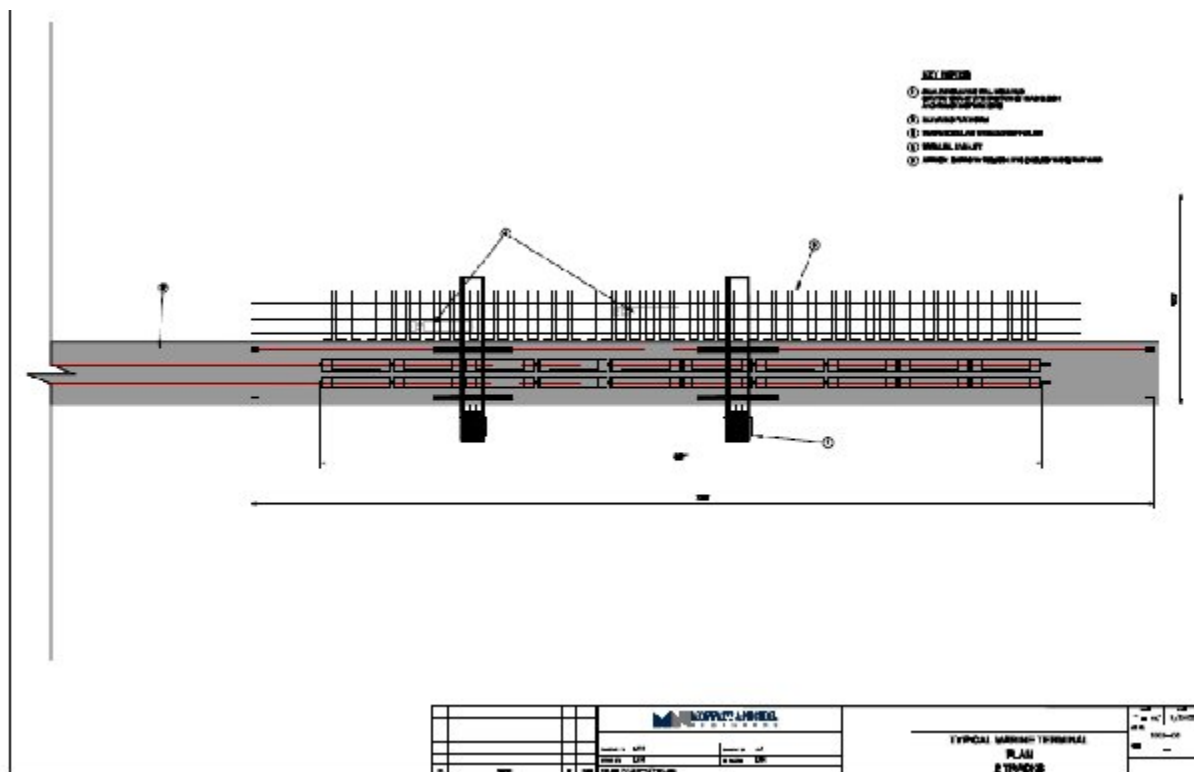
Once the vehicles are coupled, they will operate as a consist and will arrive or depart at the same time. The intent is to load all of the vehicles in the consist, but there may be times when a consist may be partially loaded due to various factors, such as the need to move cargo containers into the line haul system or the downtime to fill an entire consist.

The line haul portion of the alternative technology system will operate with four guideways. When the vehicles approach the Ports and the intermodal rail facilities, switches will be located to guide vehicles to the two guideways and to the alternative technology stations.

2. Typical Plan View of Two Guideway Alternative Technology Station

A plan view of a typical two guideway station is identified in Figure 15. The alternative technology station will be elevated and each guideway will have a rail mounted gantry crane to load or unload cargo containers. This type station has a footprint of approximately 2.9 acres.

Figure 15
Plan View of Typical Two-Track Alternative Technology Station



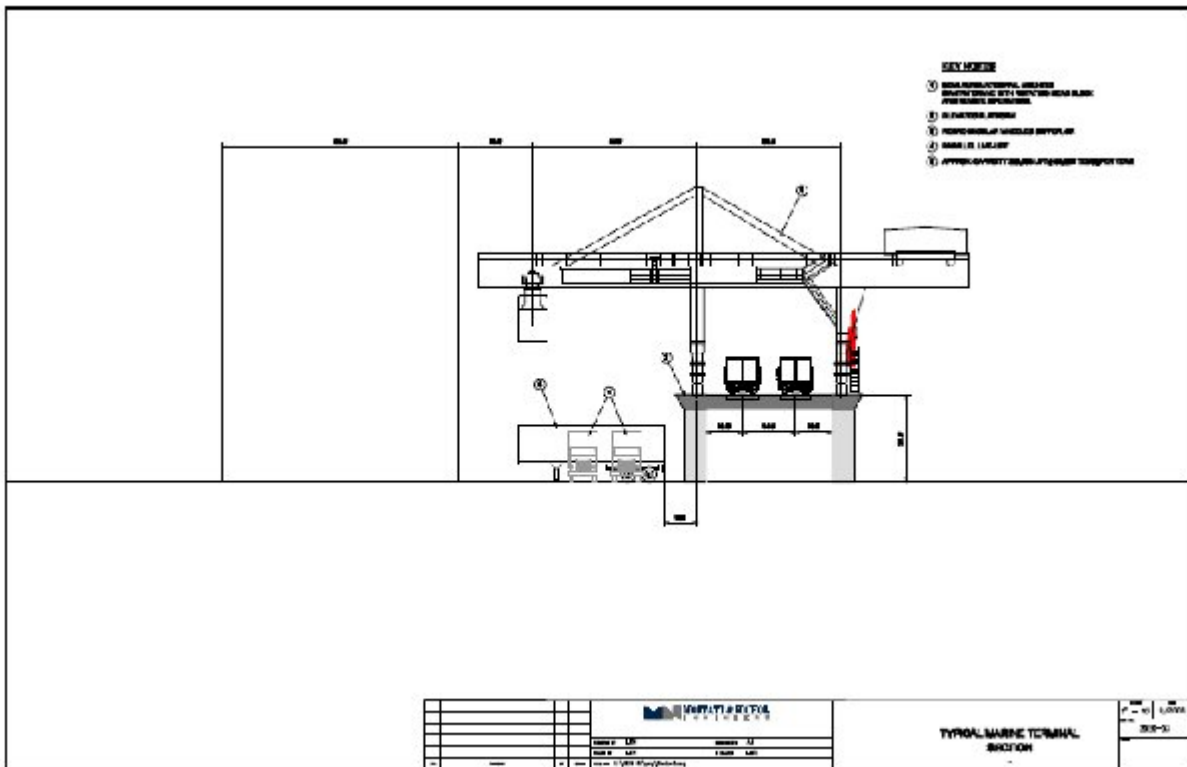
Source: Moffatt and Nichol



3. Typical Cross Section of Two Guideway Alternative Technology Station

Figure 16 below is a cross sectional view of the two guideway alternative technology station and the location of trucks.

