IMPROVEMENTS TO TORREY PINES ROAD
BETWEEN LA JOLLA SHORES DRIVE AND PROSPECT PLACE

CONCEPTUAL DESIGN REPORT

By

TRAN CONSULTING ENGINEERS

JANUARY 2011

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I. EXECUTIVE SUMMARY

Torrey Pines Road between Prospect Place and La Jolla Shores Drive is proposed to receive improvements to provide enhanced circulation of vehicle, bicycle and pedestrian traffic. Tran Consulting Engineers (TCE) technically evaluated items identified in the Torrey Pines Road Corridor Study, studying improvements in the alignment from an engineered approach. TCE developed a project alignment which includes various improvements. The project area is shown in Figure 1.

Conceptual design efforts generated a number of studies, technical memoranda and other documents to assess technical aspects of the project. All of these documents are presented in this Conceptual Design Report as appendices. They include the following:

I. **Reports and Studies**
   1. Report of Geotechnical Reconnaissance
   2. Report of Initial Site Assessment

II. **Technical Memoranda**
   3. Median Options
   4. Fences
   5. Guardrail and Bollards
   6. Trees
   7. Retaining Wall Considerations

III. **Other Documents**
   8. Letter of Extra Information on Wall Costs and Wall Options
   9. Project Cost Estimate
   10. CEQA Checklist at Conceptual Level
   11. Engineering Study for Project Scheduling
   12. Picture Package

The following are brief summaries of the reports and studies, technical memoranda and other documents developed for the project design.

1.1 REPORTS AND STUDIES

A. Report of Geotechnical Reconnaissance

The report generally presented the following soil and geotechnical conclusions and recommendations

- The active Rose Canyon fault crosses the eastern portion of the alignment. Therefore there is, a high potential for ground rupture and high ground accelerations from a nearby earthquake.
- Landslides or indications of deep-seated slope instability were not observed underlying the project site however they have been mapped in areas south of the project site.
- Potentially compressible fill soils and unknown thicknesses of potentially compressible alluvium may be encountered in some areas under existing roadways particularly the eastern part of the project. Compressible soils could impact the design of improvements or related structures.
- Liquefiable alluvial soils are present beneath the eastern end of the alignment.
- It is our understanding that a soil nail retaining wall with a dura-block facing is under consideration for the project. This retaining wall type would be feasible at the site.
- Generally soils in the area could be excavated with standard heavy-duty excavation equipment.

A comprehensive geotechnical evaluation, including subsurface exploration and laboratory testing should be conducted prior to design and construction. For specific details see that report which is contained in the Appendix

B. Report of Initial Site Assessment

This report generally presented the following conclusions and recommendations.

- The active gas station located at the east of the project was the subject of an unauthorized release According to SWRCB Geotracker website, depth to groundwater at monitoring wells associated with the gas station was generally greater than 20 feet bgs. There is a low likelihood that this case represents a significant project environmental concern because project improvements are not anticipated within approximately 350 feet of the gas station property boundary or involve construction that reaches groundwater.
- Asbestos-containing materials may be present within the project area
- PCBs from electric transformers may be present at the site.
- Lead-based paint from painted curbs, poles, and roadway striping and other features may be present within the project area.
- Materials falling under the UWR requirements such as mercury-containing switches, fluorescent light tubes, PCB-containing light ballasts, hi-intensity vapor lights and associated ballasts may be present in the project area.

Generally the following additional activities are recommended before or during the Torrey Pines Road project:

If disturbance of potentially hazardous materials is proposed, survey and/or sample to evaluate their presence and location, Work in accordance with applicable guidelines and regulations.

Follow appropriate abatement measures using trained and certified workers and supervisors. Handle and dispose of potentially hazardous materials in accordance with applicable regulations.

Groundwater monitoring wells were not noted, however if groundwater monitoring wells are encountered and disturbed, coordinate with the responsible party and/or regulatory agency

Further assessment must be performed if soil or groundwater suggestive of contamination is encountered during construction. If discovered, regulatory agencies may require additional environmental investigation and/or mitigation, particularly if there is a potential to affect public health, safety, and/or the environment.

1.2 TECHNICAL MEMORANDA

A. Median Options

Medians were studied to identify safe and reliable methods for providing turning pockets where necessary, to notify vehicles when entering the median area or crossing into oncoming lanes and to provide a route for emergency vehicles to travel through during congested traffic periods.

TCE studied traffic striping, a required delineator; grooved pavement and stamped concrete pavement. Yellow stripes along both edges of the median were identified as a basic requirement. Grooves are beneficial and inexpensive. Stamped concrete is more expensive, but provides a special look and may have a traffic calming effect. In the end TCE recommended to include stamped concrete in the median

area if monies are available. Otherwise groove the median area on the edges, and leave stamped concrete for the future.

B. Fences

Fences were studied to identify safe barriers along the alignment for the public and residents. The La Jolla Corridor Study identified a wood post and wire fence type to open areas where view corridors exist. View corridors are identified in the La Jolla Community Plan. From a technical point of view this fence is limited in its ability to provide safe protection for the public in particular at edges of steep embankments. TCE identified a fence type for this application common in San Diego, a concrete wall with Plexiglas mounted on top. This fence type also opens the view, while reducing trespassing and littering in adjacent properties, it also provides sound attenuation. Other locations along the alignment will accept the wood post and wire fabric fence however TCE recommended better corrosion resistance to the wire fabric. In one location TCE identified the need for a conventional wood privacy fence because of the proximity of a home to the road. Locations, lengths and estimated costs for the fences are shown below:

Fence No. & Station	Approx. Length	Estimated Cost	Notes & Comments
Fence 1 12+00-16+00	400’	Parapet /Plexiglas: $76,000	Integrate guardrail protection or parapet and Plexiglas top to provide fence and barrier. If a guardrail type barrier is not required in specific areas, a 72-inch wood and wire fabric fence is recommended down slope to provide an unobstructed view.
Fence 2 17+30-18+20	90’	Parapet /Plexiglas: $16,200.	Recommend 72-inch high parapet and Plexiglas top. Parapet would be approximately 42 inches high and Plexiglas approximately 30 inches high.
Fence 3 21+40-23+00	160’	Parapet /Plexiglas: $30,400	Recommend 72-inch high parapet and Plexiglas top. This location must be designed to prevent cars from crossing Torrey Pines Road from Amalfi street and running down the embankment
Fence 4 32+50-35+50	300’	Wood & Metal Fabric: $9,000	A 72-inch high wood and metal fabric fence is recommended for this location
Fence 5 38+00-41+00	300’	Wood & Metal Fabric $9,000 to be determined by Park Designer	This is the location of the proposed Little Street Park indentified in the Corridor study. Initially the recommendation is for a wood and wire fabric fence. However fence style and location should be coordinated with the designer of this park. Recommendation is for locating a wood and metal fabric fence around the top of the slope.
Fence 6 41+00-44+00	300’	Wood & Metal Fabric: $9,000	Recommend replacing the existing chain link fence with the wood and metal fabric fence
Fence 7 44+00-44+60	60’	Privacy Fence: $3,000	Recommend placing a privacy fence here because of the location of a nearby home at grade with the road here.

C. Guardrail and Bollards

For safety and protection of pedestrians, guardrail is necessary as a barrier in two locations as identified in the Corridor Study, based on TCE's evaluation and input from the City Traffic Department. From a safety standpoint the use of bollards is usually reserved for very low speed areas and parking lots, therefore cannot provide protection in high speed areas. Various guardrails were selected for examination based on whether the guardrails were approved by Caltrans. TCE technically evaluated the alignment to determine whether additional locations required guardrail and no additional guardrail locations were identified. TCE looked at several types of guardrails for these locations including Thrie Beam Barrier, Three-Cable Barrier, Concrete Barrier (Type 60), Timber Guardrail, and Precast Concrete Guardwall. Of the types reviewed, the type 60 guardrail had the added versatility for providing aesthetic surface treatment on the face of the guardrail.

Type of Barrier	Cost/Ft	Advantages	Disadvantages
Thrie Beam Barrier	$120	Common, easy construction	Visually incompatible Higher O&M than concrete
Three-Cable Barrier	$50	Inexpensive Minimal visual impact	Special O&M, not used in CA. Wide median area
Type 60 Concrete Barrier	$300	Low maintenance cost Various aesthetic treatments	May block views
Timber Guardrail	$300	Minimal visual impact	No approved terminal design
Precast Concrete Guardwall	$1500+	Various aesthetic treatments Long life and durability	Very high cost No approved terminal design

The type 60 barrier was selected because it was safe by providing vehicles to return to the roadway by its design, reasonable cost and provides potential features of the ability to provide various "Caltrans approved" aesthetic treatments that would suit the community.

Costs associated with decorative type 60 guardrail for 440 feet at station 11+80 to 16+20 and 210 feet at Station 21+40 to 23+50 would be approximately $132,000 and $63,000 respectively.

D. Trees

TCE reviewed the trees recommended in the Corridor Study and in the La Jolla Community Plan. Certain trees would not be suitable for the alignment because of factors such as spread of branches and release of debris. TCE selected Washingtonia Robusta (Mexican Fan Palm) and the Queen Palm as trees that are both recommended in the documents above and could be used effectively within the alignment. Average palm tree costs installed are approximately $3000 for a 24 inch boxed tree.

E. View Corridors

The October 2007 La Jolla Community Plan identified several view corridors and scenic overlooks in the project alignment. Views behind covered and overgrown fences are striking in this corridor, to say the least. Furthermore, Torrey Pines Road is designated a "Scenic Roadway" in the Community Plan with partially obstructed views over private properties and down public R.O.W.s.

Striking views of the surrounding area and the ocean can be found in several locations in the project alignment. The technical memorandum identified view corridor and scenic overlook

locations then discussed how the views from the right of way could be enhanced. Most recommendations made reference to better fences that provided security to residents while providing more views to pedestrians and motorists. Trees were also briefly discussed and the Tree technical memorandum was referenced. Tree selection should not cause significant obstruction to views.

F. Retaining Wall Considerations

Wall surface treatment (along I 5)

By far the costliest elements of the project will be retaining walls required to widen the alignment particularly along the south side of the road. Several locations were identified. The Technical Memorandum for Retaining Wall Considerations was prepared that identified conceptual wall locations and discussed wall types basing the approach for large walls on a wall design by others that was designed several years ago within the project limits that called for an open block wall suitable for plantings. A cost estimate for adjacent retaining wall by others identified costs significantly higher than reported in the Retaining Wall Considerations Technical Memorandum. Following receipt of cost data, TCE performed additional research on retaining wall costs recently constructed by Caltrans and interviewed Caltrans personnel regarding open (planted) retaining wall successes along heavily traveled roads with regular public agency maintenance; information was uncertain regarding success of plantings (plantings on the open walls were susceptible to dying). TCE reevaluated the initial approach and reported revised recommendations in a letter report (submitted August 16). The letter reported TCE's findings, wall recommendations and estimated construction costs for several recommended wall types. The letter emphasized decorative concrete walls instead of open planted walls because of the high costs, and ability for success of plantings based on similar situations following the letter report a Project Scheduling Technical Memorandum (TM) was developed and submitted which included a construction cost estimate. In addition to scheduling, the TM discussed wall types and costs for each wall. Wall locations are reported below with recommended wall types:

Station	Description
12+80 - 16+00	Soil nailing is anticipated for this wall with a decorative surface treatment on a vertical concrete face. This wall is below and on the north side of the road
15+50 - 16+60	Soil nailing is anticipated for this wall with a decorative surface treatment vertical concrete face. A home is close to where this wall will be constructed
17+80 - 20+80	This high and steep existing slope with limited right of way is anticipated to require a soil nail wall with a decorative surface treatment on a vertical concrete face
22+70 - 25+50	A Regional Standard Drawings retaining wall can be used. See type C-11 wall detail
27+80 -29+10	A Regional Standard Drawings retaining wall can be used. See type C-11 wall detail
30+00 - 34+90	This high steep existing slope with limited right of way is anticipated to require a soil nail wall with a decorative surface treatment on a vertical concrete face

Station	Description
35+80 -37+40	This is a high steep wall that abuts the proposed wall between station 37+40 and 40+90 This wall is anticipated to require soil nailing and a decorative surface treatment on a vertical concrete retaining wall
41+50 -43+50	A Regional Standard Drawings retaining wall can be used. See type C-2 wall detail
45+00 -45+80	A Regional Standard Drawings retaining wall can be used. See type C-2 wall detail

1.3 Engineer's Conceptual Developments

A. Engineer's Conceptual Layout Plans

TCE prepared conceptual plans for the project which identify the project centerline, lanes locations of project elements such as median, fences, guardrails, view corridors, sidewalks, parkway strips, and retaining walls throughout the alignment. The plans also show the locations where pictures were taken along the alignment which was included in the Picture Package. The plans are provided in this document at the end of the executive summary.

B. Engineering Study for Project Scheduling

Within the project area there must be a certain level of scheduling to minimize community impacts and for proper project budgeting, while effectively completing the work and protecting public safety. TCE looked at two constraints to select how to schedule the project. The community is interested in completing the work as soon as possible and completing each segment of the project including all improvements within discrete stationing of the alignment. Therefore scheduling was identified by stationing on the project. Secondly, the cost of the project would be high primarily because of retaining walls. Additionally the City placed a limit for each segment of approximately $5 Million. Applying these two criteria preliminary segments were selected as shown in Figure 1.

Prioritizing the segment sequence was reviewed and criteria selected for the best sequence of completing the project. The criteria identified were: 1) level of achievement, for example TCE high scored segments that let the public quickly see completion and use the improvements so they might get behind the project; 2) Scheduling of long lead items to complete segments unencumbered by acquisition of right of way, easements and settle pending litigation; 3) Urgency of safety improvements such as construction of barriers between pedestrians and traffic. TCE weighted these criteria and selected the best sequence for constructing the segments. The recommendation was to complete the work on segment 4 between stations 35+00 and 53+00 first followed by segment 2 between Coast Walk and Viking Way then segment 1 between Prospect Place and Coast Walk and finally segment 3 east of Viking Way between stations 29+50 and 35+00.

C. Cost Estimate

The project cost estimate is reported in the project scheduling study. Utilizing pricing acquired from development of technical memoranda, Caltrans personnel, Caltrans bid tabulations, City unit rates, and market pricing TCE developed unit prices for the project then divided costs by segment. Quantities were taken from project plans quantities. Costs were escalated 30% to include contractor overhead, profit, and contingencies for further development of design detail. The estimate is in 2010 pricing.

