CITY OF CARSON

PLANNING COMMISSION STAFF REPORT

WORKSHOP:	November 24, 2009
SUBJECT:	Alameda Street Sound-wall and Noise Mitigation Workshop
APPLICANT:	City of Carson
REQUEST:	Workshop to discuss sound-wall design and noise mitigation alternatives for train and diesel truck noise along Alameda Street between Dominguez Street and the Freeway 405
PROPERTY INVOLVED:	Light-industrial zoned properties and residences east of Alameda Street between Dominguez Street and the 405 Freeway to the Harbor View Avenue alignment

---

COMMISSION ACTION

____ Concurred with staff

____ Did not concur with staff

____ Other

COMMISSIONERS' VOTE

AYE	NO		AYE	NO	
		Chairman Faletogo			**Graber**
		Vice-Chair Saenz			**Park**
		Brimmer			**Schaefer**
		Brown			**Verrett**
		Gordon			

Item No. 12-A

I. Introduction

The purpose of this workshop is to discuss the staff identified preferred alternative design and noise attenuation alternative to mitigate diesel truck and train noise along Alameda Street (Alameda Corridor) between Dominguez Street and the San Diego 405 Freeway to the Harbor View Avenue alignment. This alternative has received varying levels of support and opposition from the community. In order to proceed, there should be a determination of the preferred alternative so that the project can proceed with CEQA review and identification of funding sources.

II. Background

On April 8, 2008, staff held a Planning Commission workshop to discuss the sound-wall design and noise attenuation alternatives for residents along the Alameda Corridor. The Planning Commission, after hearing staff's presentation and the public testimony, directed staff to: explore all funding options; determine cost of implementing a sound-wall and noise attenuation measures to mitigate diesel truck and train noise; consider traffic mitigation for Dominguez Street; evaluate the feasibility of placing a sound-wall west of Alameda Street; and to provide information as to the status of the $1 million that the city received from the Alameda Corridor Transportation Authority (ACTA) for noise mitigation to those residential properties east of Alameda Street impacted by diesel trucks and train noise.

On September 9, 2009, city engineering and planning staff met with affected residents and business owners that reside east of Alameda Street. Staff presented the attached preferred sound-wall design and noise attenuation alternative. Staff described the alternative, heard public input and addressed questions regarding the project's timing and feasibility. Concerns were raised including but not limited to the closure of the residential streets, potential traffic impacts on Harbor View Street and the acquisition of residential properties. Staff informed the public that there would be a follow-up workshop with the Planning Commission where they could provide input. Staff also met with the City Traffic Engineer and the Principal Engineer to discuss noise mitigation alternatives provided by the public.

The total cost for the staff identified preferred alternative is approximately $20 million. The preferred sound-wall design and noise attenuation alternative consists of the following:

1. A 14-foot-high sound-wall using acoustical absorption material on the west side of Alameda Street

2. The closing of the street openings east of Alameda Street between East Tyler and East Washington Streets with a 14-foot high sound-wall and an off-set cul-de-sac

3. A 14-foot-high sound-wall between existing industrial buildings on the west side of the alley

4. Installation of 5 fire hydrants east of Alameda Street on east/west streets

5. Insulating the closest three houses from Alameda Street with new energy efficient windows, doors, wall insulation and new heating/air-conditioning systems

The various components associated with the above preferred alternative can be viewed individual or in various groupings. Implementation will ultimately be determined based upon evaluating a final project design, completing the CEQA process and obtaining necessary funding for the partial, phased or complete build-out of the sound-wall design and noise attenuation project.

Regarding, the $1 million that the city previously received in 1999 from ACTA for noise mitigation along Alameda Street, planning staff confirmed that the complete funds are still in a city reserve account and available for use. Furthermore, the city retained Mr. John Young with C J Strategies LLC., based in Washington D.C. to explore funding opportunities for this project. Planning staff previously met with Mr. John Young, gave him a tour of the affected area and presented the -wall design noise attenuation alternative with projected costs.

III. Recommendation

That the Planning Commission:

- **REVIEW** and **PROVIDE** comments for implementing the subject "Preferred Alternative" for a sound-wall and noise attenuation project

IV. Exhibits

1. Planning Commission staff report for April 8, 2008 on the Alameda Street Sound-wall Noise Mitigation Workshop
2. Alameda Street cross-section
3. Preferred Alternative map
4. Preliminary Preferred Alternative Cost Estimate
5. Noise Consultant's Study

Prepared by: _____
Zak Gonzalez II, Associate Planner

Reviewed & Approved by: _____
Sheri Repp Loadsman, Planning Officer

ZG: srAlamedaPCWorkshop

CITY OF CARSON

PLANNING COMMISSION STAFF REPORT

Workshop:	April 8, 2008
SUBJECT:	Alameda Street Sound-wall and Noise Mitigation Workshop
APPLICANT:	City of Carson
REQUEST:	Workshop to discuss sound-wall design and noise mitigation alternatives for train and diesel truck noise along Alameda Street between Dominguez Street and Freeway 405
PROPERTY INVOLVED:	Light-industrial zoned properties and residences east of Alameda Street between Dominguez Street and 405 Freeway to the Harbor View Avenue alignment

---

COMMISSION ACTION

_____ Concurred with staff

_____ Did not concur with staff

_____ Other

COMMISSIONERS' VOTE

AYE	NO		AYE	NO	
		Chairman Faletogo			**Graber**
		Vice-Chair Hudson			**Saenz**
		Cannon			**Verrett**

I. Introduction

The purpose of this workshop is to discuss sound-wall design and noise attenuation alternatives to mitigate diesel truck and train noise along Alameda Street (Alameda Corridor) between Dominguez Street and the San Diego 405 Freeway to the Harbor View Avenue alignment.

II. Background

The Alameda Corridor is the primary rail access and a significant truck route to and from the ports of Los Angeles and Long Beach. The Alameda Corridor is located in southern Los Angeles County, California, running from the ports of Long Beach and Los Angeles 20 miles north to downtown Los Angeles, primarily along and adjacent to Alameda Street. The project extends through or borders the cities of Vernon, Huntington Park, South Gate, Lynwood, Compton, Carson, Los Angeles, and the County of Los Angeles. In 1989, the Alameda Corridor Transportation Authority was created to have design and construction responsibility for the Alameda Corridor. The Alameda Corridor Transportation Authority (ACTA) and cities along the corridor have made significant improvements along the length of the route to reduce delays, increase safety and lessen the impact of traffic on the adjoining neighborhoods.