Figure 16
Cross Section of Typical Two-Track Alternative Technology Station



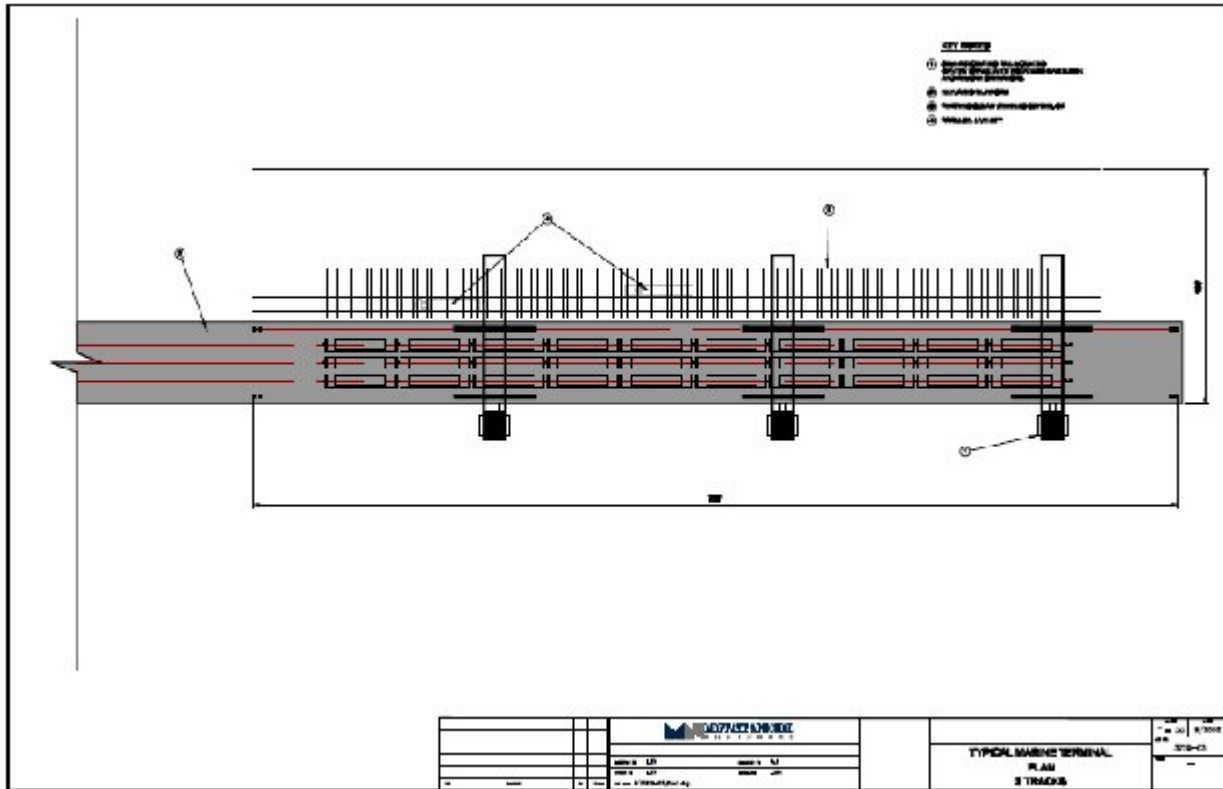
Source: Moffatt and Nichol

4. Typical Plan View of Three Guideway Alternative Technology Station

Some locations may require a three guideway station. Figure 17 is a typical plan view of the three guideway alternative technology station. This type of station has a footprint of approximately 3.1 acres.



Figure 17
Plan View of Typical Three-Track Alternative Technology Station

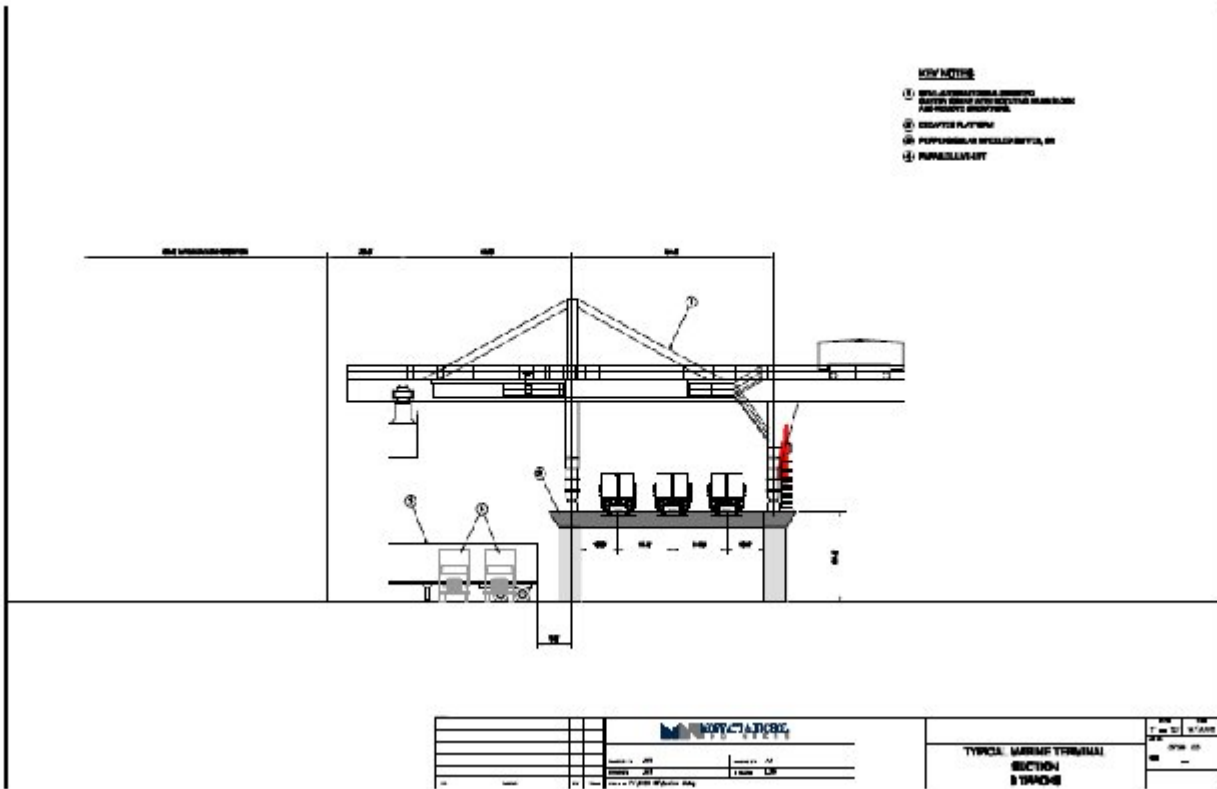


Source: Moffatt and Nichol

5. Typical Cross Section of Three Guideway Alternative Technology Station

Figure 18 is a typical cross section view of an alternative technology station.

Figure 18
Cross Section of Typical Three-Track Station



Source: Moffatt and Nichol

It is assumed for both the Ports and intermodal rail facilities that land is available for the alternative technology stations.

Ports – To serve the Ports, it is estimated that 31 to 37 stub tracks will need to be built to serve the estimated Ports container market. Based on the Ports, High Growth and Low Growth Throughput and Trip Generation Model for Existing Terminals, the Port No Build would need 37 stub tracks and the Port Build would need 31 stub tracks.

As identified earlier in this Report, ten alternative stations have been identified for the Ports and identified again in Figure 19.

Figure 19
Conceptual Alternative Technology Stations at the Ports



Each of the alternative technology stations will require a different number of stub tracks depending on the demand. Table 10 identifies the number of stub tracks per alternative technology station identified at the Ports.



Table 10
Estimated Alternative Technology Stations at the Ports

| Alternative Technology Station | Port No Build | Port Build |
|---------------------------------------|----------------------|-------------------|
| 1 | 3 | 3 |
| 2 | 5 | 5 |
| 3 | 4 | 2 |
| 3 | 2 | 2 |
| 5 | 3 | 5 |
| 6 | 7 | 7 |
| 7 | 3 | 4 |
| 8 | 3 | 3 |
| 9 | 2 | 0 |
| 10 | 5 | 0 |
| Total | 37 | 31 |

Intermodal Rail Facility - The interface and integration with existing intermodal facilities, such as exemplified by the Hobart and East Los Angeles yards, will require that the guideway be extended to existing areas currently utilized to load and offload cargo containers from trucks. At these locations, the alternative technology will interface with railroad operations and be integrated into loading and unloading operations, much like current truck operations. As identified earlier, the alternative technology system will serve both intermodal rail facilities as identified again in Figure 20.

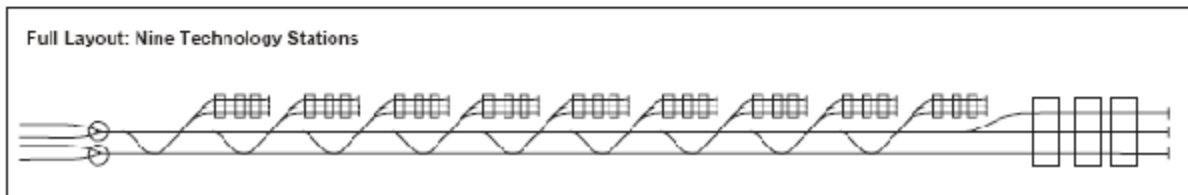
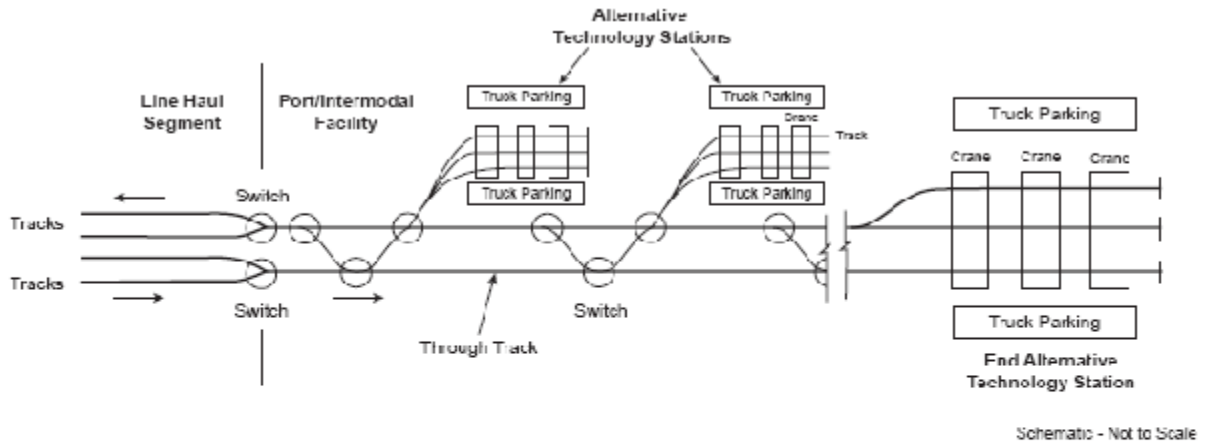
Figure 20
Conceptual Alternative Technology Alignments
within the Intermodal Rail Facilities