D. CEQA Checklist at a Conceptual Level

TCE performed a brief review of environmental factors related to CEQA. Using the CEQA checklist as a format for reporting, TCE indicated what additional studies and evaluations were required for the project. In some cases when a high level of certainty was possible, TCE selected a significance criterion on the checklist. Following is a brief summary:

Aesthetics: A visual analysis should be performed between 30% and 70% final design with features developed at that stage.
Agriculture and Forestry: This is not applicable
Air Quality: An Air Quality Report should be prepared to identify impacts based on traffic control plans for construction and the 2007 Corridor Study.
Biological Resources: Perform a biological survey and prepare a biological report to verify project area biology
Cultural Resources: Prepare Cultural Resources studies and examine sensitive archeological sites that may encompass the project. Known paleontologically sensitive area that requires monitoring for possible marine fossils, etc. during excavation work in construction
Geology and Soils: This section of the checklist was completed based on the Report of Geotechnical Reconnaissance.
Greenhouse Gas Emissions: Prepare a greenhouse gas analysis to describe impacts from greenhouse gases.
Hazards and Hazardous Materials: This section of the checklist was completed based on the Report of Initial Site Assessment
Hydrology and Water Quality: Prepare a Water Quality Technical Report and Drainage Study for the project in detailed design.
Land Use and Planning: This portion of the checklist was completed based on assumptions at this stage of the project. It is recommended to be more fully discussed in the CEQA document for the project.
Mineral Resources: This section is not applicable to the project.
Noise: Prepare a noise report for the project during detailed design
Population and Housing: This portion of the checklist was completed based on assumptions at this stage of the project.
Public Services: It was suggested that this should be discussed in the CEQA document to include discussion of temporary construction impacts to public services.
Recreation: This portion of the checklist was completed based on assumptions at this stage of the project.

FIGURE 1

Aerial View of Project Area Showing Conceptual Locations of Segments

(Yellow lines represent locations of proposed segments; Line locations are approximate)

Transportation/Traffic: It is recommended that a later traffic study be performed to address criteria in this section including construction traffic control impacts.
Utilities and Service Systems: This portion of the checklist was completed based on assumptions at this stage of the project. Storm drain facilities will be impacted by this project. Water appurtenances will also be impacted.
Mandatory Findings of Significance: It is too early to make any determinations related to this factor

E. Picture Package

A picture package was produced to identify features in the existing alignment for future reference during design. The Engineer's Conceptual Layout plans label the picture number and direction the picture was taken for reference. The picture package presents the pictures in numeric sequence for ease of use.

ENGINEER CONCEPTUAL LAYOUT FOR:

TORREY PINES ROAD BETWEEN LA JOLLA SHORES DR. AND PROSPECT PLACE

BASIS OF BEARING /COORDINATES

THE BASIS OF BEARINGS IS THE GRID BEARING BETWEEN CONTROL POINT #136 AND CONTROL POINT #202 PER RECORD OF SURVEY MAP NO. 14492; IE N 72°32'23"W.

BENCHMARK

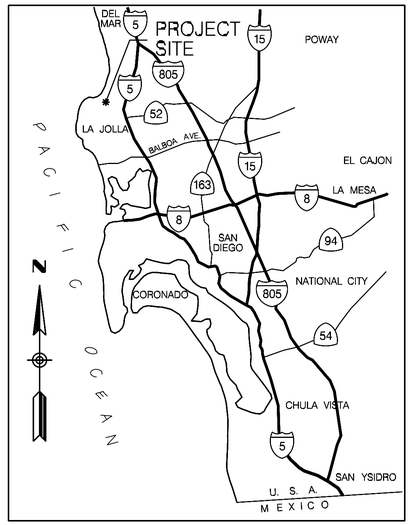
CONTROL POINT #136 PER RECORD OF SURVEY MAP NO. 14492.
A 2.25"CALTRANS BRASS DISK IN CONC. WALK STAMPED "SOLEDAD AZ ECC"ON THE WALKWAY EAST SIDE OF THE CROSS AT THE TOP OF SOLEDAD MOUNTAIN.
ELEV.: 797.28 FEET
DATUM: NGVD 29

UTILITY NOTE

THE CONTRACTOR SHALL NOTIFY THE FOLLOWING AGENCY AT LEAST TWO (2) WORKING DAYS PRIOR TO COMMENCEMENT OF EXCAVATION: UNDERGROUND SERVICE ALERT (USA) 1-800-422-4133 OR 811

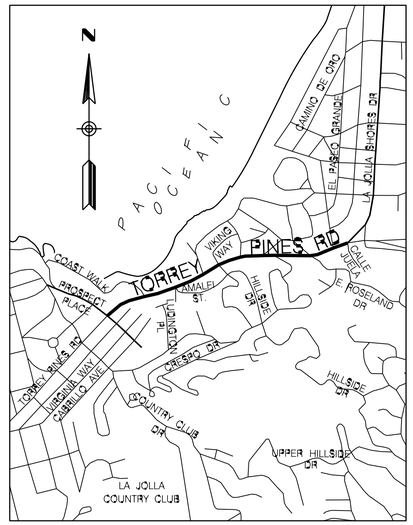
UTILITIES

LIST OF UTILITIES	PHONE NUMBERS
SDG&E	(800) 411-7343
SOCAL GAS	(714) 634-3196
COX	(760) 806-2046
AT&T	(510) 645-2949
CITY OF SAN DIEGO WATER	(619) 515-3525
CITY OF SAN DIEGO TRAFFIC	(619) 527-8050



VICINITY MAP

NTS



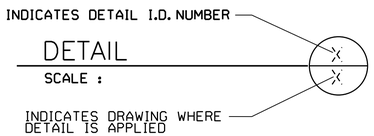
LOCATION MAP

NTS

LEGEND

	SYMBOL
6" TYPE "G" CURB AND GUTTER	
P.C.C. SIDEWALK	
GUARD RAIL	
PARAPET AND PLEXIGLAS TOP	
WOOD AND METAL FABRIC FENCE	
PRIVACY FENCE	
RETAINING WALL	
RETAINING WALL WITH SOIL NAILS	
ARROW INDICATES DIRECTION PICTURE WAS TAKEN (SEE PICTURE BOOK)	P-3399
PROPERTY ENCROACHMENT	1
ABOVE GROUND UTILITY SIDEWALK CONFLICT	2
VIEW CORRIDOR (BASED ON LA JOLLA COMMUNITY PLAN 2004)	
PARTIAL VIEW CORRIDOR	
EXISTING MAJOR CONTOUR	80
EXISTING MINOR CONTOUR	
EXISTING CURB & GUTTER	
RIGHT-OF-WAY	
EXISTING WATER METER	
EXISTING SPEED INDICATOR	
LIMIT OF ENVIRONMENTAL IMPACT	(AND AT RETAINING WALLS, FENCES, AND OUTER EDGE OF SITE WORKS)

CROSS REFERENCING



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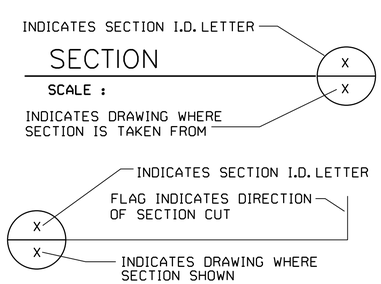

SECTION CUT MARKER

DRAWING INDEX

ABBREVIATIONS

AC	ASPHALT CONCRETE	N/A	NOT APPLICABLE
BC	BEGINNING OF CURVE	NTS	NOT TO SCALE
BMP	BEST MANAGEMENT PRACTICES	PT	POINT
℄	CENTER LINE	RCP	REINFORCED CONCRETE PIPE
CMP	CORRUGATED METAL PIPE	R/W	RIGHT OF WAY
DIA	DIAMETER	RT	RIGHT
EC	END OF CURVE	SDRSD	SAN DIEGO REGIONAL STANDARD DRAWINGS
EL	ELEVATION	SSPWC	STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION 2009 EDITION (GREEN BOOK)
EP	EDGE OF PAVEMENT	STA	STATION
EX, EXIST	EXISTING	SWPPP	STORMWATER POLLUTION PREVENTION PLAN
FT	FEET	TC	TOP OF CURB
HORIZ	HORIZONTAL	UNK	UNKNOWN
HP	HIGH POINT	VERT.	VERTICAL
IE	INVERT ELEVATION		
LT	LEFT		
MIN	MINIMUM		

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DATE: _____

07-06-2010

CONCEPTUAL LAYOUT

ENGINEER CONCEPTUAL LAYOUT FOR:
TORREY PINES ROAD
BETWEEN LA JOLLA SHORES DR.
AND PROSPECT PLACE

TITLE SHEET

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 01 OF XX SHEETS

W.O. 526160

APPROVED: _____ FOR CITY ENGINEER _____ DATE

SUBMITTED BY: _____ ASSOCIATE ENGINEER

DESCRIPTION	DRAWN BY	DATE
ORIGINAL	TCE	XXXX

PROJECT ENGINEER

CONTROL CERTIFICATION

VARIES
LAMBERT COORDINATES

CONTRACTOR: _____ DATE STARTED _____
INSPECTOR: _____ DATE COMPLETED _____

XXXXX- 01-D

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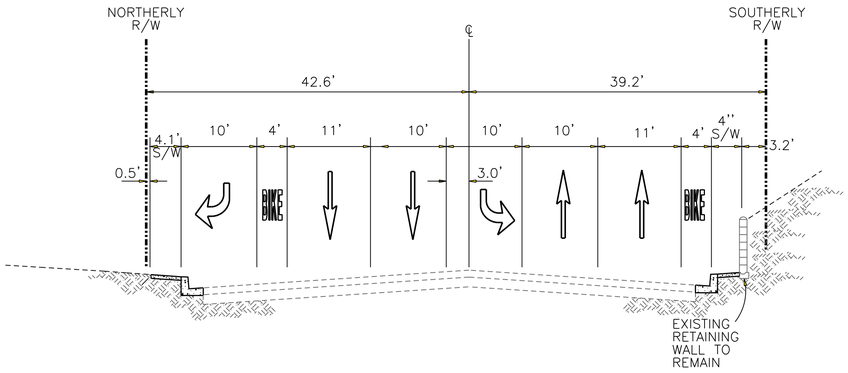
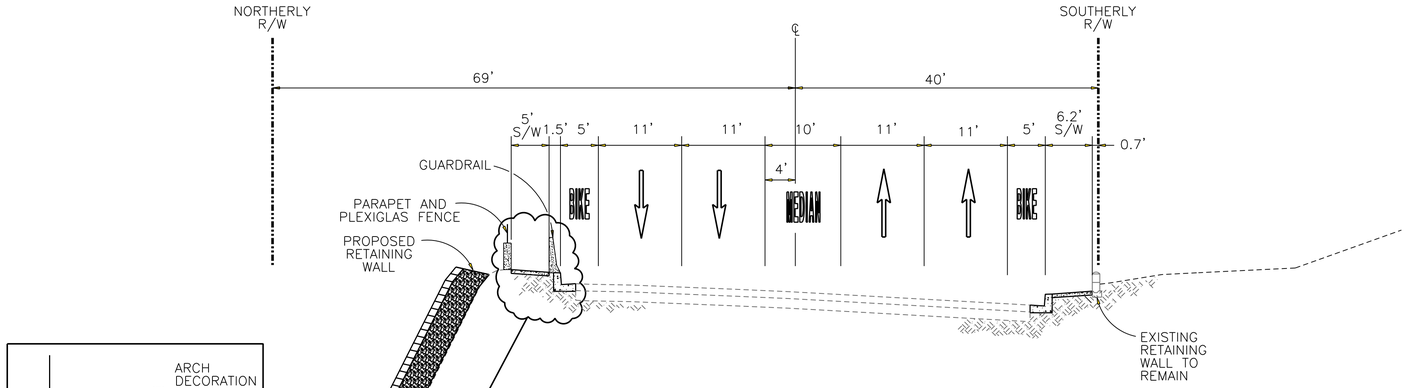
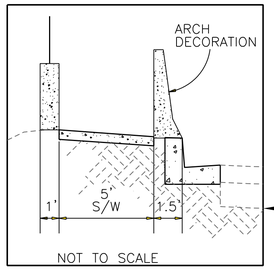


TORREY PINES ROAD AT STA 10+50

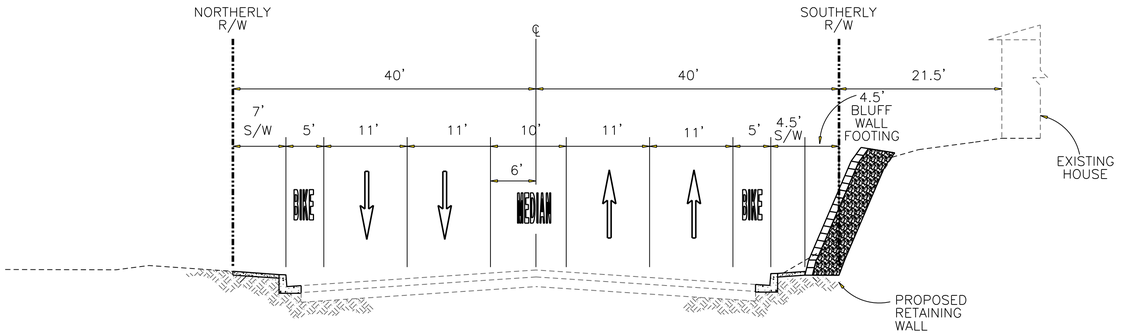
SECTION A / 5





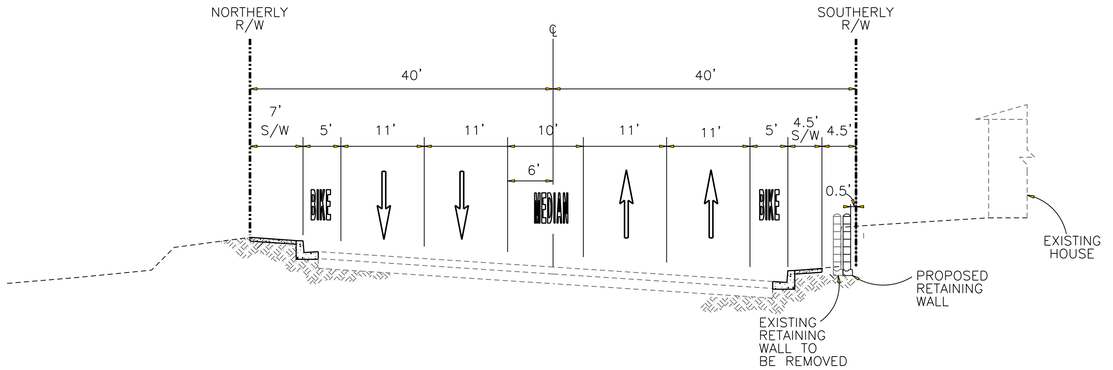
TORREY PINES ROAD AT STA 13+80

SECTION B / 5



TORREY PINES ROAD AT STA 20+10

SECTION C / 6



TORREY PINES ROAD AT STA 23+50

SECTION D / 6

0 10 20 30

SCALE 1"=10'