The 1993 Alameda Corridor EIR/EIS identified that train noise levels in the subject location met Cal-Trans "Noise Abatement Criteria" of 67 dBA decibels exterior noise levels near residences. This EIR/EIS further identified a sound-wall location in the subject area to mitigate identified excessive noise levels. The existing noise impact from the Alameda Corridor on the adjacent residents within the Dominguez neighborhood area is significant. Trains couple and idle at the Dominguez Yard and along the nearby rail lines creating loud noises. Noise levels are expected to increase as a result of increased volume of truck traffic associated with the completion of the proposed SR-47 Expressway and Schuyler Heim Bridge road and bridge improvements and other rail and transportation related projects near the ports.

Over the past 20 years, the residential community has expressed a desire for a sound wall to lessen the noise generated by the train and anticipated increased truck traffic. Both ACTA and the City of Carson acknowledged the need for a sound wall. Numerous discussions and community meetings have discussed alternatives but no final plans were developed due to difficulties in identifying an appropriate location, design and funding.

On May 2, 2006, the Carson City Council and Redevelopment Agency directed staff to retain a consultant through a Request for Proposal process to conduct the studies required to implement a sound barrier. Such studies would include alternative feasibilities analysis and preliminary designs to study and mitigate loud noise.

On June 5, 2007, staff retained Tetra Tech, an engineering/planning firm to prepare the Alameda "Sound-wall Feasibility Study". Tetra Tech completed the feasibility study in March of 2008, and identified four alternatives. The four alternatives are summarized as follows:

1. Alternative 1 is a 14 foot high masonry wall constructed at grade on the west side (business side) of the alley in properties currently occupied with industrial and commercial structures. Acquisition of private property is required between Dominguez and Carson Streets. The wall would be continuous with no breaks and would close access to side streets between Dominguez and Carson Streets.
2. Alternative 2 is a 6 foot high landscaped berm with an 8 foot high masonry wall erected atop of the berm. Acquisition of properties and street closure would also apply to this alternative.
3. Alternative 3 utilizes existing 2 story buildings as sound barriers and connects new sound-walls between the existing buildings. This alternative would require acquisition of land requiring sound-walls and does not propose side street closure.
4. Alternative 4a/b proposes a continuous 14 foot sound-wall on the east side of the alley. It would require widening the existing 15 foot alley to 26 feet and acquisition of residences east of the alley. Side street closure would also be required.

On April 3, 2008, staff in coordination with the Dominguez Area Property Owner's Association held a community meeting to discuss sound-wall design alternatives. The staff shared information regarding the potential need to acquire residential or industrial properties in order to obtain an appropriate location to place a sound wall. The community was also advised that all of the options would be subject to identifying and receiving adequate funding to complete the project.

The area south of Carson Street east of Alameda to the 405 Freeway while not addressed through the Tetra Tech study was evaluated under separate agreement. The noise study for this area found noise readings exceeding Cal-Trans "Noise Abatement Criteria". However, a sound-wall may not be the best approach to mitigate excessive noise levels in this area since constructing the wall may require closing 218th Place, the main point of vehicular access to this residential area. Staff will hold a separate community meeting with residents in this area and discuss alternative noise mitigation such as residential sound insulation programs.

III. Analysis

Staff has completed its evaluation of the sound-wall feasibility study and has also evaluated other noise mitigation alternatives. Other alternatives evaluated include: various street closure designs (cul de sac or hammer head turn-arounds); economic development opportunities for commercial/industrial properties by adding parking via alley widening; and a sound insulation program (similar to airport mitigation program used in the City of Inglewood) that retrofits residences with windows, walls, doors, and ceiling through increased insulation treatments. Additionally the residences air/heating systems may also require retrofit and or replacement to gain full benefit of structure insulation upgrade.

The 1993 Alameda Corridor EIR/EIS identified a sound-wall location in the Dominguez area to mitigate identified excessive noise levels. With the addition of new projects that increase rail and truck activities along the Alameda Corridor, the noise levels are expected to increase. The noise studies of the Tetra Tech sound-

wall feasibility study re-affirm previous noise studies in this area. Therefore, staff is presenting to the Planning Commission, Tetra Tech's Sound-wall Feasibility Study, and other potential noise mitigation alternatives to obtain comments that may assist in providing the best sound-wall/noise mitigation alternative to improve the subject area resident's health and quality of life.

Information obtained from this meeting will be utilized to refine the noise mitigation alternatives. There is a need to identify a preferred alternative so that projected costs can be determined. Additionally, if the preferred alternative requires acquisition of property, the City Council and Redevelopment Agency would need to determine a willingness to assist with the purchase and eminent domain proceedings. Staff is currently working with ACTA to identify potential funding sources and will continue to do outreach with ACTA, Cal-Trans and other key stakeholders.

IV. Recommendation

That the Planning Commission:

- **REVIEW** and **PROVIDE** comments and direction to determine a preferred noise mitigation alternative for the Dominguez area.

V. Exhibits

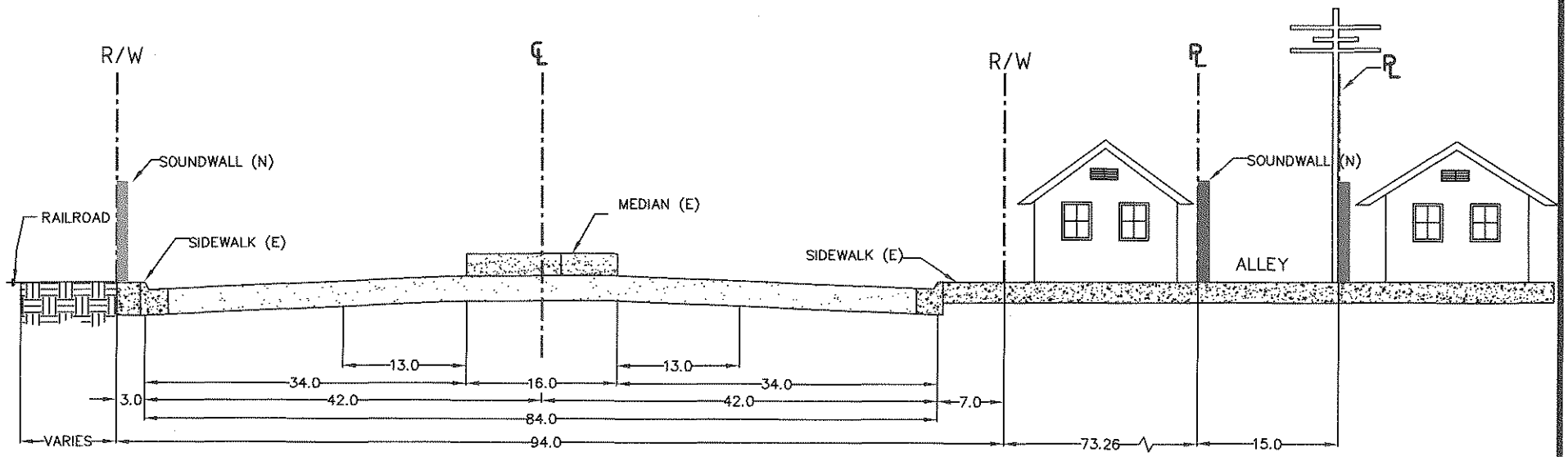
1. Tetra Tech's Sound-wall Feasibility Study