A conceptual configuration for an intermodal rail alternative technology station is indicated in Figure 21. This type of configuration allows for alternative technology stations to be placed in a horizontal setting, for intermodal rail facilities that may have land constraints.



Figure 21
Schematic of Conceptual Intermodal Rail Alternative Technology Station



To accommodate the ten potential Port alternative technology stations, the same number of stub tracks will need to be provided at the intermodal rail facilities. In Table 11, the estimated number of stub tracks per intermodal rail facilities for the Port No Build and Port Build scenarios is provided. It is assumed there is a 50/50 split between the two intermodal rail facilities and the East Los Angeles rail yard will accept international or 40' cargo containers.

Table 11
Estimated Alternative Technology Stations at the Intermodal Rail Facilities

| Intermodal Rail Facility | Port No Build | Port Build |
|--------------------------|---------------|------------|
| Hobart | 19 | 16 |
| East Los Angeles | 18 | 15 |
| Total | 37 | 31 |

As indicated in the top part of Figure 21, there are through guideway to the end stub tracks, and for illustrative purposes, three stub tracks that serve the through guideway. In order to



accommodate more stub tracks, the number that serve the through guideway would be need to be increased.

Again to illustrate, if there is only one intermodal rail facility, a configuration to accommodate 30 stub tracks is found at the bottom of Figure 21. This configuration would need approximately 36 acres for the alternative technology station footprint.

The alternative technology system is proposed to serve terminal operators and allow for the movement of cargo containers from the Ports to the representative intermodal rail facility via a non-truck based system.

The two stops defined for the alternative technology application are stations located at the Ports and stations at the intermodal rail facility. It is envisioned there are no intermediate stops and once a consist is loaded, it will proceed to either end of the system.

4.6.2 Electric/Battery Truck Alternative

This family of alternative technology systems will utilize existing terminals, with a stop at the Ports and at the intermodal rail facilities. Intermediate stops can be made when the vehicle is operating under battery power, but with existing battery technology, distance can become an issue, therefore, it is assumed the electric/battery trucks will generally operate with stops at the Ports and intermodal rail facilities at this time.

4.7 VEHICLES

The alternative technology vehicles will accommodate marine cargo containers of all sizes, including lengths of 20', 40', 45', 48', and 53' (standard and high cube, if appropriate).

All equipment for communication, and braking will be located underneath the load-bearing surface of the vehicle. Propulsion for the family of automated fixed-guideway will be located underneath the vehicle. Propulsion for the Electric/Battery Truck Alternative can be located overhead via a catenary system, located below via a third rail or other power source while on the guideway and on electric/battery power when located off the guideway.

4.7.1 Cargo Container Securement

Attachment hardware, integral to the vehicle, will secure the cargo containers using a positive securement system, such as an automated locking system or pins. No human intervention will be necessary to secure the cargo containers to the vehicle.

Vehicle may have wells that work in conjunction with the attachment hardware to secure the cargo containers.



4.7.2 Number and Size of Cargo Containers per Vehicle

The vehicle will be able to accommodate a single 40' to 53' container or two 20' containers. No stacking of containers is assumed, to minimize the vertical cross section and profile of the system.

4.7.3 Fleet Size

The vehicle fleet size for any technology will be based on instantaneous maximum system capacity plus a spare ratio of no less than 10 percent and no more than 15 percent of capacity.

4.7.4 Ride Quality

The vehicle will have a suspension system (using air springs, air bags or other systems) that enables the transport of breakable or fragile cargo.

4.7.5 Unit of Dispatch

1. Automated Fixed-Guideway Alternative

A consist for the alternative technology vehicles is ten vehicles, each fully loaded or unloaded, dispatched and controlled as complete individual units for the automated fixed-guideway alternative. However, there may be times, when an empty vehicle may operate in a consist.

2. Electric/Battery Truck Alternative

For the electric truck family, individual trucks will be dispatched.

4.7.6 Coupling

Alternative technology vehicles for the family of automated fixed-guideway will generally operate in a consist of ten vehicles. Each vehicle will have the ability to automatically couple or uncouple.

4.7.7 Type of Vehicles

It is assumed that vehicles for the alternative technology system will be new vehicles and not vehicles retrofitted to the alternative technology.

4.7.8 Illustrations of Vehicles

To provide idea concept of the type of vehicles that could be utilized for this alternative technology, the following illustrations are provided. A note, the applications that are proposed for the alternative technology or development of the alternative technology may not illustrate the transportation of cargo containers. The following are merely being provided to illustrate the type of alternative technology families.

Figure 22
Alternative Technology Vehicles

Magnetic Levitation

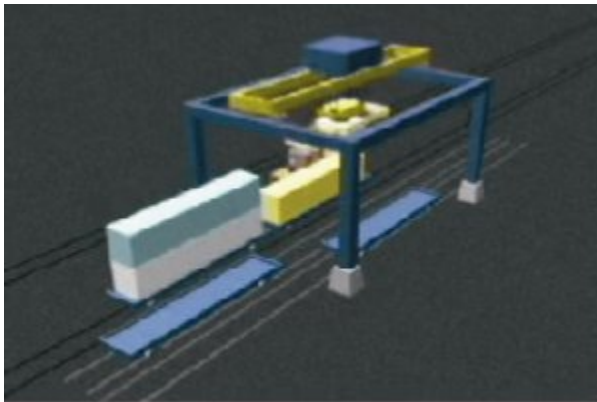


TransRapid



Electric Cargo Conveyance

Exclusive Contact Guideway



Automated Load Unload Station

Automated Shuttle Car System

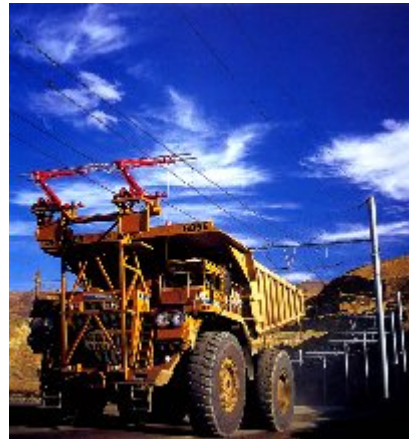


CargoRail/CargoTram

Electric/Battery Trucks



Battery Truck



Trolley Assist Truck

4.8 GUIDEWAY SWITCHING

4.8.1 Automated Fixed-Guideway Alternative

Guideway switches will be located at all control points to enable vehicles to move among all guideway elements linked to each control point. Control points will be located and configured to provide for continuous system operation:

- At no less than 75 percent of total required system throughput with the loss of ability to operate switches at a control point intermediate between terminals;
- At no less than 75 percent of total required system throughput with the loss of ability to move vehicles over a single guideway element between any two control points;
- At no less than 50 percent of total required system throughput with the loss of ability to operate switches at a control point at a terminal.

Switches will be integrated into the automated vehicle operations system and will be under the supervision of the centralized supervisory control system at all times. It will be possible to operate guideway switches locally (i.e., from a location at individual control points) with a provision that local operation of such switches will be restricted by the automated vehicle operations to conform to its protection of safe vehicle operations.



4.8.2 Electric/Battery Truck Alternative

A switching system is not envisioned for the electric truck family since the vehicles operate like standard trucks and can operate on or off the freight corridor.