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CONCEPTUAL LAYOUT

ENGINEER CONCEPTUAL LAYOUT FOR:
TORREY PINES ROAD
BETWEEN LA JOLLA SHORES DR.
AND PROSPECT PLACE

TYPICAL SECTIONS

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 02 OF XX SHEETS

W.O. 526160

APPROVED: _____ FOR CITY ENGINEER _____ DATE

SUBMITTED BY: _____ ASSOCIATE ENGINEER

DESCRIPTION	DRAWN BY	DATE	
ORIGINAL	TCE	XXXX	

PROJECT ENGINEER

CONTROL CERTIFICATION

VARIES
LAMBERT COORDINATES

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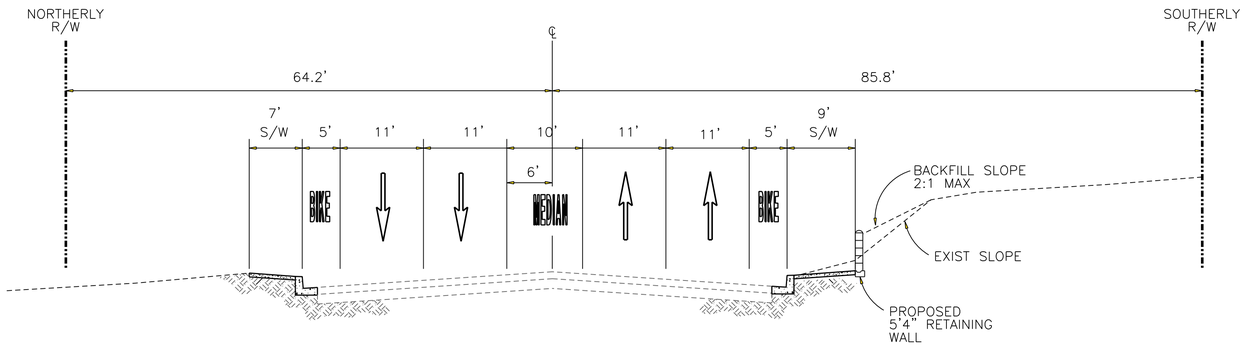
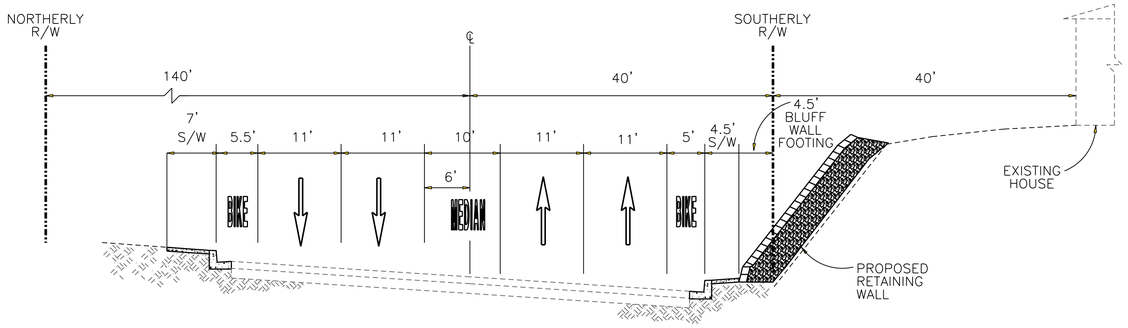


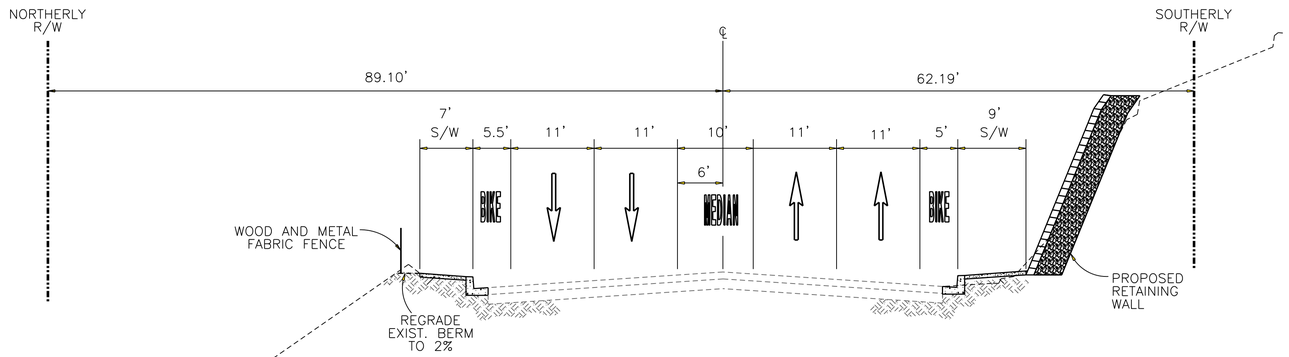
TORREY PINES ROAD AT STA 28+20

SECTION E 6



TORREY PINES ROAD AT STA 31+45

SECTION F 7



TORREY PINES ROAD AT STA 33+60

SECTION G 7

0 10 20 30

SCALE 1"=10'

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TCE Consultants
DATE: _____

01-2011

CONCEPTUAL LAYOUT

ENGINEER CONCEPTUAL LAYOUT FOR:
TORREY PINES ROAD
BETWEEN LA JOLLA SHORES DR.
AND PROSPECT PLACE

DETAILS

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 03 OF XX SHEETS

W.O. 526160

APPROVED: _____ FOR CITY ENGINEER _____ DATE

SUBMITTED BY: _____ ASSOCIATE ENGINEER

DESCRIPTION	DRAWN BY	DATE
ORIGINAL	TCE	XXXX

_____ PROJECT ENGINEER

_____ CONTROL CERTIFICATION

VARIES LAMBERT COORDINATES

CONTRACTOR: _____ DATE STARTED _____
INSPECTOR: _____ DATE COMPLETED _____

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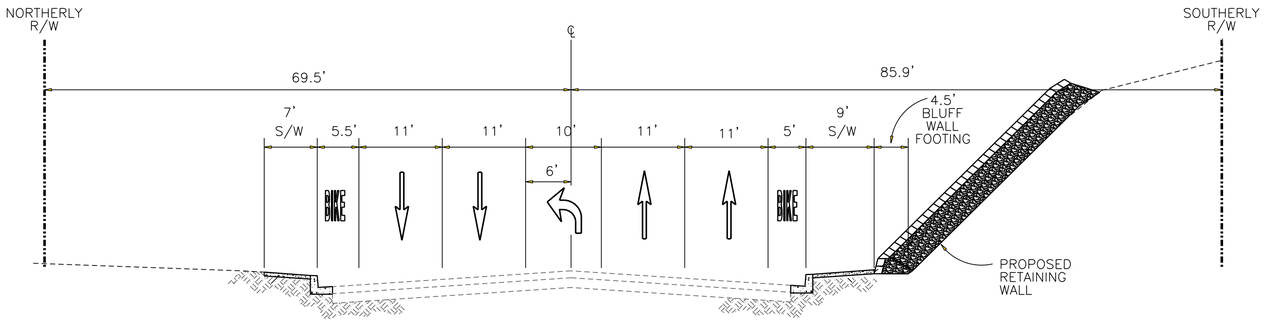
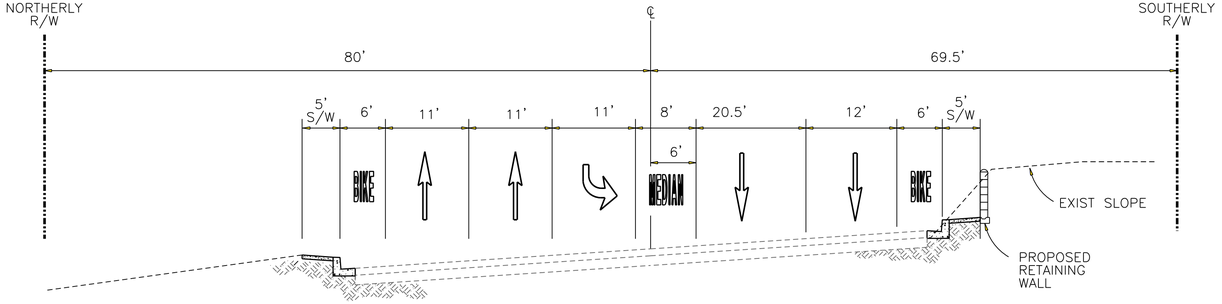
Sheet 03.dgn 1/17/2011 4:05:48 PM



TORREY PINES ROAD AT STA 36+20

SECTION H / 7



TORREY PINES ROAD AT STA 45+50

SECTION I / 8

0 10 20 30

SCALE 1"=10'

REGISTERED PROFESSIONAL ENGINEER
HUGH GIAC TRAN
No. C32268
EXP. 12-31-10
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STATE OF CALIFORNIA

Tran Consulting Engineers
4444 El Cajon Blvd. Suite 15
San Diego, California 92115
619-563-7650, FAX 619-563-7821

APPROVED: _____
TCE Consultants
DATE: _____

01-2011

CONCEPTUAL LAYOUT

ENGINEER CONCEPTUAL LAYOUT FOR:

TORREY PINES ROAD BETWEEN LA JOLLA SHORES DR. AND PROSPECT PLACE

DETAILS

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 04 OF XX SHEETS

W.O. 526160

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SUBMITTED BY: _____ ASSOCIATE ENGINEER

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ORIGINAL	TCE	XXXX	

_____ PROJECT ENGINEER

_____ CONTROL CERTIFICATION

VARIES LAMBERT COORDINATES

CONTRACTOR: _____ DATE STARTED _____
INSPECTOR: _____ DATE COMPLETED _____

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Sheet 04.dgn 1/17/2011 4:06:24 PM

PROPOSED RETAINING WALL DATA TABLE		
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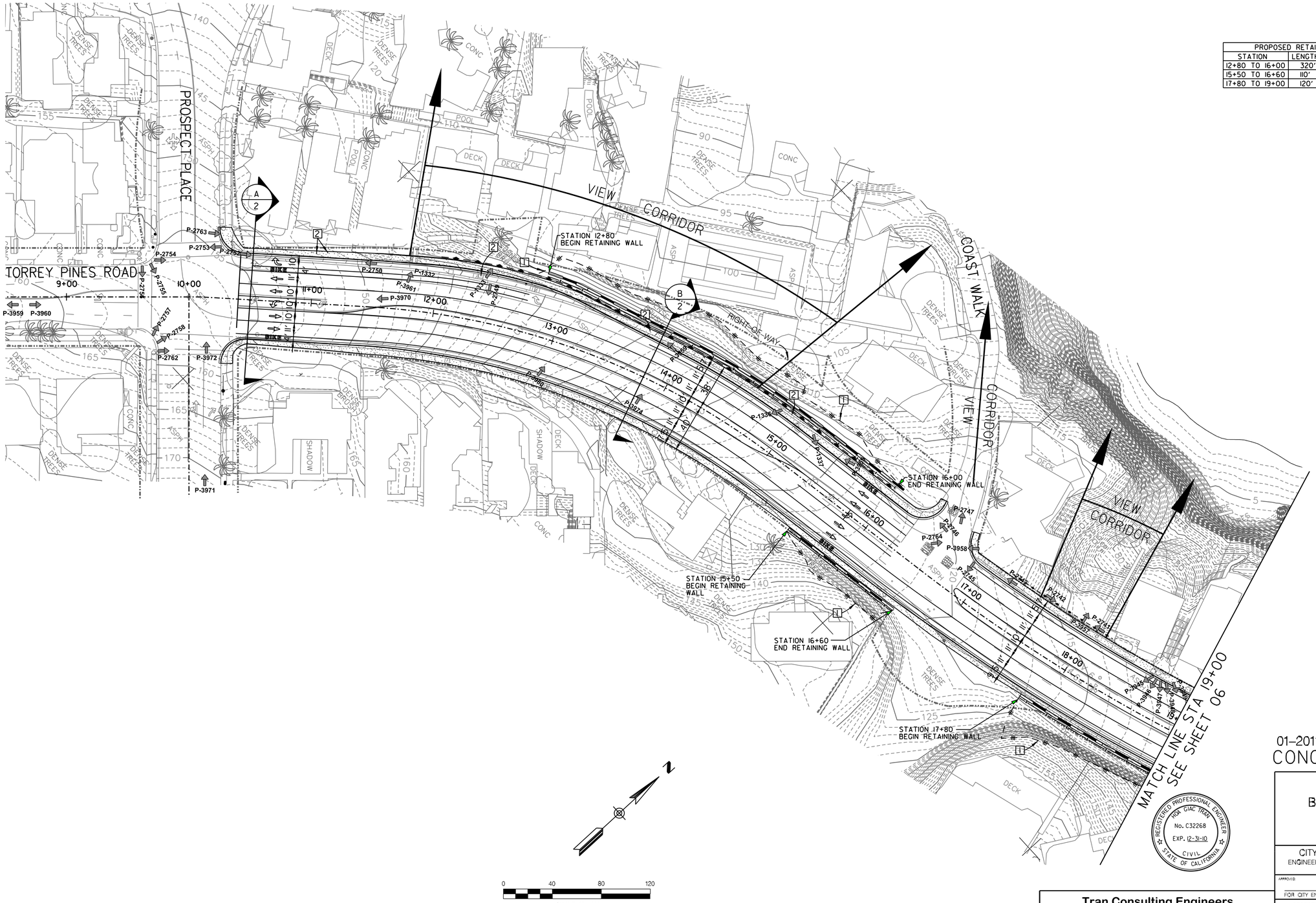
15+50 TO 16+60	110'	
17+80 TO 19+00	120'	



0 40 80 120

SCALE 1" = 40'

01-2011

CONCEPTUAL LAYOUT

ENGINEER CONCEPTUAL LAYOUT FOR:

TORREY PINES ROAD
BETWEEN LA JOLLA SHORES DR.
AND PROSPECT PLACE
STA 10+00 TO 19+00

REGISTERED PROFESSIONAL ENGINEER
HEA GIAC TRAN
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STATE OF CALIFORNIA

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 05 OF XX SHEETS

W.O. 526160

APPROVED:
FOR CITY ENGINEER
DATE

SUBMITTED BY:
ASSOCIATE ENGINEER

DESCRIPTION	DRAWN BY	DATE
ORIGINAL	TCE	XXXX

PROJECT ENGINEER

CONTROL CERTIFICATION

VARIES
LAMBERT COORDINATES

CONTRACTOR: DATE STARTED
INSPECTOR: DATE COMPLETED

XXXXX-05-D

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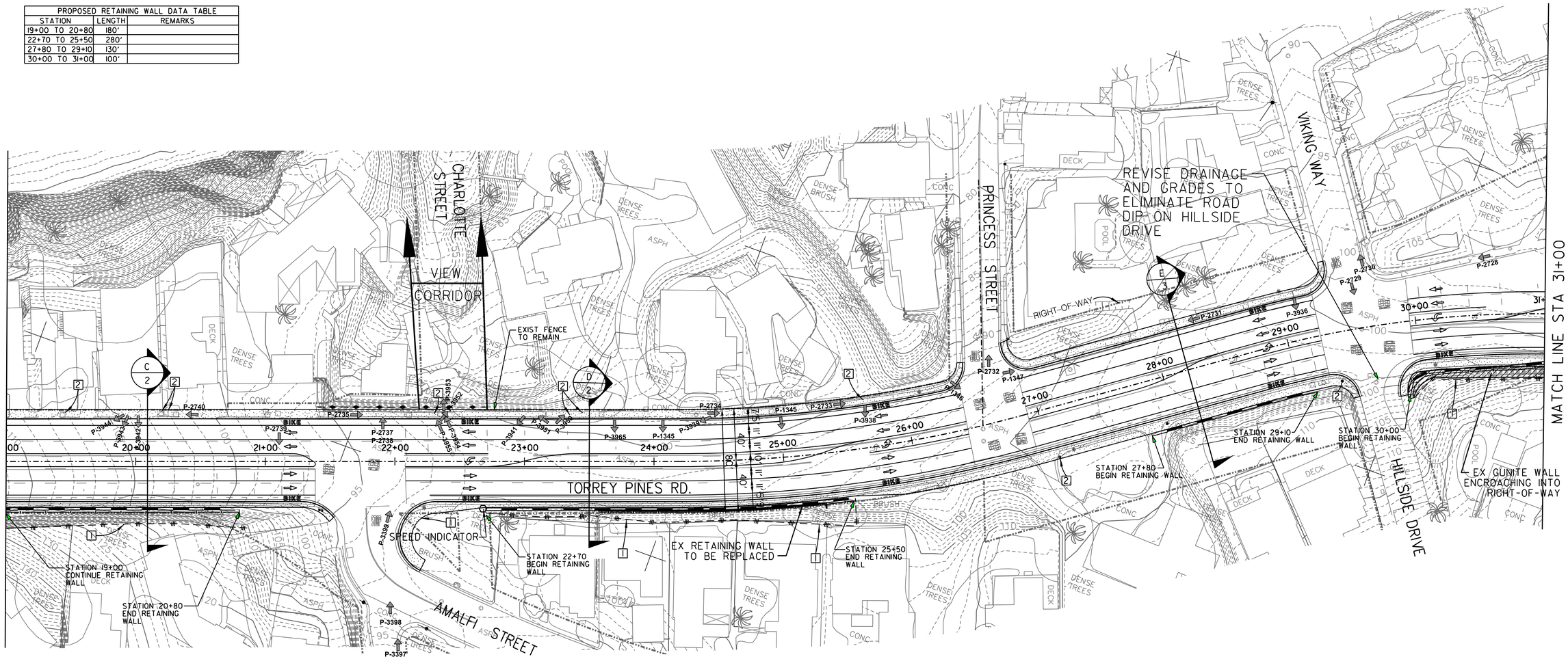
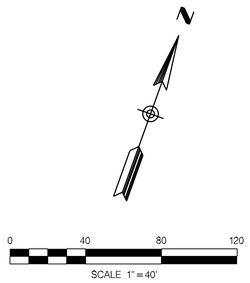
APPROVED: TCE Consultants

DATE:

Sheet 05.dgn 1/17/2011 4:07:00 PM

PROPOSED RETAINING WALL DATA TABLE		
STATION	LENGTH	REMARKS
19+00 TO 20+80	180'	
22+70 TO 25+50	280'	
27+80 TO 29+10	130'	
30+00 TO 31+00	100'	





01–2011

CONCEPTUAL LAYOUT

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APPROVED: TCE Consultants

DATE:

ENGINEER CONCEPTUAL LAYOUT FOR:
TORREY PINES ROAD
BETWEEN LA JOLLA SHORES DR.
AND PROSPECT PLACE
STA 19+00 TO 31+00

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 06 OF XX SHEETS

W.O. 526160

APPROVED: FOR CITY ENGINEER — DATE

SUBMITTED BY: ASSOCIATE ENGINEER

DESCRIPTION	DRAWN BY	DATE	
ORIGINAL	TCE	XXXX	

PROJECT ENGINEER

CONTROL CERTIFICATION

VARIES
LAMBERT COORDINATES

CONTRACTOR: DATE STARTED

INSPECTOR: DATE COMPLETED

XXXXX–06–D

Sheet 06.dgn 1/17/2011 4:22:19 PM

PROPOSED RETAINING WALL DATA TABLE		
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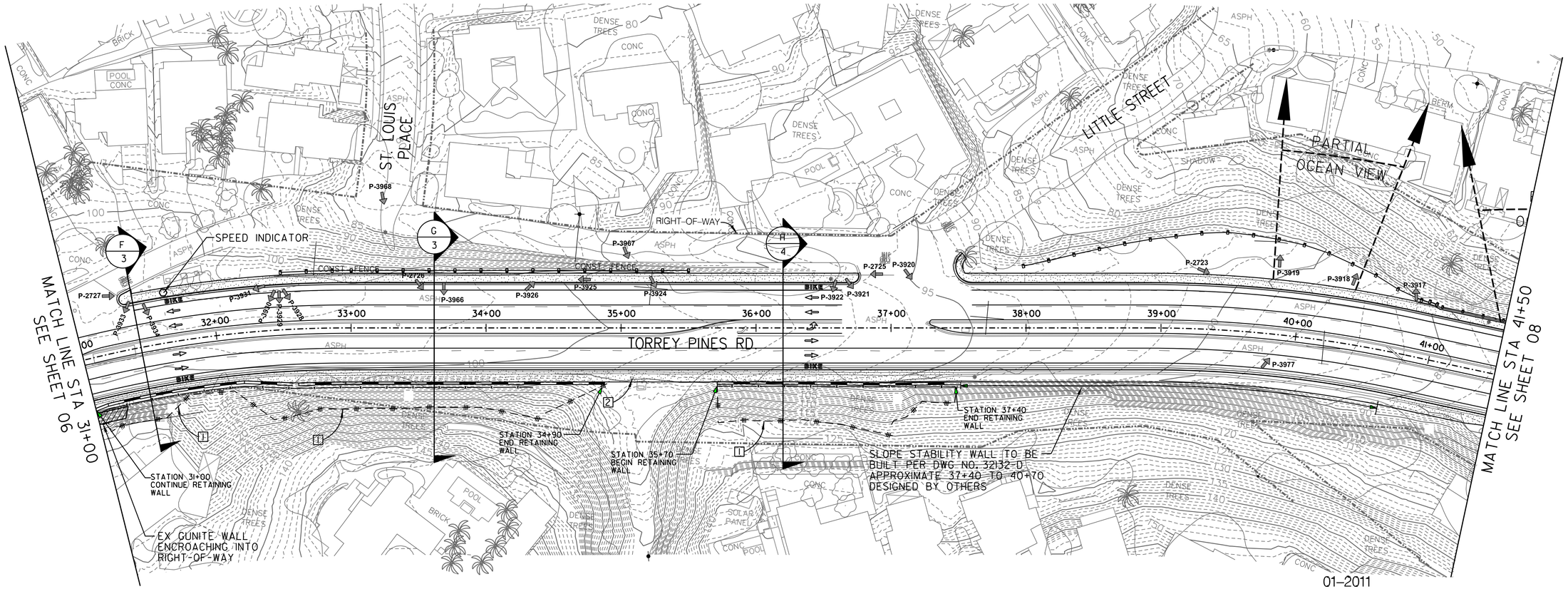
35+70 TO 37+40	170'	



01–2011

CONCEPTUAL LAYOUT

N

0 40 80 120

SCALE 1" = 40'

REGISTERED PROFESSIONAL ENGINEER
RICK GIAC TRAN
No. C32268
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APPROVED: _____
TCE Consultants
DATE: _____

ENGINEER CONCEPTUAL LAYOUT FOR:
TORREY PINES ROAD
BETWEEN LA JOLLA SHORES DR.
AND PROSPECT PLACE
STA 31+00 TO 41+50

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 07 OF XX SHEETS

W.O. 526160

APPROVED: _____ FOR CITY ENGINEER _____ DATE

SUBMITTED BY: _____ ASSOCIATE ENGINEER

DESCRIPTION	DRAWN BY	DATE	
ORIGINAL	TCE	XXXX	

_____ PROJECT ENGINEER

_____ CONTROL CERTIFICATION

VARIES LAMBERT COORDINATES

CONTRACTOR: _____ DATE STARTED _____
INSPECTOR: _____ DATE COMPLETED _____

XXXXX–07–D

Sheet 07.dgn 1/17/2011 4:24:25 PM

PROPOSED RETAINING WALL DATA TABLE		
STATION	LENGTH	REMARKS
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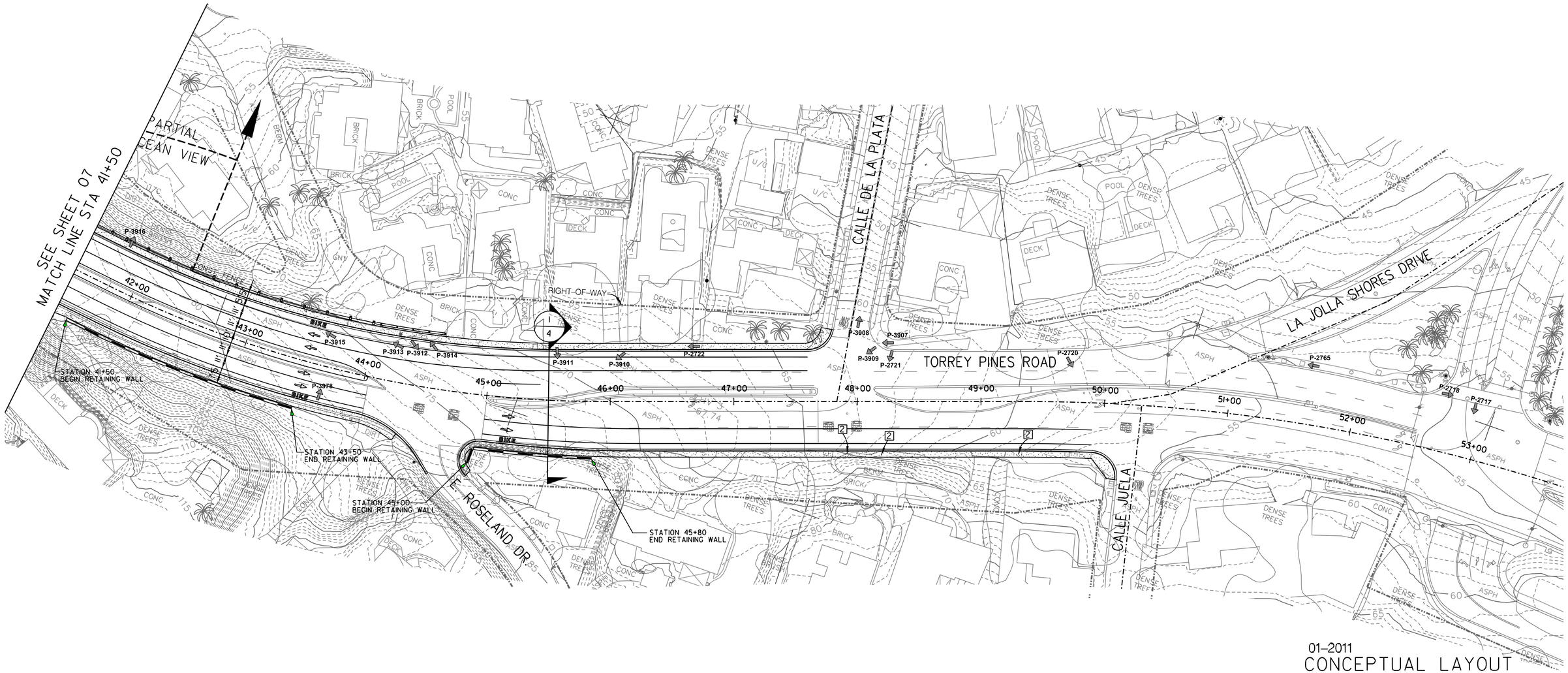

01–2011

CONCEPTUAL LAYOUT

N

0 40 80 120

SCALE 1" = 40'

REGISTERED PROFESSIONAL ENGINEER
HOA GIAC TRAN
No. C32268
EXP. 12-31-10
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APPROVED: _____
TCE Consultants
DATE: _____

ENGINEER CONCEPTUAL LAYOUT FOR:
TORREY PINES ROAD
BETWEEN LA JOLLA SHORES DR.
AND PROSPECT PLACE
STA 41+50 TO 50+00

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING AND CAPITAL PROJECTS DEPARTMENT
SHEET 08 OF XX SHEETS

W.O. 526160

APPROVED: _____ DATE: _____
FOR CITY ENGINEER

SUBMITTED BY: _____
ASSOCIATE ENGINEER

DESCRIPTION	DRAWN BY	DATE	
ORIGINAL	TCE	XXXX	

PROJECT ENGINEER

CONTROL CERTIFICATION

VARIES
LAMBERT COORDINATES

CONTRACTOR: _____ DATE STARTED _____
INSPECTOR: _____ DATE COMPLETED _____

XXXXX– 08–D

Sheet 08.dgn 1/17/2011 4:29:12 PM

APPENDICES

APPENDIX A

Report of

GEOTECHNICAL RECONNAISSANCE

GEOTECHNICAL RECONNAISSANCE
TORREY PINES ROAD REALIGNMENT
SAN DIEGO, CALIFORNIA

PREPARED FOR:
Tran Consulting Engineers
4444 El Cajon Boulevard, Suite 15
San Diego, California 92115

PREPARED BY:
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
5710 Ruffin Road
San Diego, California 92123

June 4, 2010
Project No. 106843001

June 4, 2010
Project No. 106843001

Mr. John Austin
Tran Consulting Engineers
4444 El Cajon Boulevard, Suite 15
San Diego, California 92115

Subject: Geotechnical Reconnaissance
Torrey Pines Road Realignment
San Diego, California

Dear Mr. Austin:

Transmitted herein are the results of Ninyo & Moore's geotechnical reconnaissance study for the City's proposed realignment of Torrey Pines Road. This study was conducted in accordance with your request and included review and analysis of available geologic and geotechnical background data, and a geologic reconnaissance of the project site area.

We appreciate the opportunity to be of service.