Prepared by: _____
Zak Gonzalez II, Associate Planner

Reviewed & Approved by: _____
Sheri Repp, Planning Manager

ZG: srAlamedaPCWorkshop

Exhibit 2



LEGEND

PROPOSED WALL–EAST SIDE OF THE ALLEY ON STREET

PROPOSED WALL–WEST SIDE OF THE ALLEY

PROPOSED WALL–WEST SIDE OF ALAMEDA ST.

N

ALAMEDA STREET CROSS SECTION

SCALE: 1:16

C:\Documents and Settings\jgonzale\Desktop\Alameda Section detail.dwg, 11/18/2009 11:44:59 AM

PREFERRED SOUND-WALL NOISE MITIGATION ALTERNATIVE

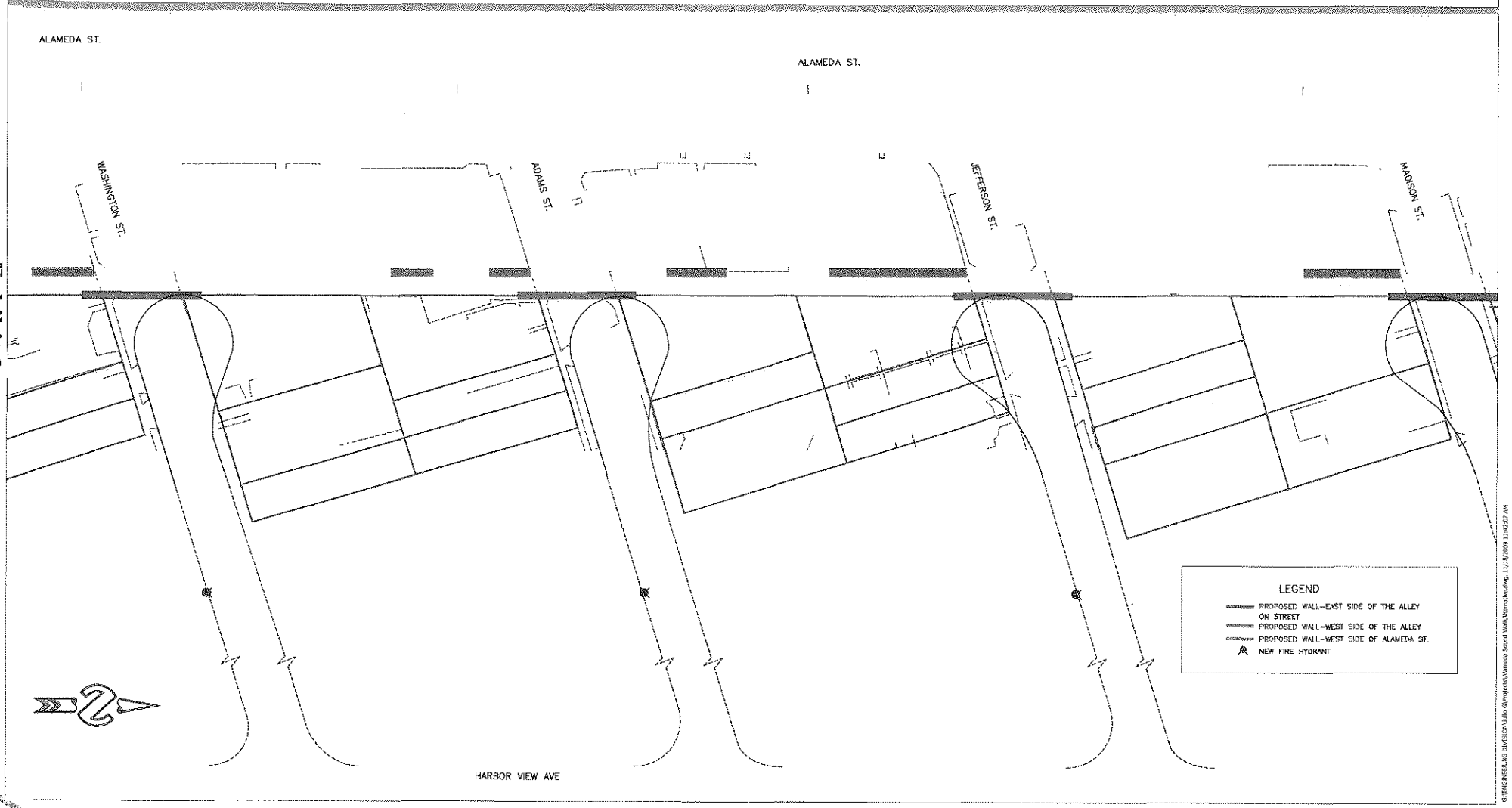


Exhibit 3

9

SOUNDWALL ON ALAMEDA STREET
PREFERRED ALTERNATIVE

SUMMARY:

1. **Cost of soundwall between exist. bldgs. - - - - - - - - - - - $1,100,000.00**
2. **Insulating first 3 rows of houses - - - - - - - - - - - - - - - - $ 2,520,000.00**
3. **Property acquisition (for cul-de-sac construction) - - - $11,000,000.00**
4. **Cul-de-sac and soundwall construction - - - - - - - - - - - $ 870,000.00**
5. **Installation of fire hydrants - - - - - - - - - - - - - - - - - - - $ 100,000.00**

SUB - TOTAL - - - - - - - - - - - - - - - - $ 15,590,000.00

6. **Cost of soundwall on the west side of Alameda St. (Using noise absorbent materials)- - - - - - - - - - - - - - - - $ 2,500,000.00**

GRAND TOTAL - - - - - - - - - - - - - - - - $ 18,090,000.00

1.) Utilize existing 2 story bldgs. as sound barrier and construct new soundwall between existing buildings:

- Cost of soundwall between exist. bldgs. = **$ 1,100,000.00**

2.) Insulating existing first 3 rows of houses from Dominguez St. to 220th St.