4.9 SORTING AND STORAGE

4.9.1 Sorting and Storage of Containers

Sorting and storage of containers will be a function of terminal operations, external to the operation of the alternative technology. Containers are assumed to be sorted within the terminals using current sorting technologies and processes, and stored on or external to terminal property, not on the alternative technology.

4.9.2 Chassis and Port Operations

Chassis, used to move cargo containers within the Port property, are assumed to be utilized to move cargo containers to the alternative technology system and assumed to be stored on Port property as currently operated.

4.9.3 Inspection of Cargo Containers

Import and export cargo containers are envisioned to be inspected by terminal operators before placement upon the alternative technology system or upon receipt from the alternative technology, respectively

4.9.4 Container Yard Layout

It is assumed that Port yard facilities will continue to be operated and utilized for the movement of cargo containers by terminal operators. The alternative technology system is envisioned to move cargo containers directly between the Port(s) and the opposite terminal(s) of the system, with no need for intermediate container sorting or storage. Marine and railroad terminal operators will continue to utilize their own container storage and sorting facilities.

4.10 SYSTEM OPERATION

4.10.1 Automated Fixed-Guideway Alternative

4.10.1.1 Operating Rules

Operating rules will be developed and programmed into the automated vehicle operations system to maintain such safe operating criteria as block occupancies and following distances or ability to operate in either direction on a guideway during slow-term demand periods if the movement is safe.



Other operating rules may govern personnel, including procedures for system activation and shut-down, visual inspection of malfunctioning components, or monitoring of security systems.

4.10.1.2 Abnormal Operations

Service disruptions will occur for the alternative technology system. The use of a quadruple guideway, with crossovers along the line, would help mitigate service disruptions by allowing for single track operations around service disruptions. Single tracking or sidings may enable vehicles to bypass the disrupted segment of the guideway while under manual operation or a service disruption mode. Single tracking will reduce the capacity of the system in the affected direction, but will preserve the mobility of cargo containers on the system.

Through the use of the automated vehicle operations system, and tracking of the vehicles, the operations staff will be able to accurately locate service disruptions and act to restore service. Maintenance workers will be dispatched via a maintenance road (located underneath the guideway) or via specially-designed vehicles that can transport maintenance workers to the service disruption area via the guideway. The specially designed vehicles should also have the capability of pushing or pulling disabled vehicles back to the maintenance facility.

It is also envisioned that the alternative technology vehicles will have enough power to push a disabled vehicle (if possible) to the maintenance facility.

4.10.1.3 Operations and Maintenance Facility

Operations and maintenance facilities will be located at one end or both ends of the system.

It is envisioned that a single operations and maintenance building can have a plan dimensions of approximately 800' × 200', a footprint of some 160,000 square feet. Approximately 75 percent of the building is assumed to house maintenance functions, including elevated tracks at a height that enables vehicle maintenance from ground level. In this location all repair and preventative maintenance will occur on the vehicles. The maintenance facility will provide enough space to repair and maintain the infrastructure, such as vehicles, communication systems, the guideway, etc and also house parts and tools for repair activities.

The remaining portion of the building is assumed to contain the operations section of the system and to house the operations staff, the command and control hardware/software and all communication systems.

Exterior guideway capacity will be provided to enable secure storage of spare vehicles and vehicles in a repair status and is envisioned to be approximately the same size as the



maintenance facility. Should the proposed fleet management strategy call for storage of vehicles on the line-haul guideway, the system will be capable of operational start-up with no delay due to queued vehicles. The vehicle storage area will be connected to the operations and maintenance facility via sufficient guideway leads to allow for vehicles to move from one location to another either under automated control or under the control of independently-powered units (i.e. 'switchers' or 'tugs').

A surface parking lot with a footprint of 5,000 square feet is envisioned for employees that report to the operations and maintenance facility.

4.10.1.4 Operations/Maintenance Staffing

It is envisioned that different staffs will be needed for operations and maintenance. Staff is not necessarily cross trained to perform operations and maintenance. However, operations and/or maintenance staff may be crossed trained within their respective areas.

The following positions are envisioned for the operations staff:

- General Manager
- Deputy General Manager
- Support/Administration
- IT/Communication
- Security

The following positions are envisioned for the maintenance staff.

- Shift Supervisors
- Mechanics (Vehicle)
- Mechanics (Electrical)
- Mechanics (Guideway)

The mechanics can be cross trained and will provide procurement support for the acquisition of spare parts.



4.10.2 Electric/Battery Truck Alternative

4.10.2.1 Operations

The electric truck family will operate much like current trucking operations and does not have special operations needs.

4.10.2.2 Maintenance Facility

It is envisioned that a maintenance facility will be needed to maintain the electric/battery truck used to transport cargo containers since these are specialized vehicles that can not be repaired at any truck repair facility and the electrification system.

It is envisioned that the electric truck maintenance facility will be ½ of the family of automated fixed-guideway or approximately 400' x 100' of a footprint of some 40,000 square feet.

At this facility, all repair and preventative maintenance will occur on the vehicles. The maintenance facility will provide enough space to repair and maintain the infrastructure, such as vehicles, and the guideway, etc and also house parts and tools for repair activities.

A surface parking lot with a footprint of 5,000 square feet is envisioned for employees that report to the maintenance facility and for storage of vehicles needing repair.

4.10.2.3 Maintenance Staffing

Maintenance staff may be cross trained within their respective areas.

The following positions are envisioned for the maintenance staff.

- Superintendent
- Security
- Support/Administration
- Shift Supervisors
- Mechanics (Vehicle)
- Mechanics (Electrical)
- Mechanics (Guideway)



The mechanics can be cross trained and will provide procurement support for the acquisition of spare parts.

4.11 SYSTEMS ASSURANCE

4.11.1 Safety – Automated Fixed-Guideway Alternative

System safety goals will be demonstrated for the alternative technology system through the use of an automated system, restricted access to the guideway, operating rules, and training and qualification of all system personnel. Safety criteria for similar automated systems are fewer than 0.1 incidents per million vehicle miles, fewer than 0.1 injuries per 100 million vehicle miles, and zero fatalities excluding suicides, acts of God and acts of terrorism.

4.11.2 Safety – Electric/Battery Truck Alternative

System safety goals are to be as safe as existing truck operations.

4.11.3 Security

The guideway will be elevated and secure from intrusion. Exclusion devices may include:

- Fencing of the guideway.
- Fencing of the columns at ground level.
- Installation of motion detectors and incorporating the detectors into the automated vehicle operations system.
- Installation of a closed circuit television system with remote controlled cameras and a monitoring system that utilizes software to detect intrusion.
- Visual observation of the guideway via closed circuit television by security personnel.

4.11.4 Reliability

The alternative technology system will have to demonstrate 99.9 percent reliability for the movement of cargo containers between the Ports and inland destinations in order to be considered viable.

4.11.5 Maintainability

Maintenance will be performed according to a preventive maintenance schedule prescribed by the supplier to mitigate system failures. The supplier will provide training and documentation for the operations and maintenance staff to respond to system failures and restore service.



Failures that disable vehicles on the line-haul guideway will be clearable by active vehicles or service vehicles that will move the disabled vehicle via a push or pull operation to the maintenance facility or a section of the guideway for repairs. Repairs and maintenance of vehicles and fixed system elements will be affected from the guideway or the maintenance roadway. For a failure that requires on-site diagnostics, replacement, testing and repair, the mean time to restore full system operability will be less than 30 minutes, excluding travel time. For a failure that requires the shop repair of a failed unit, the mean time to restore the system will be less than 2 hours.



5.0 LONG TERM FEASIBILITY

While the 'Zero Emission Container Movement System' study (see Appendix A) for the Ports identified a broad range of alternative technologies and some qualified and motivated proponents, none have advanced to the stage of demonstrating cargo container transport in revenue service. The alternative technologies identified can all be considered in various stages of research and development. Some have working proofs of concept for levitation and propulsion, but none are represented by a complete system that transports cargo containers in response to a market.

Several of the alternative technology proponents considered in the ZECMS propose to integrate proven and commercially available sub-systems, such as traction power motors, guideway beams, columns and wayside communication. However major sub-systems of the alternative technologies (such as vehicles, the propulsion system, switches, and active guideway and command and control system) are yet to be fully developed and integrated in response to a defined service scenario. To date, none of these major systems have been integrated into a complete alternative technology system that is demonstrated to be capable of transporting cargo containers on a reliable daily basis, on any meaningful scale. It is therefore not possible to quantify the long-term feasibility of an individual alternative technology or of any family of technologies at this time.