Respectfully submitted,
NINYO & MOORE

Francis O. Moreland, C.E.G. 2071
Senior Geologist

REGISTERED GEOLOGIST
FRANCIS O. MORELAND
No 2071
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

Randal L. Irwin, C.E.G. 1521
Chief Engineering Geologist

Gregory T. Farrand, C.E.G. 1087
Principal Geologist

PROFESSIONAL GEOLOGIST
Randal L. Irwin
No. 1521
Certified
Engineering
Geologist
Exp. 9/30/11
STATE OF CALIFORNIA

FOM/RI/GTF/gg

Distribution: (5) Addressee

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Figures

1. INTRODUCTION

In accordance with your request, Ninyo & Moore has performed a geotechnical reconnaissance study of the project site. This report presents our preliminary findings and conclusions pertaining to the City's proposed realignment of Torrey Pines Road. The purpose of this study was to evaluate geologic and geotechnical conditions using available geologic and geotechnical data and to provide a geotechnical reconnaissance report, which we understand will be utilized as part of a study for the subject project. Subsurface exploration and laboratory testing of materials were not included in the scope of this reconnaissance study.

2. SCOPE OF SERVICES

Ninyo & Moore's scope of services has included review of background materials and geologic reconnaissance of the site area. Specifically, we have performed the following tasks:

- Review of pertinent, available geotechnical literature including topographic maps, geologic maps, stereoscopic aerial photographs, and geotechnical and geologic reports. Documents reviewed for our site study are listed in the References section of this report.
- Geologic reconnaissance of the project study area by a California-certified engineering geologist from our firm.
- Compilation and analysis of the data obtained.
- Preparation of this report presenting our preliminary findings, conclusions, and recommendations.

3. PROJECT AND SITE DESCRIPTION

The site is located in the **re**sidential community of La Jolla in northwestern San Diego (Figure 1). The project extends along Torrey Pines Road from Prospect Place on the southwest to Calle Juela (near La Jolla Shores Drive) on the northeast. Elevations across the alignment range from a high of approximately 155 feet above mean sea level (MSL) at Prospect Place to a low of approximately 55 feet above MSL at the Calle Juela.

The purpose of the project is to provide continuous sidewalks on both sides of Torrey Pines Road. Retaining walls, soil nail walls, durawalls or other measures are planned along portions of the

alignment west of Amalfi Street, and between Hillside Drive and East Roseland Drive. Relatively minor vertical and lateral changes in the roadbed (less than 3 feet) will be made to Torrey Pines Road.

4. GEOLOGY

The following sections present our findings relative to regional geology, site geology, groundwater, faulting, and seismicity.

4.1. Regional Geologic Setting

The project study area is situated in the western portion of the Peninsular Ranges geomorphic province of southern California. This geomorphic province encompasses an area that extends roughly 125 miles from the Transverse Ranges and the Los Angeles Basin, south to the Mexican border, and beyond another 795 miles to the tip of Baja California (Norris and Webb, 1990; Harden, 1998). The geomorphic province varies in width from 30 to 100 miles, most of which is characterized by northwest trending mountain ranges separated by subparallel fault zones. In general, the Peninsular Ranges are underlain by Jurassic- and Cretaceous-age metavolcanic and metasedimentary rocks and by Cretaceous-age igneous rocks of the southern California batholith. The westernmost portion of the province in San Diego County generally consists of Upper Cretaceous-, Tertiary-, and Quaternary-age sedimentary rocks.

The Peninsular Ranges are traversed by several major active faults (Figure 3). The Whittier-Elsinore, San Jacinto, and the San Andreas faults are major active fault systems located northeast of the site and the Agua Blanca-Coronado Bank and San Clemente faults are active faults located to the west-southwest. The nearby Rose Canyon fault zone, which crosses the eastern portion of the site, has also been recognized as active by the State of California. Major tectonic activity associated with these and other faults within this regional tectonic framework is right-lateral strike-slip movement. These faults, as well as other faults in the region, have the potential for generating strong ground motions at the project site. Further discussion of faulting relative to the site is provided in the Faulting and Seismicity section of this report.

4.2. Site Geology

Based on our literature review of published geologic maps and available geologic reports and our site reconnaissance, the project vicinity is underlain by surficial soils consisting of artificial fill underlain by young alluvium, old paralic deposits (formerly designated Bay Point Formation), the Cabrillo Formation, and the Point Loma Formation. A geologic map is provided as Figure 4. A brief description of these units, as described in the cited literature or as observed on the site, is presented below.

4.2.1. Artificial Fill

Artificial fill soils are present beneath the roadway and within utility trenches. The fill soils may have been derived from nearby alluvial and formational materials or imported soils and are expected to range in composition from loose to medium dense, silty sand to sandy silt with scattered gravel and cobbles.

4.2.2. Alluvium

Alluvial soils are expected to underlie the eastern end of the project alignment. These soils are generally expected to be composed of soft to firm silt and clay to loose to medium dense silty sand and clayey sand, possibly with scattered gravel and cobbles.

4.2.3. Old Paralic Deposits (Bay Point Formation)

Pleistocene-age old paralic deposits are mapped on the west side of Torrey Pines Road. The old paralic deposits in the vicinity of the site generally consist of a brown to reddish brown, weakly cemented, silty fine to coarse grained sandstone.

4.2.4. Cabrillo Formation

The Cretaceous-age Cabrillo Formation is mapped at the western end of the project alignment. The Cabrillo Formation in the vicinity of the site generally consists of massive medium-grained sandstone and cobble conglomerate.

4.2.5. Point Loma Formation

The Cretaceous-age Point Loma Formation is mapped on the east side of Torrey Pines Road in the central portion of the alignment. The Point Loma Formation in the vicinity of the site generally consists of interbedded fine-grained dusky yellow sandstone and olive-gray clay shale. Relative weak clay-rich strata such as sheared bedding surfaces (bedding plane faults) and fractures are common in the Point Loma Formation in this region.

4.2.6. Groundwater

The depth to groundwater in the vicinity of the project is expected to be located roughly at or near sea level. Groundwater levels are expected to fluctuate due to seasonal variations, tidal changes, and other factors.

4.3. Faulting and Seismicity

The project site, like the rest of southern California, is considered to be located in a seismically active area. The western portion of the alignment is located within a State of California Earthquake Fault (Alquist-Priolo Special Studies) Zone. In addition, multiple known, inferred, and concealed inactive or potentially active faults are located in the site vicinity. The approximate locations are shown on Figure 5.

The Rose Canyon fault zone is a part of a more extensive fault zone that includes the Offshore Zone of Deformation and the Newport-Inglewood fault to the north, and several possible extensions southward, both onshore and offshore (Treiman, 1993). The Rose Canyon fault zone consists predominantly of right-lateral strike-slip faults that extend south-southeast through the San Diego metropolitan area. Various fault strands display strike-slip, normal, oblique, or reverse components of displacement (Treiman, 1993). South of downtown San Diego, the Rose Canyon fault breaks into several subparallel splays that underlie much of central and southern San Diego Bay. Portions of the Rose Canyon fault zone in the Mount Soledad, La Jolla, Rose Canyon, Mission Bay, and downtown areas of San Diego have been recognized by the State of California as Earthquake Fault Special Studies Zones

(California Geological Survey [CGS], 2001). The Coronado Bank fault zone, located approximately 13 miles southwest of the project and the Elsinore fault zone, located approximately 40 miles northeast of the site, are also considered to be active.

4.3.1. Strong Ground Motion

The 2007 California Building Code (CBC) recommends that the design of structures be based on the horizontal peak ground acceleration (PGA) having a 2 percent probability of exceedance in 50 years, which is defined as the Maximum Considered Earthquake (MCE). The statistical return period for PGA_{MCE} is approximately 2,475 years. Based on our review of subsurface data, the project site corresponds to a Site Class D. The site modified PGA_{MCE} was estimated to be 0.68g using the United States Geological Survey (USGS) (USGS, 2010) ground motion calculator (web-based). The site modified design PGA was estimated to be 0.45g. These estimates of ground motion do not include near-source factors that may be applicable to the design of structures on site.

4.3.2. Ground Surface Rupture

Based on our review of the referenced literature and our site reconnaissance, the active Rose Canyon fault is known to cross the project site. Therefore, the potential for ground rupture due to faulting at the site is high. Lurching or cracking of the ground surface as a result of nearby seismic events is also possible.

4.3.3. Liquefaction and Seismically Induced Settlement

Liquefaction of cohesionless soils can be caused by strong vibratory motion due to earthquakes. Research and historical data indicate that loose granular soils and non-plastic silts that are saturated by a relatively shallow groundwater table are susceptible to liquefaction. The eastern end of the alignment is mapped as being underlain by alluvium. If groundwater is present within the alluvium, this portion of the alignment may be subject to liquefaction and seismically induced settlement during a nearby seismic event. Based on the competent nature of the underlying formational materials and lack

of shallow groundwater beneath remaining portions of the alignment, it is our opinion that the potential for liquefaction and seismically induced settlement to occur is not a design consideration.

4.3.4. Tsunamis

Tsunamis are long seismic sea waves (long compared to ocean depth) generated by sudden movements of the sea floor caused by submarine earthquakes, landslides, or volcanic activity. Due to the orientation of California's coastline with regard to Pacific Ocean tsunami generating areas and our relatively wide continental shelf, wave heights from historic tsunamis in the San Diego Region have generally been within the normal tidal range. Based on these factors, there is little potential for catastrophic tsunamis in San Diego, however some coastal flooding and damage may occur. Based on its elevation, the potential for damage due to tsunamis at the site is not a design consideration.

4.4. Landsliding

Based on our review of published geologic maps and stereoscopic aerial photographs, as well as our site reconnaissance, no landslides or indications of deep-seated slope instability were observed underlying the project site. However, numerous large landslides have been mapped approximately 1,000 feet south of the alignment.

4.5. Geologic Hazards Map

We have included as Figure 5 a portion of Sheet 29 of the City of San Diego Seismic Safety Study that includes the site. The hazard map indicates the mapped location of known or suspected faults and landslides and areas of potentially unfavorable geologic structure relative to slope stability. The hazard map indicates that the Alquist-Priolo earthquake fault zone for the Active Rose Canyon fault crosses the eastern portion of the alignment. The active strand of the Rose Canyon fault crosses the alignment at approximately Roseland Drive. Multiple strands of the Rose Canyon fault which are classified as potentially active or inactive cross the western portion of the alignment.

5. CONCLUSIONS

The following sections discuss site-specific geologic and geotechnical issues.

- The active Rose Canyon fault crosses the eastern portion of the alignment. There is therefore, a high potential for ground rupture at the alignment in the event of a nearby seismic event.
- Based on our seismic hazard analysis, there is a potential for high ground accelerations at the site as a result of nearby earthquakes.
- Landslides or indications of deep-seated slope instability were not observed underlying the project site but are mapped in areas to the south of the project site.
- Potentially compressible fill soils may be encountered in some areas under the existing roadways. In addition, unknown thicknesses of potentially compressible alluvium may exist at the eastern end of the alignment. The presence of compressible soils could potentially impact the design of improvements or other related structures. The nature and extent of potentially compressible subsurface soils should be further evaluated by a subsurface geotechnical evaluation.
- Potentially liquefiable alluvial soils are present beneath the eastern end of the alignment.
- It is our understanding that a soil nail retaining wall with a dura-block facing is under consideration for the project. This retaining wall type would be feasible at the site.
- In general, the soils in the area should be excavatable with standard heavy-duty excavation equipment. The engineering properties of the subsurface soils should be further evaluated by a subsurface geotechnical evaluation.

6. PRELIMINARY RECOMMENDATIONS

We recommend that a comprehensive geotechnical evaluation, including subsurface exploration and laboratory testing, be conducted prior to design and construction. The purpose of the subsurface evaluation would be to further evaluate the subsurface conditions and to provide information pertaining to the engineering characteristics of earth materials at the project site. From these data, a geotechnical design report would be prepared presenting recommendations pertaining to geotechnical aspects of the design and construction of the project.

7. LIMITATIONS

The field evaluation and geotechnical analyses presented in this report have been conducted in accordance with current engineering practice and the standard of care exercised by reputable geotechnical consultants performing similar tasks in this area. No warranty, implied or expressed, is made regarding the conclusions, recommendations, and professional opinions expressed in this report. Variations may exist and conditions not observed or described in this report may be encountered. Our preliminary conclusions and recommendations are based on an analysis of the observed conditions and the referenced background information.

The purpose of this study was to evaluate geologic and geotechnical conditions within the project site and to provide a geotechnical reconnaissance report to assist in the preliminary design of the project. A comprehensive geotechnical evaluation, including subsurface exploration and laboratory testing, should be performed prior to design and construction of structural improvements.

8. REFERENCES

Anderson, J.G., Rockwell, T.K., and Agnew, D.C., 1989, Past and Possible Future Earthquakes of Significance to the San Diego Region: Earthquake Spectra, Volume 5, No. 2.

California Building Standards Commission, 2007, *California Building Code*, Title 24, Part 2, Volumes 1 and 2.

California Geological Survey (CGS), 2001, State of California, Special Studies Zones, La Jolla Quadrangle: effective November 1, 2001, scale 1:24,000.

California Geological Survey (CGS), 2003, Probabilistic Seismic Hazard Assessment Maps (PSHA), World Wide Web, http://www.consrv.ca.gov/cgs/rghm/psha/index.htm.

City of San Diego, 1963, Topographic Survey, Sheet 246-1683, Scale 1" = 200'.

City of San Diego, 1963, Topographic Survey, Sheet 246-1689, Scale 1" = 200'.

City of San Diego, 1979, Topographic Survey (Orthotopographic), Sheet 246-1683, Scale 1" = 200'.

City of San Diego, 1979, Topographic Survey (Orthotopographic), Sheet 246-1689, Scale 1" = 200'.

City of San Diego, 1979, Topographic Survey, Sheet 250-1689, Scale 1" = 200'.

City of San Diego, 1995, Seismic Safety Study, Sheet 29, scale 1" = 800'.

Geotechnics, Inc., 2000, Report of Geotechnical Evaluation, Torrey Pines Road Slope Repair Between Little Street and Roseland Drive, La Jolla, California, Work Order No. 526740: dated April 20.

Harden, D.R., 1998, *California Geology*: Prentice Hall, Inc.

Jennings, C.W., 1994, Fault Activity Map of California and Adjacent Areas: California Geological Survey, California Geologic Data Map No. 6, scale 1:750,000.

Kennedy, M.P., 1975, Geology of the La Jolla Quadrangle, San Diego County, California Geological Survey, Bulletin 200, Scale 1:24,000.

Kennedy, M.P., and Tan, S. S., 2008, Geologic Map of the San Diego 30’ X 60’ Quadrangle, California Regional Geologic Map Series, 1:100,000 Scale, Map No. 3, Sheet 1 of 2.

Norris, R.M., and Webb, R.W., 1990, *Geology of California*: John Wiley & Sons, Inc.

Rockwell, T.K., Lindvall, S.C. Haraden, C.C., Hirabayashi, C.K., and Baker, E., 1991, Minimum Holocene Slip Rate for the Rose Canyon Fault in San Diego, California *in* Abbott, P.L. and Elliott, W.J., eds., Environment Perils, San Diego Region: San Diego Association of Geologists.