- Insulating 1st 3 rows of houses = 63 houses @ $ 40,000.00/house
  = **$ 2,520,000.00**

3.) Property Acquisition for closing the side street by construction of soundwall and offset cul-de-sac.

- Property Acquisition = 22 parcels @ $500,000.00/parcel
  = **$11,000,000.00**

4.) Construction of soundwall & offset cul-de-sac.

- 8,400 S.F. of soundwall @ $50.00/S.F. = $ 420,000.00
- 9 cul de sac @ $50,000.00/cul de sac = $ 450,000.00

$ 870,000.00

5.) Installation of Fire Hydrant per FD requirements:

- 5 FH @ $20,000.00/FH = **$100,000.00**

6.) Construction of soundwall on the west side of Alameda St. = **$2,500,000.00**

ATSConsulting
acoustics, transportation + strategy

MEMORANDUM

To: Sherri Repp
Zak Gonzalez II
City of Carson
Economic Development/Planning Division

From: Hugh Saurenman
ATS Consulting

Date: July 22, 2008

Subject: Acoustical Benefits of Sound Wall on West Side of Alameda Street

INTRODUCTION

At the request of the City of Carson Planning Division, ATS Consulting has reviewed the potential locations and benefits of placing a sound wall along the west side of Alameda Street between Dominguez Street on the north and I-405 on the south. The general area and location for a sound wall on the west side of Alameda Street is shown in Figure 1.

The goal of the sound wall would be to reduce noise from freight rail activities in the residential areas east of Alameda Street. A wall west of Alameda Street would not reduce noise from traffic on Alameda Street and could result in a small increase in traffic noise because of reflections off the wall. The City of Carson has conceptual plans for a sound wall east of Alameda that would reduce noise from both traffic and rail operations. Options for the wall east of Alameda include a solid wall east of the commercial properties fronting on Alameda and redevelopment of the commercial area so that the buildings act a sound wall. The expectation is that a wall on the west side of Alameda would be an interim measure until the wall or redevelopment on the east side of Alameda has been completed.

The topics covered in this memorandum are:

1. Where the wall should be located to be effective.
2. The attenuation of different rail noise sources that could be achieved with different heights walls.
3. How much reflections off the wall would increase levels of traffic noise in the residential area east of Alameda.

Attached as an appendix is some information on suppliers of sound wall products. The list does not include all suppliers of suitable sound wall systems but is representative of the products that are available and would be suitable for the proposed sound wall along the west side of Alameda.

RAIL NOISE SOURCES

Noise sources associated with the Union Pacific rail yard and the Alameda Corridor mainline tracks include locomotives, intermittent train horns, wheel/rail noise from steel wheels rolling on steel rails, impact noise from assembling trains and from trains starting up and stopping, and activities within the UP yard. Although there are some curves in the yard for access to the storage tracks, we have not observed wheel squeal to be a major issue.

801 South Grand Avenue, Suite 575 Los Angeles, CA 90017 t 213 488 7770 f 213 488 0270 www.ATSConsulting.com

Our understanding is that the community is most annoyed by the impact noise from coupling cars together, locomotive engine noise, and train horn noise. A key part of the design of any sound wall is to make sure that the wall blocks the direct path between the noise source and the receiver's ears. The equivalent heights of the principal noise sources are:

- Locomotive engines and fans: 8 ft.
- Locomotive horns: 12 to 15 ft.
- Steel wheels rolling on steel tracks: 2 ft. Our observation is that noise levels are relatively low when trains are moving on the Alameda Corridor tracks or on the yard tracks except when the locomotives are passing. The wheel/rail noise is source A in Figure 2.
- Impact noise: 4 ft to 14 ft.

The wide range in the source height indicated for impact noise is because the source height depends on which part of the rail car and containers the noise is radiated from. Figure 2 shows a typical container flatcar with two containers. The letters indicate locations on the vehicle and containers that impact noise could be radiated from. First is at the couplers (B). This is where the impact occurs but is a relatively inefficient noise radiator because of the small surface area. It is about 3 ft above the top of rail. The second is the car skirt (C). The top of the skirt is about 4 ft above the top of rail. The final source is the container sides. In essence, the containers could act as large sounding boards amplifying the radiated noise. For a double stack container car or a boxcar, the equivalent noise source height would be 10 to 12 ft above top of rail; for a single container the equivalent height would be 7 to 8 ft high. It is important to note that the heights are relative to top of rail. As shown in Figure 2, south of Carson Street the top of rail is approximately 4 ft higher than the sidewalk.

For this analysis we have used the following noise sources and source heights relative to top of rail:

Source	Height	
Locomotive Horn	12 ft	
Locomotive Noise	8 ft	
Coupler Impacts 1	3 ft	(at coupler)
Coupler Impacts 2	6 ft	(flat car skirt and bottom container)
Coupler Impacts 3	11 ft	(top container)

POTENTIAL LOCATIONS FOR BARRIERS

Area 1 (South of Carson Street)

There are limited options for locating sound walls on the west side of Alameda. For Area 1 south of Carson, there is an approximately 60-ft wide buffer of open land between the tracks and Alameda. As shown in Figure 3 and Figure 4, a sound wall could be placed either along the tracks or along Alameda. The preferred location for the wall is location 1 along the Union Pacific tracks with sufficient room between the tracks and the wall for vehicle access. Sound wall location 2 along the west side of the Alameda sidewalk is an alternative location for the wall south of Carson Street.

The advantage of location 1 is that the wall would be close to the noise sources, which would make it more effective at reducing train noise. The rule of thumb is that sound walls are most effective when they are placed close to the receiver or close to the noise source. The obvious disadvantage is that location 1

would require cooperation and approval of the railroad and could leave a "no-man's land" between the wall and Alameda Street.

Sound wall location 2 is along the sidewalk of Alameda. This is a less favorable location for the wall because the footing for the wall would be located approximately 4 ft below the top of rail and because there would be a greater distance between the wall and the noise source, which would make the wall less effective at reducing noise.