Given the current state of development among the technologies surveyed, initial deployment of any system that could effectively divert cargo containers from trucks in the I-710 Corridor would require the sponsoring entity to make a significant commitment to the maturation of the technology, likely including some form of subsidy. While individual proponents may propose to develop and deploy an application at their own expense, the cost of development is likely to be amortized over the long-term price for actual cargo container transport. If the requisite number of cargo containers to amortize costs are not shipped, the public entity that authorized the project may be expected to make up the difference, in fact subsidizing the development of the technology.

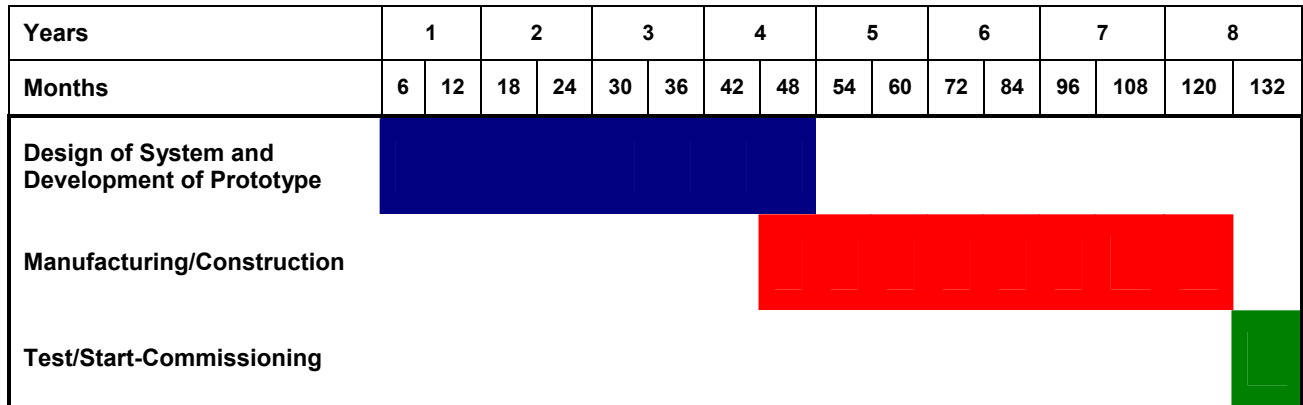
5.1 SCHEDULE FOR DEPLOYMENT OF AN ALTERNATIVE TECHNOLOGY

The following conceptual schedule (Figure 23) is provided for deployment of an alternative technology system based on being conservative due to development of a new alternative technology that is not currently available at this time, combining information from several alternative technology proponents schedules together and assuming that right-of-way, utility relocations, and environmental documentation/clearances will be conducted in parallel during



the design and manufacturing/construction phases; however if they do not, additional time will be needed for the alternative technology system.

**Figure 23
Conceptual Schedule for Deployment of
Alternative Technology System**



* Assumes right-of-way, utility relocations, and environmental documentation/clearances will be conducted in parallel during the design and manufacturing/construction phases.

Once a working demonstration is developed that can carry multiple cargo containers, the system will need to be scaled up to the capacity and length necessary to serve a viable market. Only one of the alternative technology proponents has ever produced a commercial application of their technology, but for transportation of passengers and not cargo containers. Therefore, time needed to scale up to the number of vehicles that will be needed may be underrepresented since alternative technology proponents appear to have little experience with commercialization of their specific technology.

Additional time may be needed to re-design any element of the alternative technology during development of a prototype and this in turn, could add addition time to manufacture, test/start up/commission the service.

The family of electric/battery truck is an established technology but providing power to trucks through electricity via a wire, third rail or another power source such as power coming from the pavement in an open roadway is not as well established. Until a heavy duty working prototype can be developed specifically for the cargo container application, the time line identified above could also be used as a conceptual schedule for this family of alternative technologies.



6.0 ESTIMATED COSTS

As part of the 'Zero Emission Container Movement System' study for the Ports, conceptual cost estimates were derived for an alternative technology system in service between the Port(s) and a destination 20 miles inland. However, these estimates were based on a conceptual or evolving design that has not been commercially realized, and are likely understated. Until a proponent has designed, installed, operated and maintained an alternative technology in an operating setting carrying cargo containers, their cost estimates remain conceptual and should be used for planning purposes only.

6.1.1 Automated Fixed-Guideway Alternative

The following estimated unit costs are based on the highest costs per category provided by alternative technology proponents for the 'Zero Emission Container Movement System' study, and updated information and are applicable for the magnetic levitation and exclusive contact guideway systems.

- **Design/Construction Management:** \$30 - \$44 million per mile, for staff to manage the design and the construction of the alternative technology system, based on an estimate of 10% of the capital costs for each.
- **Capital:** From \$150 million to \$220 million per mile, for a two-guideway system including the use of sorting/storage facilities, guideway, vehicles, systems (communication, automated vehicle operations, etc.), loading/unloading equipment and an operations and maintenance facility. A quadruple guideway system was estimated at \$270 million to \$350 million per mile based on a 'technology risk premium' for development of a new design.
- **Operations:** \$6.6 – \$9.0 million per mile for the 1st year of operations including staffing and power consumption.
- **Maintenance:** \$.9 - \$1.5 million per mile for the 1st year of operations including staffing and consumables.

A rough order of magnitude cost for the one time capital costs for the automated fixed-guideway system is found in Table 12. It identifies the unit cost for both a low and high range and the number of miles for the line haul, the intermodal rail facilities and the Ports.



Table 12
Rough Order of Magnitude One Time Capital Cost Estimates
Automated Fixed-Guideway (millions)

| Segment | Miles | Low Range | High Range | Total – Low Range | Total – High Range |
|----------------------------|-----------|-----------|------------|-------------------|--------------------|
| Line Haul | 16 | \$300 | \$394 | \$4,800 | \$6,304 |
| Intermodal Rail Facilities | 4 | \$180 | \$264 | \$720 | \$1,056 |
| Ports | 15 | \$180 | \$264 | \$2,700 | \$3,960 |
| Total | 35 | | | \$8,220 | \$11,320 |

A rough order of magnitude cost for the first year of operations and maintenance costs for the automated fixed-guideway system is found in Table 13. It identifies the unit cost for both a low and high range and the number of miles for the line haul, the intermodal rail facilities and the Ports.

Table 13
Rough Order of Magnitude 1st Year Operations and
Maintenance Cost Estimates
Automated Fixed-Guideway (millions)

| Segment | Miles | Low Range | High Range | Total – Low Range | Total – High Range |
|----------------------------|-----------|-----------|------------|-------------------|--------------------|
| Line Haul | 16 | \$8 | \$11 | \$120 | \$168 |
| Intermodal Rail Facilities | 4 | \$8 | \$11 | \$30 | \$42 |
| Ports | 15 | \$8 | \$11 | \$112 | \$157 |
| Total | 35 | | | \$262 | \$367 |

6.1.2 Electric/Battery Truck Alternative

The following estimated unit costs are rough order of magnitude costs for an electric truck system that would use an exclusive elevated freight guideway system. The cost estimates are derived from cost estimates the estimates for the freight corridor for the I-710 project, and cost estimates for light rail passenger system that utilize overhead catenary for propulsion and substations for power. The cost does not include any trackwork.



- **Design/Construction Management:** \$38 - \$39 million per mile, for staff to manage the design and the construction of the alternative technology system, based on an estimate of 10% of the capital costs for each.
- **Capital:** From \$192million to \$196 million per mile, for a system including the use of existing loading/unloading equipment and sorting/storage facilities, elevated guideway with catenary and substations, existing systems for communication, and a light duty maintenance facility; vehicles, not including right-of-way acquisition.
- **Operations:** From \$1.8 million to \$2.0 million per mile for the 1st year of operations based on a cost of \$.20 per mile to operate an electric/battery truck.
- **Maintenance:** Can not be determined at this time.

A rough order of magnitude cost for the electric/battery family is found in Table 14. It identifies the estimated one item capital costs for both a low and high range and the number of miles for the line haul only since it is assumed that existing street networks would be utilized at both the Ports and intermodal rail facilities.

Table 14
Rough Order of Magnitude One Time Capital Cost Estimates
Electric/Battery Truck (millions)

| Segment | Miles | Low Range | High Range |
|-----------|-------|-----------|------------|
| Line Haul | 16 | \$3,843 | \$3,929 |

A rough order of magnitude cost for the first year of operations for the electric/battery family is found in Table 15. It identifies the unit cost for both a low and high range and the number of miles for the line haul, the intermodal rail facilities and the Ports.