Tan, S.S., 1995, Landslide Hazards in the Southern Part of the San Diego Metropolitan Area, San Diego County, California, Plate A: Open File Report 95-03.

Treiman, J.A., 1993, Rose Canyon Fault Zone, Southern California: California Geological Survey.

United States Geological Survey, 2010 Ground Motion Parameter Calculator v. 5.0.9a, World Wide Web, http://earthquake.usgs.gov/research/hazmaps/design/.

AERIAL PHOTOGRAPHS

Source	Date	Flight	Numbers	Scale
United States Department of Agriculture	5/2/53 & 4/11/53	AXN-7M/8M	189 & 190	1:20,000

REFERENCE: 2005 THOMAS GUIDE FOR SAN DIEGO COUNTY, STREET GUIDE AND DIRECTORY,

APPROXIMATE SCALE

0 2400 4800 FEET

N

Ninyo & Moore	SITE LOCATION MAP	FIGURE
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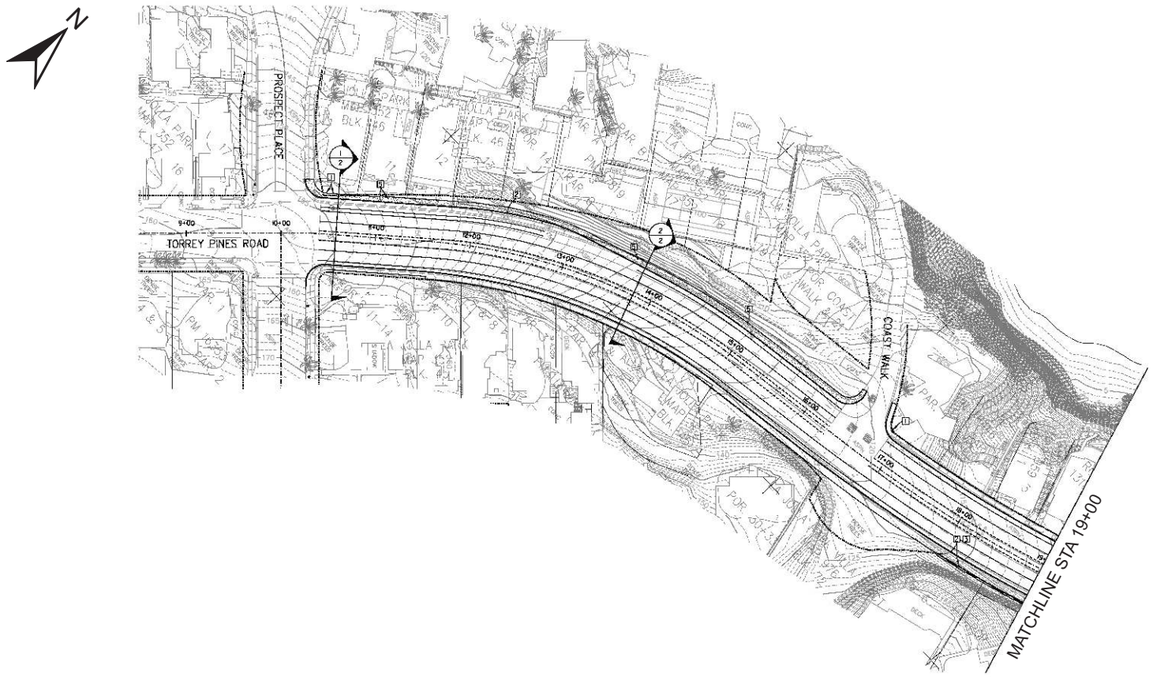
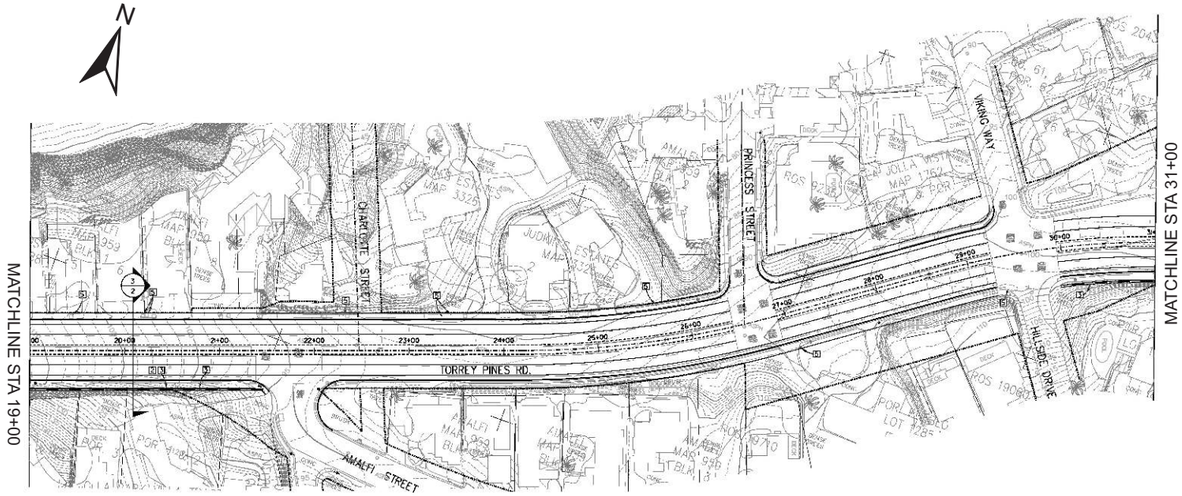
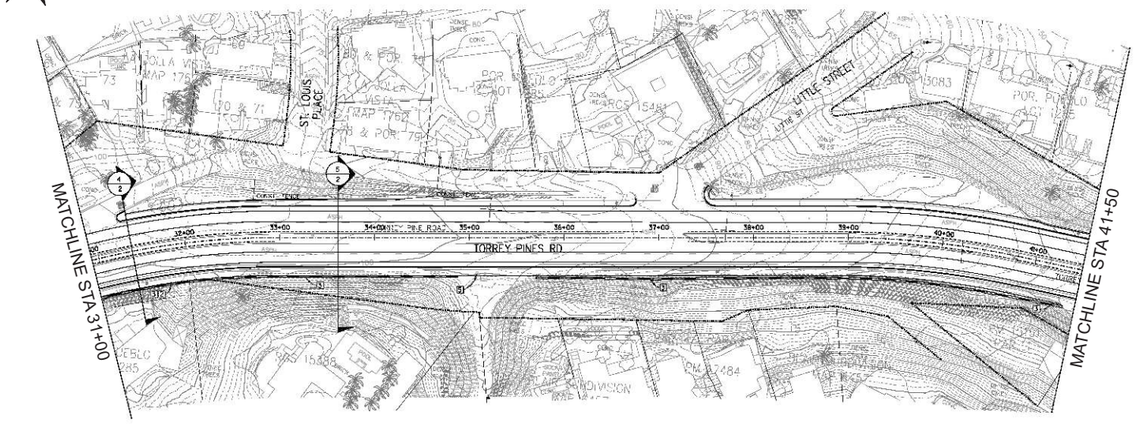
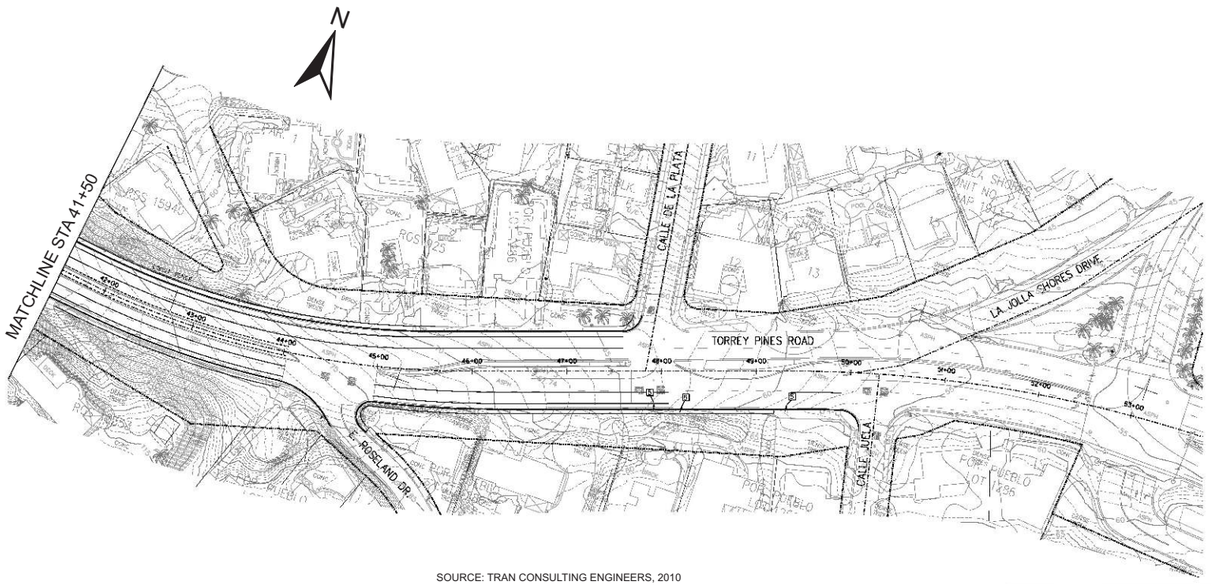
fig 1 106843001 slm permit 5-09









SOURCE: TRAN CONSULTING ENGINEERS, 2010

APPROXIMATE SCALE

0 100 200 FEET

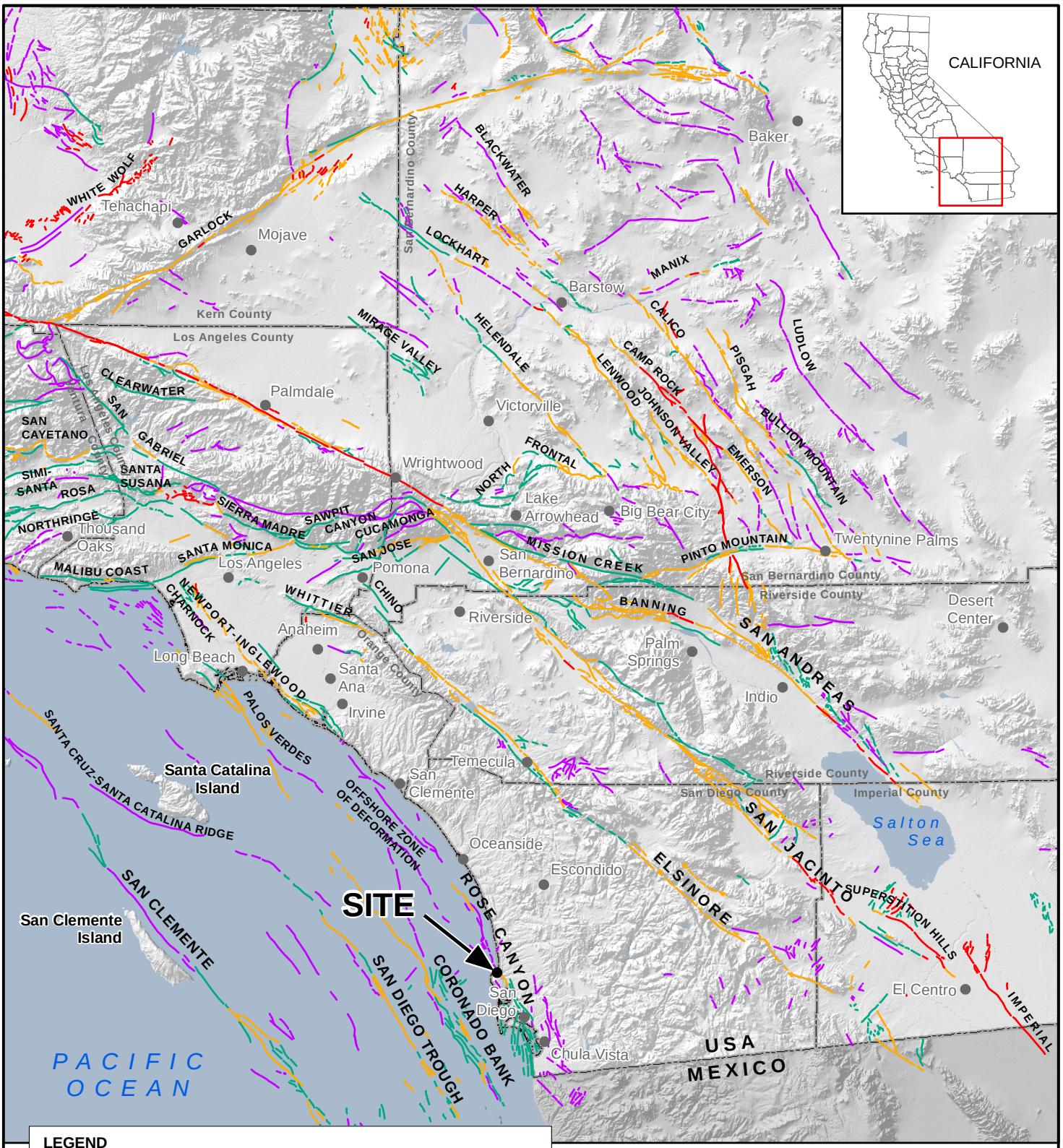
LEGEND

- [1] PROPERTY ENCROACHMENT
- [2] RETAINING WALL ENCROACHMENT
- [3] RETAINING WALL
- [4] POTENTIAL RETAINING WALL
- [5] ABOVE-GROUND UTILITY SIDEWALK CONFLICT

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

106843001 site plan.cdr

Ninyo & Moore		SITE PLAN	FIGURE
PROJECT NO.	DATE	TORREY PINES ROAD REALIGNMENT SAN DIEGO, CALIFORNIA	2
106843001	6/10		



LEGEND

CALIFORNIA FAULT ACTIVITY

- HISTORICALLY ACTIVE
- HOLOCENE ACTIVE
- LATE QUATERNARY (POTENTIALLY ACTIVE)
- QUATERNARY (POTENTIALLY ACTIVE)
- STATE/COUNTY BOUNDARY