As shown in Figure 4, for both wall locations the wall would need to extend from just north of the I-405 off ramp to a point approximately 350 ft south of Carson Street.

Area 2

Because of the short distance between the tracks and Alameda north of Carson Street, the only feasible location for the sound wall is at the railroad property line. As seen in Figure 5, the track ballast extends to the sidewalk and it is only about 10 ft from the sidewalk to the side of the rail cars. The wall would need to extend from Carson Street to just south of Dominguez Street (see Figure 6). The top of rail north of Carson Street is approximately 1 ft higher than the sidewalk.

BARRIER EFFECTIVENESS

We have used standard formulas for sound wall attenuation to estimate the noise attenuation that would be provided by various height walls. The results for wall heights of 8 ft, 12 ft and 14 ft are summarized in Table 1. The heights are measured from the top of rail, which means that for location 2 south of Carson Street the wall heights relative to the existing grade are 12 ft, 16 ft, and 18 ft.

A common rule of thumb is that a noise mitigation measure should provide a minimum of 5 decibels of attenuation. This is sufficient for most people to notice that noise levels are lower. A reduction of 10 decibels is commonly perceived as making the noise source half as loud and is considered a substantial noise reduction. The attenuations in Table 1 that are 5 decibels or greater are in **bold**, and those 10 decibels or greater are in **bold and blue**.

An 8-ft wall is the minimum height that would have any noticeable effect on the impact noise. It would have no effect on the horn or locomotive engine noise. The 12-ft wall would provide substantial reduction of most potential sources of the impact noise and would have a marginal effect on locomotive noise. The 14-ft wall is the minimum height required to be effective at reducing horn noise. It would also be very effective at reducing noise from all the other sources. Whether a 14-ft wall would be practical is questionable, particularly at location 2 south of Carson Street where the grade is approximately 4 ft below the top of rail.

MATERIALS FOR BARRIERS

Effective sound walls have been constructed from a variety of materials. The primary requirements for a wall to be acoustically effective are that the wall material have a minimum surface density of 4 lb/ft^2 and that it be an impervious material. Most highway sound walls are constructed of concrete or masonry block. However, 1" thick plywood meets the density requirement and would be equally effective as a concrete sound wall at reducing noise levels. Plywood is often used for temporary barriers at construction sites, although it has obvious esthetic and maintenance problems for permanent installations.

Another option is to use composite sound walls that are proprietary products. There are a number of potential suppliers of suitable products. The material cost for the commercial products tends to be higher but the construction costs can be much lower. For barriers that will not be in place for an extended

period, mass-loaded vinyl curtain barriers are a viable option. These are often used on construction sites where they will be in place for several years. The curtains are held in place by a metal framework; often the framework is supported by standard "k-rail" guardrail. The advantages of the curtain walls are that they are relatively inexpensive, that they are straightforward to install and take down, and, after the project is complete, the materials are usually recycled by the supplier.

REFLECTED NOISE

The traffic noise reflected off a sound wall west of Alameda would tend to increase traffic noise in the residential area east of Alameda Street. Except for the residences closest to Alameda, the effect would be marginal and may not be noticed by residents. Even at the properties adjacent to the alley east of Alameda, the noise level increase caused by reflections would be less than 1 to 1.5 decibels. A 1-decibel change is normally considered an insignificant and unnoticeable noise level increase. However, people often say that they believe that the noise levels increased after a sound wall was installed on the opposite side of a noise source. Possible reasons for this include:

- annoyance that a sound wall was installed to protect people on the opposite side of the roadway and not for them,
- reflections off the wall causing a small change in the character of the traffic noise that is noticeable to those who have lived with the noise for a long period of time, and
- people who have lived with the traffic noise for a long time may be sensitized to the sound levels and be able to notice a 1 to 2 decibel change in noise levels.

The amount of acoustic energy reflected by a sound wall can be substantially reduced by acoustical absorption material placed on the traffic side of the wall. The acoustical absorption material can be as simple as fiberglass bats or semi-rigid fiberglass panels. In addition, there are a number of sound wall products that incorporate acoustical absorption on one or both sides. If the acoustical curtains are a feasible option, there are models that incorporate absorption material on one side.

Table 1: Sound Wall Effectiveness			
Noise Source	**Barrier Attenuation for Different Height Walls***		
	8 ft	**12 ft**	**14 ft**
South of Carson, Location 1(30 ft from tracks)			
Horn	0	1	**6**
Loco	0	**9**	**13**
Coupler	**10**	**15**	**15**
Skirt/Container	4	**12**	**15**
Top Container 2	0	3	**8**
South of Carson, Location 2 (next to Alameda sidewalk)			
Horn	0	2	**6**
Loco	1	**8**	**11**
Coupler	7	**12**	**14**
Skirt/Container	3	**10**	**12**
Top Container 2	0	4	**8**
North of Carson			
Horn	0	0	8
Loco	0	**13**	**15**
Coupler	**15**	**15**	**15**
Skirt/Container	7	**15**	**15**
Top Container 2	0	4	**11**

Note:
* The attenuations that are 5 decibels or greater are in **bold**, and those 10 decibels or greater are in **bold and blue**. An attenuation of 5 decibels is sufficient for most people to notice and an attenuation of 10 decibels or greater is usually considered a substantial noise reduction.

Figure 1: Aerial Photograph of Area

Figure 2: Noise Source Locations for Container Flatcar

Noise Sources:
A: Wheel/rail noise (steel wheels rolling on steel rails)
B: Couple impact noise (when coupling cars and when slack is taken up as trains start up
C: Impact noise radiated off of car skirt
D: Impact noise radiated off of containers

Figure 3: Open Area between Sidewalk and Tracks, Alameda, Area 1 (South of Carson)