Table 15
Rough Order of Magnitude 1st Year Operations and
Maintenance Cost Estimates
Electric/Battery Truck (millions)

| Segment | Miles | Low Range | High Range |
|-----------|-------|-----------|------------|
| Line Haul | 16 | \$36 | \$41 |

I-710 Corridor Project EIR/EIS - Alternative Technology Working Group

Draft Alternative Goods Movement Technology Analysis - Initial Feasibility Study Report

Please provide comments on this form and return to Irene Avetyan (irene_avetyan@urscorp.com) by August 6th, 2008 or bring it to the meeting.

| Number | Source | Organization | Report Section and Page | | Comment | Response |
|--------|-------------|--------------------|-------------------------|---|--|--|
| 1 | Jerry Woods | Gateway Cities COG | Executive Summary | 1 | Comment: add the word "possibly" in front of "moving cargo containers" in the sentence "The purpose of the Alternative Goods Movement Technology Analysis – Initial Feasibility Study Report is to provide a single generalized definition encompassing a range of alternative technologies for moving cargo containers to and from the Ports of Long Beach and Los Angeles. " | Acknowledged, No Change: |
| 2 | Jerry Woods | Gateway Cities COG | Executive Summary | 1 | Comment: add the term "potential" in front of the term "environmental impacts". "This definition will be used to evaluate the potential environmental impacts and benefits attributed to alternative technologies for the I-710 Corridor Project Environmental Impact Report/Environmental Impact Statement (EIR/EIS)." | Report Revised: "This definition will be used to evaluate the potential environmental impacts and benefits attributed to alternative technologies for the I-710 Corridor Project Environmental Impact Report/Environmental Impact Statement (EIR/EIS)." |
| 3 | Jerry Woods | Gateway Cities COG | Executive Summary | 2 | Comment: add the term "estimated" or "possible" to describe system capacity. | Report Revised "The estimated capacity of the system at the Ports/intermodal rail facilities ranged from 4.7-11.3 million 40' cargo containers annually; while estimated capacity for the line haul portion of the alternative technology system ranged from 2.7-12.1 million 40' cargo containers annually." |
| 4 | Jerry Woods | Gateway Cities COG | Executive Summary | 2 | Comment: add the word "limits" in the term "capacity limits of the system" in the sentence "The estimated capacity of the system at the Ports/intermodal rail facilities ranged from 4.7 – 11.3 million 40' cargo containers annually; while estimated capacity for the line haul portion of the alternative technology system ranged from 2.7 – 12.1 million 40' cargo containers annually." | Acknowledged, No Change: |
| 5 | Jerry Woods | Gateway Cities COG | Executive Summary | 2 | Comment: Add "for loading and unloading containers" to the sentence in the second paragraph "For the automated fixed-guideway alternative technology, system, a typical two-track alternative technology station has an approximate footprint of 2.9 acres; while a typical three-track alternative technology station has an approximate footprint of 3.1 acres." | Report Revised: "For the automated fixed-guideway alternative technology, system, a typical two-track alternative technology station for loading and unloading containers has an approximate footprint of 2.9 acres; while a typical three-track alternative technology station has an approximate footprint of 3.1 acres." |
| 6 | Jerry Woods | Gateway Cities COG | Executive Summary | 2 | Comment: What is the cost to move a 40' container with these two systems? Asked about sentence "For maglev and fixed-guideway technologies, capital costs are estimated to range from \$8.2 to \$11.3 billion (including design, construction management fixed facilities and vehicles) and from \$222 to \$367 million for the first year of operations and maintenance." | Answer: Not within URS scope - issues with how to estimate. |
| 7 | Jerry Woods | Gateway Cities COG | Executive Summary | 2 | Comment: Over what limits XXXXXXXX. Asked about "For maglev and fixed-guideway technologies, capital costs are estimated to range from \$8.2 to \$11.3 billion (including design, construction management fixed facilities and vehicles) and from \$222 to \$367 million for the first year of operations and maintenance. For the electric/battery truck alternative, capital costs are estimated to range from \$3.8 to \$3.9 billion and from \$35 to \$40 million for the first year of operations." | Answer: From the Ports to the representative intermodal railyard. |
| 8 | Jerry Woods | Gateway Cities COG | Executive Summary | 2 | Comment: delete the term "is introduced" and replace with "was now evaluated" in the sentence "Therefore, a new technology of electric/battery truck is introduced." | Acknowledged, No Change: URS did not evaluate the electric truck technology. |
| 8 | Jerry Woods | Gateway Cities COG | 1.1 - Introduction | 4 | Comment: Add the the term " and evaluation" after the word "consideration" in "Among the alternatives being developed for consideration in the I 710 Corridor Project EIR/EIS process is one that would apply a 'new technology' for container transport – to enable the diversion of cargo container traffic to a physically separate, non-polluting transport mode, reducing the local effects of container transport operations and emissions." | Acknowledged, No Change: |

| Number | Source | Organization | Report Section and Page | Comment | Response |
|--------|-------------|--------------------|---|---------|--|
| 9 | Jerry Woods | Gateway Cities COG | 1.1 - Introduction | 4 | Comment: add the term "from trucks in particular" at the end of the sentence "Among the alternatives being developed for consideration in the I 710 Corridor Project EIR/EIS process is one that would apply a 'new technology' for container transport – to enable the diversion of cargo container traffic to a physically separate, non-polluting transport mode, reducing the local effects of container transport operations and emissions." Report Revised: The technology definition is based principally on information provided by proponents of new technologies, definitions of other technology applications (e.g. airport people movers, high-speed rail, electric buses and trucks), and forms of similar non-proprietary performance specifications from tracks in particular." |
| 10 | Jerry Woods | Gateway Cities COG | 1.2 - Purpose of Initial Feasibility Report | 4 | Comment: add the word "Transportation" to the term "transportation alternatives" in the sentence "The characteristics of such a technology are derived from the performance requirements, to enable the evaluation of their impacts and benefits alongside those of other I-710 Corridor alternatives. " Report Revised: "Among the alternatives being developed for consideration in the I 710 Corridor Project EIR/EIS process is one that would apply a 'new technology' for container transport – to enable the diversion of cargo container traffic to a physically separate, non-polluting transport mode, reducing the local effects of container transport operations and emissions from trucks in particular." |
| 11 | Jerry Woods | Gateway Cities COG | 1.2 - Purpose of Initial Feasibility Report | 4 | Comment: add "applicability and likelihood" at the end of the sentence "The Report thus provides a generalized definition of alternative technologies to move cargo containers to and from the Ports that can be evaluated on the basis of their market-responsive physical and operational characteristics." Acknowledged, No Change: Not sure about these - need to review the evaluation paper to see if included, otherwise drop. |
| 12 | Jerry Woods | Gateway Cities COG | 1.2 - Purpose of Initial Feasibility Report | 4 | Comment: add the word "capabilities" in the sentence "Given that it is technology-neutral, the Report defines criteria that represent the 'outer boundaries' of the characteristics of technologies for which data are available today, to enable quantification of the maximum environmental impacts from the alternative technology's footprint and operations." Report Revised: "Given that it is technology-neutral, the Report defines criteria that represent the 'outer boundaries' of the characteristics of technologies for which data are available today, to enable quantification of the maximum environmental impacts and capabilities from the alternative technology's footprint and operations." |
| 13 | Jerry Woods | Gateway Cities COG | 1.2 - Purpose of Initial Feasibility Report | 5 | Comment: delete "It is likely that" in front of the sentence and replace the word "will" with "could" in the sentence "It is likely that technologies that impose lesser impacts than this generalized surrogate will be available in the future" Report Revised: Technologies that impose lesser impacts than this generalized surrogate could be available in the future. |
| 14 | Jerry Woods | Gateway Cities COG | 1.4 - Additional Alternative Technology | 8 | Comment: add "possibly in an automated system" at the end of the sentence "As this alternative is envisioned, electrically-powered trucks could draw power from an overhead catenary wire, third rail, or conductor embedded in the roadway, and could operate over the highway as conventional trucks do today." Report Revised: " As this alternative is envisioned, electrically-powered trucks could draw power from an overhead catenary wire, third rail, or conductor embedded in the roadway, and could operate over the highway as conventional trucks do today, possibly in an automated system." |
| 15 | Jerry Woods | Gateway Cities COG | 1.4 - Additional Alternative Technology | 9 | Comment: add "with possibly more destination flexibility than a fixed-guideway system" to the end of the sentence "The potential capacity of an electric/battery truck system could be further enhanced by automated guidance technology that could enable 'platoons' of electric/battery trucks to operate as single virtual consists, at closer headways than safely possible with individually-operated vehicles." Report Revised: ". The potential capacity of an electric/battery truck system could be further enhanced by automated guidance technology that could enable 'platoons' of electric/battery trucks to operate as single virtual consists, at closer headways than safely possible with individually-operated vehicles with possibly more destination flexibility than a fixed-guideway system." |
| 16 | Jerry Woods | Gateway Cities COG | 1.5 - Summary Assumptions | 11 | Comment: not sure why "The alternative technology will be owned by a public entity that will be responsible for operations and maintenance of the system." is relevant and not sure about the claim of the question? Report Revised: "The alternative technology will be procured via competitive solicitation by a public entity, in response to performance specifications for the system's physical characteristics, operations, systems assurance, maintenance and revenue." |
| 17 | Jerry Woods | Gateway Cities COG | 1.5 - Summary Assumptions | 12 | Comment: responding to the statement in the report "Delivery of cargo containers will be evenly distributed between the two rail yards." - East LA only gets a small percentage of marine containers currently - making this a huge change in operation. Acknowledged, No Change: The report has an assumption on page 61. |
| 18 | Jerry Woods | Gateway Cities COG | 1.5 - Summary Assumptions | 12 | Comment: responding to the statement in the report "Land is assumed to be available for the alternative technology stations at the Ports and intermodal rail facilities." - this tab holds a big assumption, land will be taken away from other operations. Acknowledged, No Change: Land could be taken away from other operations but the automated fixed guideway is aerial requiring footprint for the columns and cranes, while the electric/battery truck would operate like current trucks. At this time the system is highly conceptual, if this work is continued, then at that time issues like this would be addressed. |
| 19 | Jerry Woods | Gateway Cities COG | 1.5 - Summary Assumptions | 14 | Comment: mention "Maintenance road required" to the last bullet point statement "The operations and maintenance facility may be located at either end of the system." Report Revised: "A Maintenance Road can be provided under the elevated guideway of the automated fixed guideway system." |