SOURCE: FAULTS - CA DEPT OF CONSERVATION, 2000; BASE - ESRI, 2008

N

APPROXIMATE SCALE

0 25 50 MILES

NOTES: ALL DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

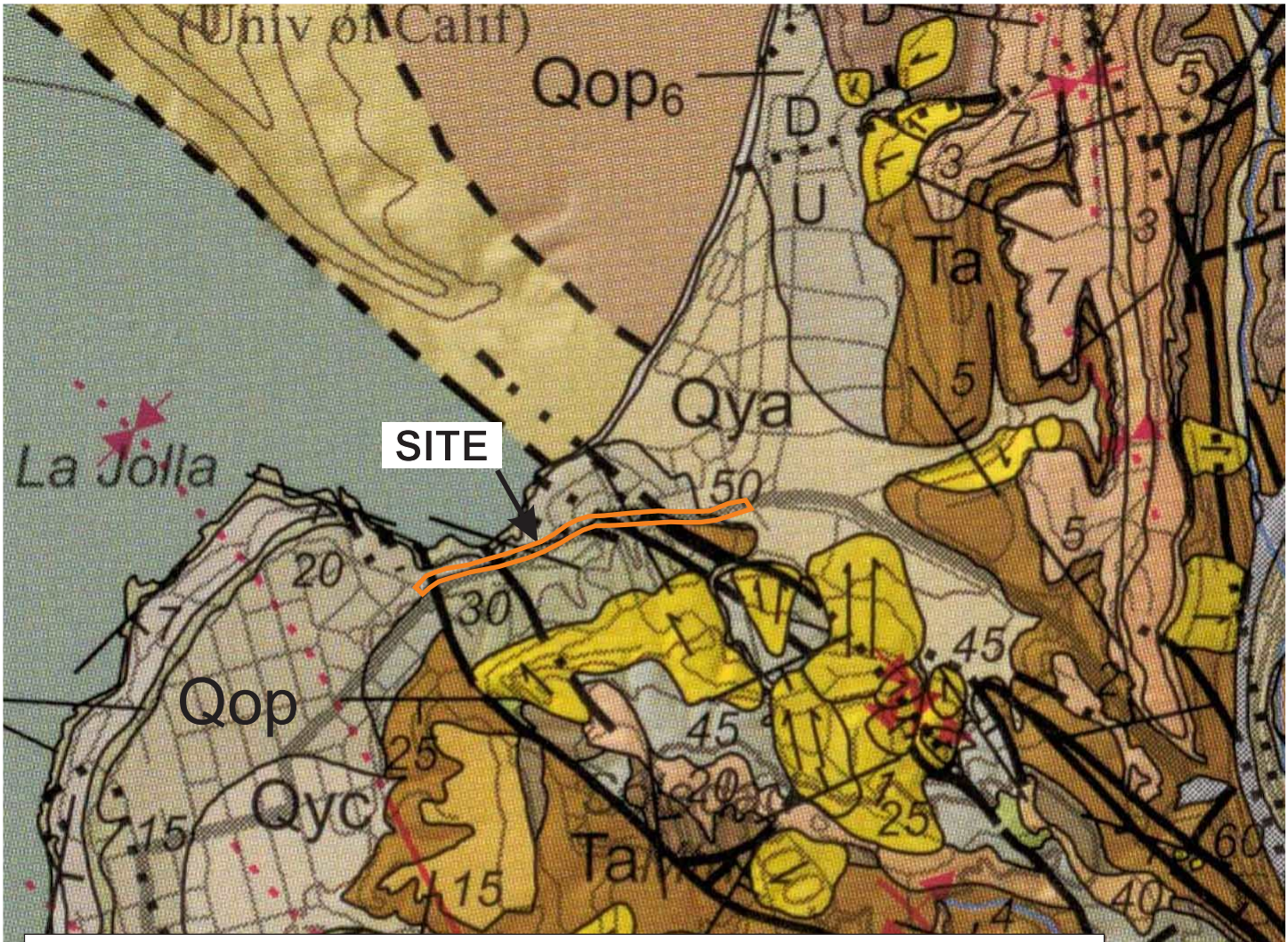
Ninyo & Moore

FAULT LOCATION MAP

FIGURE 3

PROJECT NO.	DATE
106843001	6/10

TORREY PINES ROAD REALIGNMENT
SAN DIEGO, CALIFORNIA



LEGEND

Qya	YOUNG ALLUVIAL FLOODPLAIN DEPOSITS
Qop	OLD PARALIC DEPOSITS, UNDIVIDED
Qop6	OLD PARALIC DEPOSITS, UNIT 6
Qvop10a	VERY OLD PARALIC DEPOSITS, UNIT 10a
Qvop11	VERY OLD PARALIC DEPOSITS, UNIT 11
Ta	ARDATH SHALE
10	STRIKE AND DIP OF INCLINED SEDIMENTARY BEDS
70 U D	FAULT - SOLID WHERE ACCURATELY LOCATED, DASHED WHERE APPROXIMATE, DOTTED WHERE CONCEALED. U = UPTHROWN BLOCK, D = DOWNTHROWN BLOCK. ARROW AND NUMBER INDICATE DIRECTION AND ANGLE OF DIP OF FAULT PLANE
	ANTICLINE - SOLID WHERE ACCURATELY LOCATED, DASHED WHERE APPROXIMATE, DOTTED WHERE CONCEALED. ARROW INDICATES DIRECTION OF AXIAL PLUNGE
	SYNCLINE - SOLID WHERE ACCURATELY LOCATED, DOTTED WHERE CONCEALED. ARROW INDICATES DIRECTION OF AXIAL PLUNGE
Qls?	LANDSLIDE - ARROWS INDICATE PRINCIPAL DIRECTION OF MOVEMENT, QUERIED WHERE EXISTENCE IS QUESTIONABLE

APPROXIMATE SCALE

0 2000 4000 FEET

N

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

REFERENCE: KENNEDY, M.P., AND TAN, S.S., 2008, GEOLOGIC MAP OF THE SAN DIEGO 30' X 60' QUADRANGLE, CALIFORNIA.

Ninyo & Moore

GEOLOGIC MAP

FIGURE 4

PROJECT NO.	DATE
106843001	6/10

TORREY PINES ROAD REALIGNMENT
SAN DIEGO, CALIFORNIA

fig4 106843001 geol.cdr

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

REFERENCE: CITY OF SAN DIEGO SEISMIC SAFETY STUDY, 2008.

Ninyo & Moore	GEOLOGIC HAZARDS MAP	FIGURE
PROJECT NO. 106843001 / DATE 6/10	TORREY PINES ROAD REALIGNMENT SAN DIEGO, CALIFORNIA	5

fig4 106843001 geo haz.cdr

APPENDIX B

Report of

INITIAL SITE ASSESSMENT

INITIAL SITE ASSESSMENT
TORREY PINES ROAD REALIGNMENT
SAN DIEGO, CALIFORNIA

PREPARED FOR:
Tran Consulting Engineers
4444 El Cajon Boulevard, Suite 15
San Diego, California 92115

PREPARED BY:
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
5710 Ruffin Road
San Diego, California 92123

June 4, 2010
Project No. 106843002

June 4, 2010
Project No. 106843002

Mr. John Austin
Tran Consulting Engineers
4444 El Cajon Boulevard, Suite 15
San Diego, California 92115

Subject: Initial Site Assessment
Torrey Pines Road Realignment
San Diego, California

Dear Mr. Austin:

In accordance with our proposal P-8676 dated December 23, 2009, and your subconsultant agreement, Ninyo & Moore has performed an Initial Site Assessment (ISA) for the above-referenced project in San Diego, California. The attached report presents our methodology, findings, opinions, conclusions, and recommendations regarding the environmental conditions at the project area.

We appreciate the opportunity to be of service to you on this project.

Sincerely,
NINYO & MOORE

Shannon L. Smith, R.E.A. 30186
Senior Project Environmental Scientist

W. Scott Snyder, P.G. 7356, HG. 748
Principal Geologist

SLS/WSS/gg

Distribution: (1) Addressee

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1. INTRODUCTION

This Initial Site Assessment (ISA) for the Torrey Pines Road Realignment project was conducted by Ninyo & Moore in accordance with our proposal P-8676 dated December 23, 2009. The project involves proposed improvements to enhance vehicle and pedestrian access along Torrey Pines Road, including the addition of sidewalks on both sides of the road and minor changes to roadway grade and width. The ISA involved evaluation of potential environmental concerns within the boundaries of the project (herein referred to as the "project area"), which extends from approximately La Jolla Shores Drive and Calle Juela to Prospect Place in the community of La Jolla, in the city of San Diego, California.

1.1. Purpose

The purpose of the ISA is to document potential environmental concerns related to hazardous materials or wastes associated with the proposed project. The scope of work for this ISA was developed using general guidance from the California Department of Transportation (Caltrans) ISA Guidance Document and associated templates (Geomatrix, 2006), and the Caltrans Standard Environmental Reference. The scope of work for this ISA was modified based on the scope of work listed in our proposal, to accommodate the nature of the project area as an existing street right-of-way (ROW) and the fact that this study is intended to support preliminary design.

1.2. General Limitations

Opinions given in this ISA report relative to the potential for hazardous materials or petroleum hydrocarbons to exist in the project area are based on the information obtained from information sources described herein. Certain indicators of the presence of hazardous materials or petroleum hydrocarbons may become observable at a later date. Ninyo & Moore has also reviewed public information sources as providing complete and accurate information, without independent verification. The findings and conclusions in this report are based solely on the limited scope of an ISA, including information from a variety of sources that Ninyo & Moore believes to be reliable. Because the scope of an ISA is necessarily limited

and based in part on third party sources and significant assumptions, Ninyo & Moore does not warrant that the site does not include hazardous material or petroleum hydrocarbon releases in areas not identified in this report.

1.3. Methodology

Our scope of work for this ISA consisted of the following tasks.

- Review of readily available maps (e.g., topographic, geologic) pertaining to the project area and information available from the client.
- Review of historical aerial photographs available from online sources.
- Review of online environmental databases to evaluate locations of known hazardous waste project areas, landfills, leaking underground storage tanks (USTs), and/or other facilities/areas of potential environmental concern.
- Preparation of an ISA report that compiles information from research activities described above and provides opinions and recommendations regarding possible environmental impacts from hazardous materials or wastes and soil and/or groundwater contamination associated with the project area.

2. PROJECT AREA DESCRIPTION AND PHYSICAL SETTING

The project area includes the street ROW of Torrey Pines Road from approximately La Jolla Shores Drive/Calle Juela to Prospect Place (Figure 1). The project area is located in a predominantly residential area. Single-family homes are located adjacent to the north, south, and west sides of the project area. Adjacent to the east of the project area at the intersection of La Jolla Shores Drive and Torrey Pines Road is a commercial property developed as a gasoline service station and coffee shop. The Pacific Ocean is located approximately 1/4 mile north of the western end of the project area. Landmarks and features of interest (e.g., major roads, adjacent properties) are depicted on Figure 2.

2.1. Topography

Elevations across the project area range from a high of approximately 155 feet above mean sea level (MSL) at Prospect Place to a low of approximately 55 feet above MSL at Calle Juela (Ninyo & Moore, 2010).

2.2. Geology

According to the Geotechnical Reconnaissance report being prepared concurrently with this assessment, the project vicinity is underlain by surficial soils consisting of artificial fill underlain by young alluvium, old paralic deposits (formerly designated Bay Point Formation), and/or the Point Loma Formation (Ninyo & Moore, 2010).

2.3. Hydrogeology

According to documents reviewed on the State Water Resources Control Board (SWRCB) Geotracker website for the unauthorized release associated with the gas station located adjacent to the east of project area (Figure 2), the project area is located in the Scripps Hydrologic Area (906.30) of the Penasquitos Hydrologic Unit (County of San Diego, 2004). Groundwater in this hydrologic area has been exempted from municipal beneficial use, and no other existing or potential beneficial uses are reported in the San Diego Region Basin Plan for the Scripps Hydrologic Area (RWQCB, 2007). Depth to groundwater at monitoring wells associated with the gas station was reported to be range from approximately 24 to 51 feet below ground surface (bgs). The direction of groundwater flow was to the northwest (County of San Diego, 2004). Groundwater levels can fluctuate due to seasonal variations, groundwater withdrawal or injection, and other factors.

3. HISTORICAL AERIAL PHOTOGRAPH REVIEW

Historical aerial photographs of the project area were reviewed to document the presence of facilities of potential environmental concern within and adjacent to the project area. Aerial photographs for selected years covering the period 1953 to 2005 were reviewed using online re-

sources. A listing of the aerial photographs reviewed is provided in Table 1, followed by a summary of noted observations.

Table 1 – Aerial Photographs Reviewed

Date	Photograph Identification	Scale
1953	www.historicaerials.com	1: 2,400
1964	www.historicaerials.com	1: 2,400
1980	www.historicaerials.com	1: 2,400
1990	www.historicaerials.com	1: 2,400
2003	www.historicaerials.com	1: 2,400
2005	www.historicaerials.com	1: 2,400

Based on review of historical aerial photographs, the project area has been developed with land usage similar to the present since the early 1950s. Torrey Pines Road has been present in the project area in generally its current configuration since that time. Residential development adjacent to the project area has steadily increased over time. Facilities of potential environmental concern, which may be distinguished based on their building configurations (e.g., gas stations, large industrial facilities), were generally not noted within the project area or immediately adjacent to the project area in the photographs reviewed, with the exception of the gas station located on the eastern corner of La Jolla Shores Drive and Torrey Pines Road, which appears to have been present since the 1960s.

4. ENVIRONMENTAL DATABASE REVIEW

In order to assess the significance of properties on and in the vicinity of the project area with documented hazardous waste impacts, a search and review of online regional environmental regulatory agency databases was conducted, including the following databases:

- SWRCB Geotracker database,
- California Department of Toxic Substances Control (DTSC) EnviroStor (Brownfields database),
- DTSC Cortese List,
- California Department of Resources, Recycling, and Recovery (CalRecycle) Solid Waste Information System database,

- SWRCB Sites with Deed Restrictions,
- United States Army Corps of Engineers, Formerly Used Defense Sites (FUDS) program Geographic Information System website.

No properties of potential environmental concern under the jurisdiction of the DTSC, CalRecycle, or FUDS program were documented as being located on or adjacent to the project area.

The "La Jolla Shores Mobil" gas station at 2204 Torrey Pines Road, located adjacent to the east of the project area (Figure 2), was listed on the SWRCB Geotracker and DTSC EnviroStor databases as a Leaking Underground Storage Tank site. Based on review of information on the Geotracker website, the unauthorized release case involved a release of diesel fuel to groundwater. The case was issued closure by the lead agency, the County of San Diego Local Oversight Program (Department of Environmental Health) in November 2004. Several groundwater monitoring wells associated with the release were depicted on maps reviewed as being located within Torrey Pines Road. Information was not available on the SWRCB Geotracker website regarding whether the monitoring wells have been abandoned to date; however, the nearest wells are depicted as being located at least 100 feet from the project area. Although groundwater was documented as being impacted, there is a low likelihood that the unauthorized release case at this facility represents a significant environmental concern to the project, based on the case closed status and the fact that project improvements are not proposed within approximately 350 feet of the gas station property boundary. Based on the anticipated depth to groundwater at the project area (greater than 20 feet bgs), it is not anticipated that the project would be significantly affected by the potential for impacted groundwater, if present.

4.1. Mines

According to the California Division of Mines and Geology, Mines and Mineral Resources of San Diego County book dated 1963, no mines and/or sand and gravel pits were located at the project area (California Division of Mines and Geology, 1963).