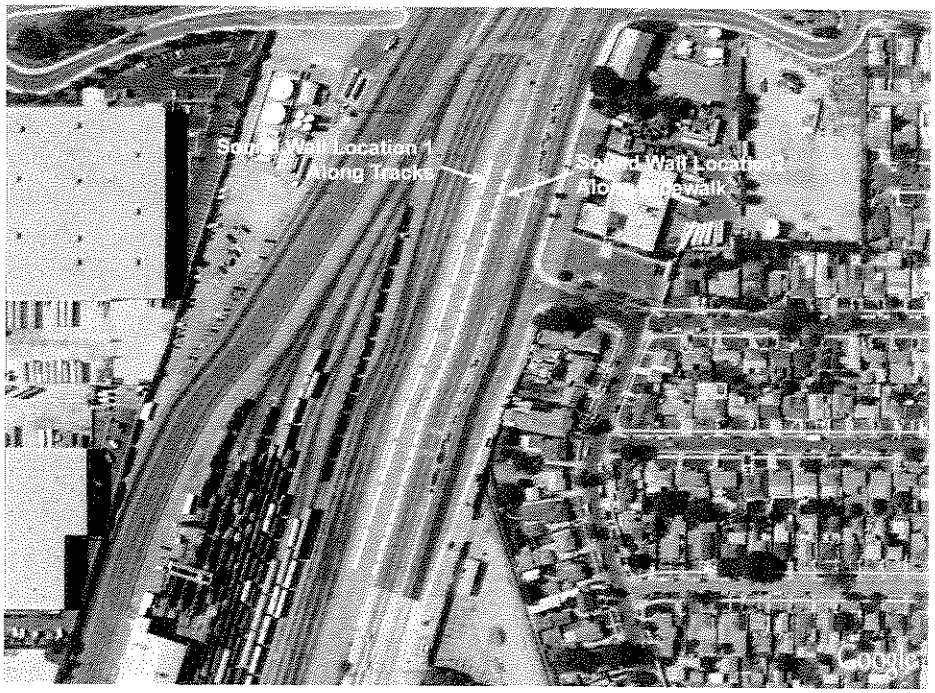


Figure 4: Locations for Barrier on West Side of Alameda, Area 1 (South of Carson)

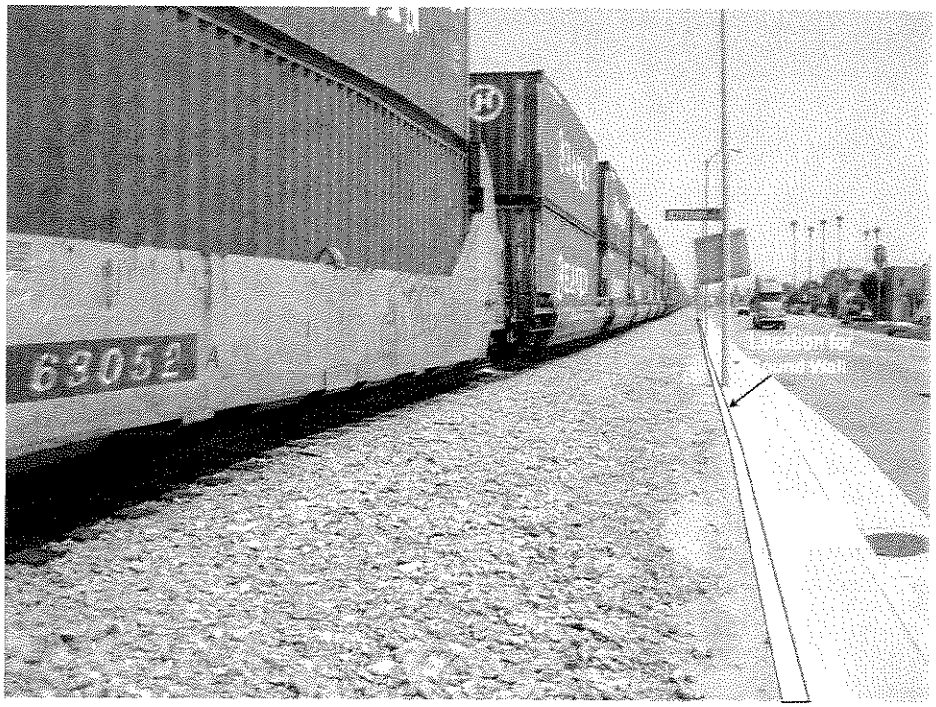


Figure 5: West Sidewalk of Alameda, Area 2, North of Carson

Figure 6: Location for Barrier on West Side of Alameda, Area 2 (North of Carson)

APPENDIX A. SOUND WALL SYSTEMS

The most common materials used for sound walls on roadways are concrete, either cast-in-place or precast panels, and masonry block. The primary requirement for a sound wall material is that the sound transmitted through the wall material be at least 10 decibels less than the sound transmitted over the top or around the sound wall. This means that a sound wall designed to reduce noise levels at the receiver by 15 decibels, which represents a very effective sound wall, should reduce sound transmitted through the wall by at least 25 decibels. Sound transmission of materials is generally characterized using the STC rating. STC, which stands for Sound Transmission Class, is approximately equal to the A-weighted reduction that would be achieved by the material. That is, a material with an STC of 25 will have a transmission loss of approximately 25. There are a wide variety of materials and commercially available sound wall systems that have an STC rating of 25 or greater.

Discussed below are several of the commercially available sound wall systems that could be used for the proposed sound wall along Alameda. Table 2 is a summary of the seven different systems. This list is not exhaustive. Rather these systems were selected as representative of the systems that are available. There are a number of other commercially available products designed specifically for sound wall systems that would be equally effective.

Carsonite®

Carsonite® is a composite system using fiberglass-reinforced composite for the shell and shredded tires for the filler. A 12-foot-high sound wall can use up to 250,000 lbs. of recycled tire rubber per mile of installation. This system was used for that sound wall along the Union Pacific tracks in Pomona, CA that is shown in Figure 7. The basic system is load bearing structural composite tongue and groove building planks that are placed between beams. The shell does not support combustion and the system can contain a fire retardant when requested. The shell wall can be painted.