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|--------|-------------|--------------------|---------------------------------|----|--|---|
| 20 | Jerry Woods | Gateway Cities COG | 2.2 - Potential Alignments | 17 | Comment: improve graphics for Figure 2 - Potential Alternative Technology Alignments | Acknowledged, No Change: The unclear graphic is a result of a bad scanner. |
| 21 | Jerry Woods | Gateway Cities COG | 2.2 - Potential Alignments | 19 | Comment: add "and is used as the basis for evaluation in this study" to the end of the sentence "On the bases of initial visual inspection and review of aerial photography, it is assumed that a clear cross-section of approximately 82' in width may be developed within the I-710 freeway alignment for an alternative technology right-of-way." | Report Revised: "On the bases of initial visual inspection and review of aerial photography, it is assumed that a clear cross-section of approximately 82' in width may be developed within the I-710 freeway alignment for an alternative technology right-of-way and is used as the basis for evaluation in this study." |
| 22 | Jerry Woods | Gateway Cities COG | 2.2 - Potential Alignments | 19 | Comment: add "or difficulties" to the end of the sentence "The Los Angeles River does appear to have more width available; however, it is assumed that new construction in the river may not be possible for environmental reasons." | Report Revised: "The Los Angeles River does appear to have more width available; however, it is assumed that new construction in the river may not be possible for environmental reasons or difficulties." |
| 23 | Jerry Woods | Gateway Cities COG | 2.2 - Potential Alignments | 19 | Comment: add "along any alignments to be studied in more detail at a later time and are beyond the limits of this study" at the end of the sentence "The actual design of an alternative technology alternative would need to address the tradeoffs between system capacity and impacts to adjacent land uses." | Report Revised: Replace entire paragraph with: "The actual selection and design of an alternative technology alternative would need to consider tradeoffs between system capacity and impacts to adjacent land uses. These tradeoffs are beyond the limits of this study, and would be the subject of detailed study of a specific alignment and technology." |
| 24 | Jerry Woods | Gateway Cities COG | 2.3 - Terminal Configurations | 20 | Comment: switch the word "the" for "this" in the sentence "The sizes and distribution of loading and unloading stations have been determined via an iterative process summarized in Section 3 of the Report." | Report Revised: "The sizes and distribution of loading and unloading stations have been determined via an iterative process summarized in Section 3 of this Report." |
| 25 | Jerry Woods | Gateway Cities COG | 2.3 - Terminal Configurations | 21 | Comment: referring to Figure 4 - spur to SCIG and ICTF? | Acknowledged, No Change |
| 26 | Jerry Woods | Gateway Cities COG | 2.3 - Terminal Configurations | 22 | Comment: add "and inside the Ports and Railyards as is currently done for diesel trucks" to the end of the sentence "The electric/battery trucks would use the I-710 freight corridor and the proposed truck ramps, would move through the Ports and intermodal yards on their own individual auxiliary power, and would be loaded and unloaded by existing container handling equipment." | Report Revised: "The electric/battery trucks would use the I-710 freight corridor and the proposed truck ramps, would move through the Ports and intermodal yards on their own individual auxiliary power, and would be loaded and unloaded by existing container handling equipment and Inside the Ports or Railyards as is currently done for diesel trucks." |
| 27 | Jerry Woods | Gateway Cities COG | 3.1 - Market Demand Assumptions | 23 | Comment written in and deleted by Jerry Woods | Acknowledged, No Change: |
| 28 | Jerry Woods | Gateway Cities COG | 3.5 - System Capacity | 28 | Comment: Make changes in Figure 6 - Capacity Equations - change "F=dispatch frequency, in movements per hour" to "F=resulting consist dispatch frequency, per every X sender" | Report Revised: "F=dispatch frequency, in consists or platoons dispatched per hour by the port or railyard" |
| 29 | Jerry Woods | Gateway Cities COG | 3.5 - System Capacity | 29 | Comment: add "a total of" and "(See Table 5)" to the sentence "To serve the Ports, it is estimated that 31 to 37 stub loading and unloading station tracks will need to be built to serve the estimated market." | Report Revised: "- To serve the Ports, it is estimated that a total of 31 to 37 stub loading and unloading station tracks (See Table 5) will need to be built to serve the estimated market." |
| 30 | Jerry Woods | Gateway Cities COG | 3.5 - System Capacity | 31 | Comment: add explanation "(resulting consists per X sender dispatched)" to #4 - Frequency | Acknowledged, No Change: |
| 31 | Jerry Woods | Gateway Cities COG | 3.5 - System Capacity | 31 | Comment: add "for every consist to be dispatched" to the end of the sentence "For the purpose of 'matching' port and rail facility productivity to that of the line-haul guideway, frequency is treated as the dependent variable of the capacity calculation for the Ports and intermodal rail facilities, and ranges from 35 to 70 seconds." | Report Revised: "For the purpose of 'matching' port and rail facility productivity to that of the line-haul guideway, frequency is treated as the dependent variable of the capacity calculation for the Ports and intermodal rail facilities, and ranges from 35 to 70 seconds for every consist to be dispatched. " |
| 32 | Jerry Woods | Gateway Cities COG | 3.5 - System Capacity | 31 | Comment: add "if consists need to be dispatched in less than 90 seconds to achieve required capacity throughput" to the end of the sentence "If the minimum practical headway for the line haul segment is assumed to be 90 seconds for any individual guideway, then multiple guideways must be provided in each direction." | Acknowledged, No Change |