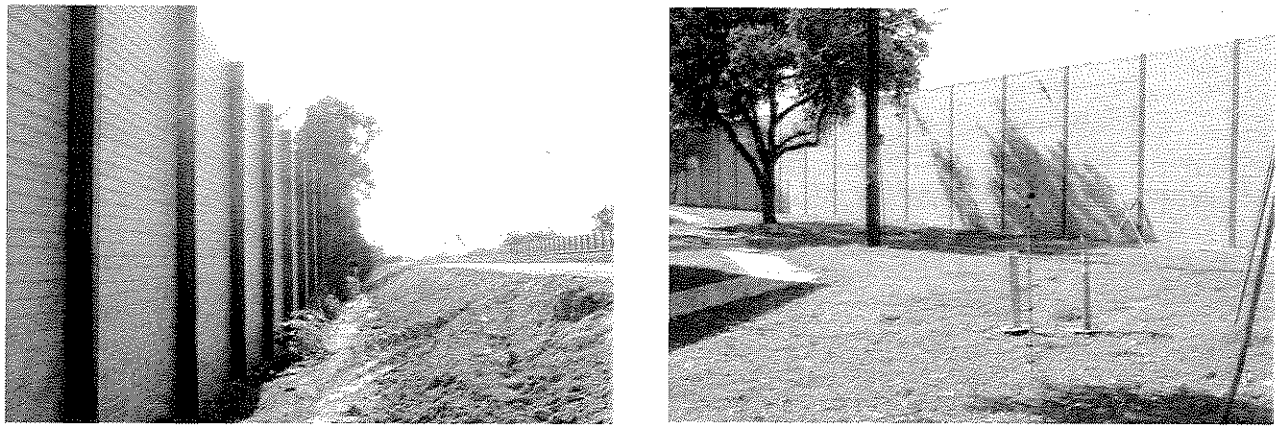


Figure 7. Carsonite Sound Wall at Lanterman Development, Pomona, CA

(Photograph on left is track side of wall and photograph on right is receiver side)

Plywall®

Plywall® by Hoover Treated Wood Products, Inc. is a pre-engineered treated wood noise barrier system. Hoover claims that the cost is 45% less than concrete walls of that have the same noise ratings. It has been used in a wide-variety of outdoor sound wall applications for residential neighborhoods near highways transit systems. According to the Hoover web site:

"PLYWALL® is adaptable to various heights, soils, climates, and terrains. Because of the warm natural appearance of wood and our specific design, our barrier system is aesthetically pleasing and well received by the public. Compared to other barriers, like concrete and steel, PLYWALL® has economical advantages, including material, repair, and installation costs."

Photographs of Plywall installations are shown in Figure 8.

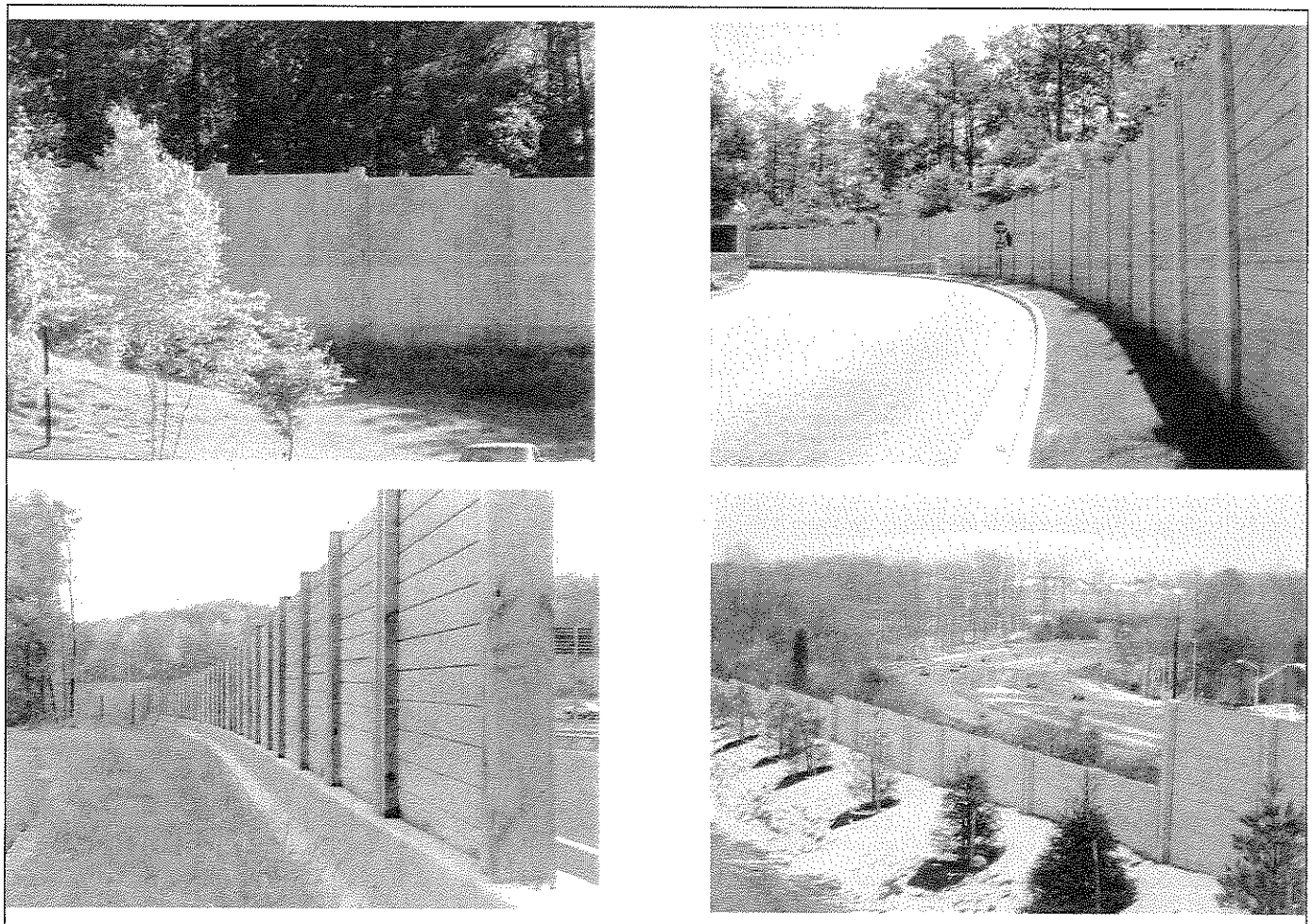


Figure 8. Examples of Plywall® Installations

Acoustax®

Acoustax sound walls are designed to be acoustically absorbent. That is, sound is not reflected off the barrier face, rather it is absorbed. Using absorptive barriers will generally improve the noise reduction, particularly when there are parallel barriers that the sound can reflect back and forth between the walls. The description on the Acoustax web site is:

"Acoustax is a stackable, lightweight noise barrier designed to remedy a broad range of community and industrial noise problems. Certified tests prove Acoustax absorbs a broad frequency spectrum and prevents noise transmission through the barrier, making it ideal for use as noise walls – absorbing twice as much noise as painted concrete block."