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| 33 | Jerry Woods | Gateway Cities COG | 3.5 - System Capacity | 31 | Comment: Request to word the following paragraph better since it is confusing "For the purpose of 'matching' port and rail facility productivity to that of the line-haul guideway, frequency is treated as the dependent variable of the capacity calculation for the Ports and intermodal rail facilities, and ranges from 35 to 70 seconds for every consist to be dispatched. If the minimum practical headway for the line haul segment is assumed to be 90 seconds for any individual guideway, then multiple guideways must be provided in each direction." | Acknowledged, No Change |
| 34 | Jerry Woods | Gateway Cities COG | 3.5 - System Capacity | 32 | Comment: switch "ten" to "twelve" in the sentence "Given that each vehicle is assumed to carry a single container, the 'Unit of Dispatch' – the number of vehicles assembled and moved through the system as a complete, individual unit - is assumed to range from consists of six to ten vehicles, each fully loaded or unloaded, dispatched and controlled as complete individual units." | Report Revised: "Given that each vehicle is assumed to carry a single container, the 'Unit of Dispatch' – the number of vehicles assembled and moved through the system as a complete, individual unit - is assumed to range from consists of six to twelve vehicles, each fully loaded or unloaded, dispatched and controlled as complete individual units." |
| 35 | Jerry Woods | Gateway Cities COG | 3.5 - System Capacity | 32 | Comment: add "(40)" after "containers" in the sentence "Using 20 lifts per hour, varying the vehicles in a consist length of 6 – 12, and varying the headway, achievable capacity ranges from 4.7 million to 5.6 million containers per year." | Report Revised: "Using 20 lifts per hour, varying the vehicles in a consist length of 6 – 12, and varying the headway, achievable capacity ranges from 4.7 million to 5.6 million containers (40') per year." |
| 36 | Jerry Woods | Gateway Cities COG | 3.5 - System Capacity | 33 | Comment: add "(40' containers, Two-guideway system)" to the title of Table 7 | Report Revised: Table 7 Station Capacity (Port/Intermodal Rail Facility) – System Variations (40' Containers, Two-Guideway System) initially requested to add "Four-guideway system" by Jerry but Stephanie corrected to Two-Guideway system |
| 37 | Jerry Woods | Gateway Cities COG | 3.5 - System Capacity | 36 | Comment: add "(40)" after "12-29 million containers" to the sentence "In operation similar to that of conventional trucks, but on a dedicated roadway, an electric/battery alternative technology system would offer capacity in excess of the forecast demand for the combined off dock, near dock, and east of Los Angeles markets; ranging from 12 – 29 million containers annually, depending on the system variables." | Report Revised: "In operation similar to that of conventional trucks, but on a dedicated roadway, an electric/battery alternative technology system would offer capacity in excess of the forecast demand for the combined off dock, near dock, and east of Los Angeles markets; ranging from 12 – 29 million containers (40') annually, depending on the system variables." |
| 38 | Jerry Woods | Gateway Cities COG | 4.2 - Guideway | 39 | Comment: consider the option that there could be truck land under the guideway in the paragraph "The cross-section shown in Figure 7 represents a concept for elevated quadruple guideway, support structure and access roadways, illustrated as it would fit within the available width within the I 710 freeway right-of-way. The access roadway underneath the guideway will facilitate construction and maintenance of the system. It is not meant to be a roadway available to the general public. The guideway and access roads will be separated from adjacent land uses by security fencing or some other physical barrier." | Acknowledged, No Change |
| 39 | Jerry Woods | Gateway Cities COG | 4.2 - Guideway | 39 | Comment: Figure 7 graphic is illegible, please clear up. | Acknowledged, No Change: graphic appears unclear due to scanning of the report |
| 40 | Jerry Woods | Gateway Cities COG | 4.2 - Guideway | 43 | Comment: mention truck lanes as an option in subsection 4.2.1.9 | Acknowledged, No Change: (see comment #38) |
| 41 | Jerry Woods | Gateway Cities COG | 4.2 - Guideway | 44 | Comment: Figure 11 graphic is illegible, please clear up. | Acknowledged, No Change: graphic appears unclear due to scanning of the report |
| 42 | Jerry Woods | Gateway Cities COG | 4.2 - Guideway | 45 | Comment: Trucks cannot climb more than 6 percent grade, correct in subsection 4.2.2.4 "The alternative technology system should be able to climb and descend at least a 10 percent grade." | Report Revised: "The alternative technology system should be able to climb and descend at least a 6 percent grade." |
| 43 | Jerry Woods | Gateway Cities COG | 4.6 - Terminal Interfaces | 52 | Comment: Figure 12 graphic is poor, please make it clear. | Acknowledged, No Change: graphic appears unclear due to scanning of the report |

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| 44 | Jerry Woods | Gateway Cities COG | 4.6 - Terminal Interfaces | 53 | Comment: Figure 13 graphis is poor, please make it clear. | Acknowledged, No Change: graphic appears unclear due to scanning of the report |
| 45 | Jerry Woods | Gateway Cities COG | 4.6 - Terminal Interfaces | 54 | Comment: Figure 15 graphis is poor, please make it clear. | Acknowledged, No Change: graphic appears unclear due to scanning of the report |
| 46 | Jerry Woods | Gateway Cities COG | 4.6 - Terminal Interfaces | 55 | Comment: Figure 16 graphis is poor, please make it clear. | Acknowledged, No Change: graphic appears unclear due to scanning of the report |
| 47 | Jerry Woods | Gateway Cities COG | 4.6 - Terminal Interfaces | 62 | Comment: add the term "at this time" to the end of the sentence "Intermediate stops can be made when the vehicle is operating under battery power, but with existing battery technology, distance can become an issue, therefore, it is assumed the electric/battery trucks will generally operate with stops at the Ports and intermodal rail facilities." | Report Revised: "Intermediate stops can be made when the vehicle is operating under battery power, but with existing battery technology, distance can become an issue, therefore, it is assumed the electric/battery trucks will generally operate with stops at the Ports and intermodal rail facilities at this time." |
| 48 | Jerry Woods | Gateway Cities COG | 4.11 - Systems Assurance | 70 | Comment: add "have to" and "in order to be considered viable" in the sentence "The alternative technology system will demonstrate 99.9 percent reliability for the movement of cargo containers between the Ports and inland destinations." in Subsection 4.11.4 | Report Revised: "The alternative technology system will have to demonstrate 99.9 percent reliability for the movement of cargo containers between the Ports and inland destinations in order to be considered viable." |
| 49 | Jerry Woods | Gateway Cities COG | 6.0 - Estimated Costs | 75 | Comment: One or two guideways when discussing capital costs per mile for automated fixed guideway technology? | Report Revised: -Capital: From \$150 million to \$220 million per mile, for a two-guideway system including the use of sorting/storage facilities, guideway, vehicles, systems (communication, automated vehicle operations, etc.), loading/unloading equipment and an operations and maintenance facility. |
| 50 | Jerry Woods | Gateway Cities COG | 6.0 - Estimated Costs | 76-77 | Comment: Need to discuss cost per container in section 6.0 | Acknowledged, No Change |
| 51 | Jerry Woods | Gateway Cities COG | 6.0 - Estimated Costs | 77 | Comment: How about Intelligent Transportation Systems (ITS) costs? | Acknowledged, No Change: No ITS costs. |
| 52 | Jerry Woods | Gateway Cities COG | Email sent to Susan Taylore on 11/04/2008 | | Comment: Need to discuss cost per container. | Acknowledge, No Change: |
| 53 | Jerry Woods | Gateway Cities COG | Email sent to Susan Taylore on 11/04/2008 | | Comment: Not clear from the terminal graphic plan, but does this system connect to near dock yards? | Acknowledge, No Change: |
| 54 | Jerry Woods | Gateway Cities COG | Email sent to Susan Taylore on 11/04/2008 | | Comment: The assumption of equal delivery of marine containers to the BNSF and UP rail yards would require a significant change in operation of the UP railyard which only currently receives a small percentage of its containers as marine containers (probably worth putting out - one of the limitations of a fixed guideway systemJ). | Acknowledged, No Change (Consulted with Willard Keeney) |
| 55 | Jerry Woods | Gateway Cities COG | Email sent to Susan Taylore on 11/04/2008 | | Comment: Can the eletric/battery truck technology idea be applied to new diesel trucks or hybrid trucks? Certainly looks like a lot less costs and more capacity. | Acknowledged, No Change For the purposes of this report, as the electric truck technology envisioned is not yet a product, we cannot assume that existing trucks may be retrofit. |
| 56 | Jerry Woods | Gateway Cities COG | Email sent to Susan Taylore on 11/04/2008 | | Comment: I am assuming (not sure though) that the costs for electric trucks includes the "system" to move them. Is the cost for an automated system included? | Answer: No, depends what "automated" means in this scenario. |
| 56 | Jerry Woods | Gateway Cities COG | Email sent to Susan Taylore on 11/04/2008 | | Comment: Could other trucks (non-port) also use the system mentioned above. | Answer: Yes, it is possible. |
| 56 | Jerry Woods | Gateway Cities COG | Email sent to Susan Taylore on 11/04/2008 | | Comment: Might also mention that if battery technology could be significantly improved or hybrid trucks developed, then the trucks that use this facility might be able to get farther away from it, increasing its attractiveness. | Answer: Yes, that is true. |