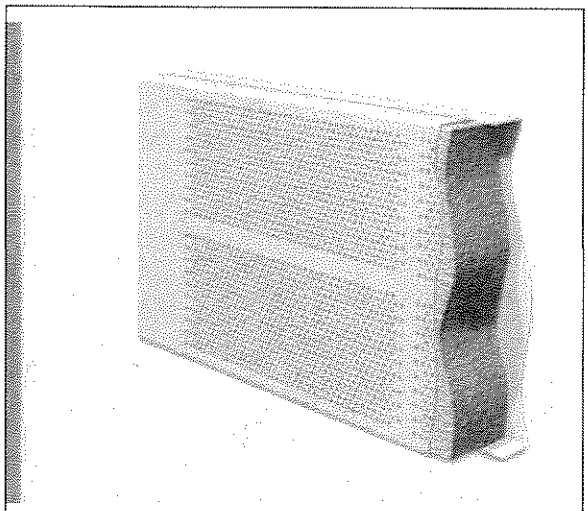


Figure 9. Acoustax® Sound Wall Panel

As seen in Figure 9, the basic design is perforated metal covering an acoustically absorbent material. The covering can be either perforated aluminum (3 lb/ft^2) or galvanized steel (7.5 lb/ft^2) with panels mounted horizontally or vertically. The lighter weight of Acoustax makes it easier and less expensive to install than concrete panels.

Sound Fighter®

This is a second example of an absorptive sound wall, in this case a composite made of polyethylene channels that are filled with mineral wool. The channels are installed in beams that are made of Aluminum or fiber-reinforced plastics (FRP). This is a very-lightweight system and is claimed to be graffiti-proof. According to the supplier: "The Sound Fighter® LSE Noise Barrier Wall System is the perfect solution to virtually any highway or industrial noise application. The noise absorptive panels are easy to install and maintenance free. … Sound Fighter has been manufacturing and shipping the LSE Noise Barrier Wall System throughout the world for over 30 years." An interesting feature of this system is that it is easy to both assemble and disassemble.

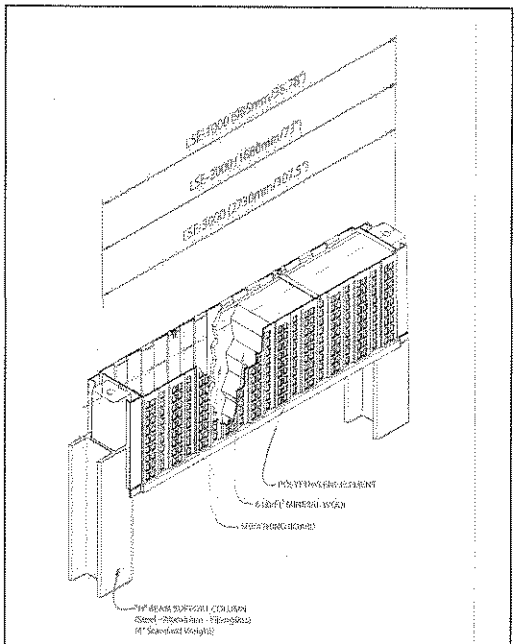


Figure 10. Sound Fighter Systems

Quietline®

QuietLine is a sound wall system similar to the SoundFigher and Acoustax absorptive barriers discussed above.

Noise Control Corporation

Noise control corporation provides a variety of sound wall systems ranging from blankets held in place with a metal framework to solid panels. The Noise Control Corp. blankets and similar products by other suppliers are often used for construction sites and are usually mass loaded vinyl. The curtain material is returned to the supplier once the construction project is complete. The installed cost of temporary barriers of this type is currently between $350 and $500 per foot. The installed price is sometimes lower when a third party contractor does the installation rather than the supplier.

The figure to the right shows a temporary barrier being installed at a construction site.

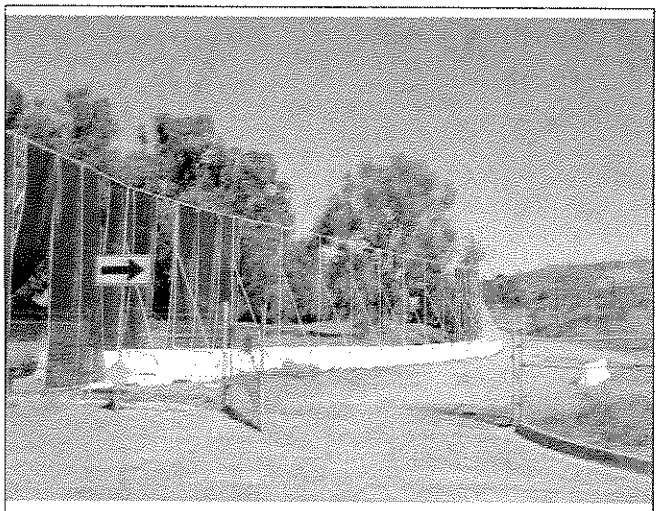


Figure 11. Temporary sound wall under construction along West Los Angeles College haul road (loaded-vinyl curtain)

Table 2. Examples of Alternative Barrier Systems

Product	Manufacturer	STC[1]	Material	Cost per square ft[2]	Example Projects
Carsonite®	Carsonite Composites www.carsonite.com 800-648-7916	36	Composite channels filled with rubber from recycled tires	Negotiable	City of Long Beach has recently used this for 33,000 feet of sound wall
Plywall®	Hoover Treated Wood Products, Inc. www.plywall.com 800-531-5558 Ext: 189	31/36	Pre-fabricated wood	Negotiable	Stocktown, GA Grovetown, GA
Acoustax®	Acoustax Noise Barriers www.acoustax.com 570-430-1058	34 (Al) 39 (Steel)	Perforated metal covering absorptive material	$20 - $30	
Sound Fighter Systems®	Sound Fighter Systems, LLC www.soundfighter.com 318-861-6640	33	Polyethylene elements filled with mineral wool and using Al/FRP beams	$30 - $35	Used for several highway projects by state agencies including Caltrans
QuietLine®	Noise Barriers, LLC www.noisebarriers.com 847-843-0500	37	Perforated metal covering with absorptive material	Negotiable	
Noise Barrier Blankets	Noise Control Corporation www.noisecontrol.com	Up to 31	Various types of blankets and panels	$18 to $25 (blankets)[3]	West Los Angeles College Construction Site

Notes:
(1) Cost varies with the choice of material for beams and type of installation.
(2) Includes installation cost. Installation cost may be higher for relatively small sound walls.
(3) Based on 20 ft high barrier that client received bids on of $350 to $500 per linear foot (installed cost).