4.2. Oil, Gas, Geothermal Fields

No existing or abandoned oil, gas, or geothermal wells were depicted on the State of California Department of Conservation, Regional Wildcat Map for the project area and vicinity (California Department of Conservation, 2007), or on the State of California, Department of Conservation, DOGGR Online Mapping System (California Department of Conservation, 2010).

4.3. Naturally-Occurring Asbestos

Based on a review of the California Department of Conservation reference material, ultramafic rocks with a higher likelihood of containing naturally-occurring asbestos are generally not located in the vicinity of the project area (California Department of Conservation, 2000).

4.4. Underground Pipeline

According to the United States Department of Transportation, Pipeline and Hazardous Materials Safety Administration, National Pipeline Mapping System website, no gas transmission pipelines, hazardous liquid pipelines, liquefied natural gas plants, or break out tanks are located within the project area.

5. COMMONLY ENCOUNTERED CONDITIONS

The following sections describe additional environmental conditions that are commonly encountered.

5.1. Aerially Deposited Lead

Based on the distance of the project area from the nearest major freeway (Interstate 5, greater than 1 mile to the east), aerially-deposited lead as a result of emissions from vehicular exhaust prior to the elimination of lead from fuels in the mid-1980s is not interpreted to be of significant concern to the project area.

5.2. Polychlorinated Biphenyls-Containing Transformers

Transformer equipment potentially containing polychlorinated biphenyls (PCBs) may be located within the project area. San Diego Gas & Electric (SDG&E) states that it is responsible for ensuring that its transformers comply with USEPA regulations. SDG&E states that it has not specified PCB transformers for its electrical distribution system; however, some older (pre-1980) mineral transformers could have been inadvertently contaminated with PCBs by the manufacturer. Based on SDG&E's statistical sampling and testing program, SDG&E states that it is unlikely that its transformers are PCB-contaminated. The only way to know with certainty is by actually obtaining and testing a sample of the fluid from the specific transformer, which may result in a fee from SDG&E.

5.3. Asbestos-Containing Materials

Commonly encountered potentially asbestos-containing materials in street ROWs include pipe insulation found on natural gas lines and cementitious pipe lines (e.g., transite). Other asbestos-containing pipelines may be present within the project area.

5.4. Lead-Based Paint

Painted curbs, poles, and roadway striping may be present in the street ROW and may contain lead-based paint. The Consumer Product Safety Commission banned the use of paint containing lead above certain thresholds for residential uses; however, it is possible that lead-based paint is used in industrial settings, such as for street improvements in the project area. The California Department of Public Health defines lead-based paint as paint containing greater than or equal to 0.5 percent by weight and/or 1.0 milligrams per square centimeter.

5.5. Miscellaneous Hazardous Materials

Materials falling under the Universal Waste Rule (UWR) requirements may be present at the project area, including, but not limited to: potentially mercury-containing switches and fluorescent light tubes, potentially PCB-containing light ballasts, and hi-intensity vapor lights and associated ballasts.

6. ISA FINDINGS AND CONCLUSIONS

This report presents the results of an ISA conducted by Ninyo & Moore for properties associated with the Torrey Pines Road Realignment project in San Diego, California. Based on the research activities conducted for this ISA, the following evidence of potential environmental concerns was noted to be associated with the project area.

- The active gas station located adjacent to the east of the project area was the subject of an unauthorized release case under the oversight of the County of San Diego Department of Environmental Health due to petroleum impacts to soil and groundwater. According to information reviewed on the SWRCB Geotracker website, depth to groundwater at monitoring wells associated with the gas station was generally greater than 20 feet bgs. Although groundwater was documented as being impacted, there is a low likelihood that the unauthorized release case at this facility represents a significant environmental concern to the project, based on the case closed status and the fact that project improvements are not proposed within approximately 350 feet of the gas station property boundary. Based on the anticipated depth to groundwater at the project area (greater than 20 feet bgs), it is not anticipated that the project would be significantly affected by impacted groundwater, if present.

- Asbestos-containing materials may be present within the project area, including pipe insulation on natural gas lines and cementitious pipe lines (e.g., transite).

- Electrical transformers can be a source of PCBs. The transformers in the project area are likely owned and operated by SDG&E, which states that it is responsible for ensuring that its transformers comply with applicable regulations. SDG&E states that it is unlikely that its transformers, such as those in the project area, are PCB-contaminated. However, sampling and analysis of transformer fluid would be necessary to evaluate PCB content.

- Painted curbs, poles, and roadway striping in the street ROW of the project area may contain lead-based paint. Other lead-based paint may be present within the project area.

- Materials falling under the UWR requirements including, but not limited to: potentially mercury-containing switches and fluorescent light tubes, potentially PCB-containing light ballasts, and hi-intensity vapor lights and associated ballasts, may be present at the project area.

7. RECOMMENDATIONS

The scope of an ISA is limited to anecdotal and visual evidence of potential environmental concerns and does not include verification based on environmental analysis/testing. The following additional activities are recommended before or during implementation of the Torrey Pines Road Realignment project:

- If disturbance of potentially hazardous materials (e.g., suspect asbestos-containing materials, lead-based paint) is proposed, it is recommended that a survey and/or sampling be conducted to evaluate the presence and location of potentially hazardous materials such as asbestos-containing materials, lead-based paint, and other materials falling under UWR requirements prior to disturbance of infrastructure with potentially hazardous materials (e.g., suspect asbestos-containing materials). The survey(s) should be conducted by California Department of Public Health Certified Lead Inspector/Assessors, California Division of Occupational Safety and Health Certified Asbestos Consultants, and/or other appropriately qualified professionals in accordance with applicable local, state, and federal guidelines and regulations.

- Prior to removal or demolition of infrastructure with potentially hazardous materials, appropriate abatement measures should be implemented by a licensed abatement contractor using trained and certified workers and supervisors. Potentially hazardous materials should be handled and disposed in accordance with applicable regulations.

- Groundwater monitoring wells were not noted to be located within the project area, based on review of regulatory records. However, if wells are proposed to be disturbed during project improvements, the project proponent should coordinate with the responsible party and/or regulatory agency for the wells to evaluate their appropriate abandonment or relocation.

- Further assessment is recommended to be performed by a qualified environmental professional if soil or groundwater suggestive of contamination (e.g., discoloration, odors), or other potential environmental issues are encountered in the project area during project construction activities. If contamination is discovered, regulatory agencies may require additional environmental investigation and/or mitigation to be conducted, particularly if there is the potential to affect public health, safety, and/or the environment.

8. LIMITATIONS

The environmental services described in this report have been conducted in general accordance with current regulatory guidelines and the standard of care exercised by environmental consultants performing similar work in the project area. No warranty, expressed or implied, is made regarding the professional opinions presented in this report. Please note that this study did not include an evaluation of geotechnical conditions or potential geologic hazards. In addition, it should be noted that this ISA does not include analysis of the following: human health risk, asbestos-containing materials, methane gas, radon, lead-based paint, lead in drinking water, wetlands, regulatory compliance, cultural and historic resources, mold, industrial hygiene, health and safety, ecological resources, endangered species, indoor air quality including vapor intrusion, pipelines, and high-voltage power lines.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires any additional information or has questions regarding the content, interpretations presented, or completeness of this document.

Our findings, opinions, and conclusions are based on an analysis of the observed site conditions and the referenced literature. It should be understood that the conditions of a site can change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control. Ninyo & Moore cannot warrant or guarantee that not finding indicators of any particular hazardous material means that this particular hazardous material or any other hazardous materials do not exist on the site. Additional research, including invasive testing, can reduce the uncertainty, but no techniques now commonly employed can eliminate the uncertainty altogether.

9. REFERENCES

California Department of Conservation, 2000, A General Location Guide for Ultramafic Rocks in California - Areas More Likely to Contain Naturally-Occurring Asbestos: dated August.

California Department of Conservation, 2007, Division of Oil, Gas, and Geothermal Resources, Draft Regional Wildcat Map, Riverside and San Diego Counties, California (WI-7): dated December 18.

California Department of Conservation, Division of Oil, Gas, and Geothermal Resources, 2010, Oil, Gas, and Geothermal Digital Well Locations, http://www.conservation.ca.gov/dog/Pages/Index.aspx: accessed in June.

California Department of Toxic Substances Control, 2010, Cortese List, http://www.dtsc.ca.gov/SiteCleanup/Cortese_List.cfm: accessed in June.

California Department of Toxic Substances Control, 2010, EnviroStor Online Database, http://www.envirostor.dtsc.ca.gov/public/: accessed in June.

California Division of Mines and Geology, 1963, Mines and Mineral Resources of San Diego County California, County Report 3.

California Department of Resources, Recycling, and Recovery (CalRecycle), 2010, Solid Waste Information System (SWIS) Online Database, http://www.CALRECYCLE.ca.gov/SWIS/: accessed in June.

California Regional Water Quality Control Board, San Diego Region, 2007, Water Quality Control Plan for the San Diego Basin (9): dated September 8, amended through April 25.

California State Water Resources Control Board, 2010, Sites with Deed Restrictions, http://www.waterboards.ca.gov/water_issues/programs/deed_restrict/: accessed in June.

County of San Diego, Department of Environmental Health, 2004, Closure Letter, Underground Storage Tank Case No. H12899-001, Private Oversight Program, 2204 Torrey Pines Road, La Jolla, California: dated November 3.

Geomatrix, 2006, Caltrans Initial Site Assessment Guidance Document, Prepared for California Department of Transportation: dated September.

Ninyo & Moore, 2010, Geotechnical Reconnaissance, Torrey Pines Road Realignment, San Diego, California: dated June.

State Water Resources Control Board (SWRCB), 2010, GeoTracker online database, www.geotracker.swrcb.ca.gov, accessed in June.

United States Department of Defense, 2010, Formerly Used Defense Sites (FUDS) Online GIS Database, https://ekopowered.usace.army.mil/ecop/what_we_do/fuds/: accessed in June.

United States Department of Transportation, 2010, Pipeline and Hazardous Materials Safety Administration (PHMSA), Office of Pipeline Safety (OPS) National Pipeline Mapping System (NPMS) Website: https://www.npms.phmsa.dot.gov/: accessed in June.

REFERENCE: 2005 THOMAS GUIDE FOR SAN DIEGO COUNTY, STREET GUIDE AND DIRECTORY,

APPROXIMATE SCALE

0 2400 4800 FEET

N

Ninyo & Moore	PROJECT AREA LOCATION MAP	FIGURE
PROJECT NO. 106843002	DATE 6/10	TORREY PINES ROAD REALIGNMENT SAN DIEGO, CALIFORNIA	1

fig 1 106843001 slm.cdr

SOURCE: Aerial Imagery - Bing Maps, (c) 2010 Microsoft Corporation and its data suppliers

LEGEND

PROJECT AREA

N

NOTE: ALL DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

APPROXIMATE SCALE

0 600 1,200 FEET

Ninyo & Moore		SITE AND VICINITY MAP	FIGURE
PROJECT NO.	DATE	TORREY PINES ROAD REALIGNMENT SAN DIEGO, CALIFORNIA	2
106843002	6/10		

Wednesday, June 2, 2010 4:03:56 PM \100000_SD\106000-106999\106843002\106843002_svm.mxd JDL

APPENDIX C

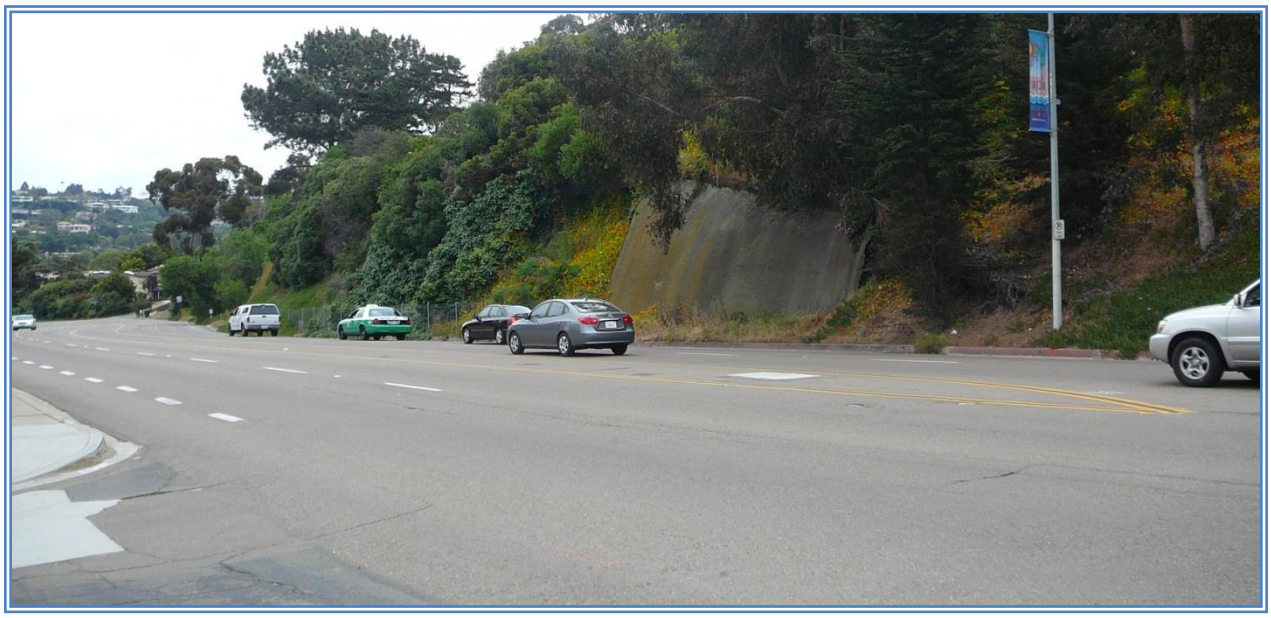
Technical Memorandum for

MEDIANS

TORREY PINES ROAD PRELIMINARY ENGINEERING STUDY

TECHNICAL MEMORANDUM FOR

MEDIAN OPTIONS



By

TRAN CONSULTING ENGINEERS

January 2011

I. TOPIC DESCRIPTION

Technical items in Torrey Pines Road are being evaluated for a proposed improvement project between Prospect Place and La Jolla Shores Drive. Within the project area medians are intended to be designed and constructed to provide for safe left turns for residents and as a lane for emergency vehicles. This technical memo will look at methods for a safe median.

Median areas are located in the center of Torrey Pines Road throughout the project area.

I. DISCUSSIONS OF FINDINGS

The proposed improvements will maintain or create a 10-foot corridor between west-bound and east-bound traffic. The median corridor will be available for emergency vehicles and left-turns into adjacent streets and driveways.

II.1. Median Alternatives

Various commonly used types of medians in California considered are:

- Striping – double yellow lines or single yellow line with a broken stripe
- Striping with speed grooves
- Stamped concrete - Cobble stone appearance
- Grasscrete (with and without a rolled curb)
- Raised medians
- Depressed medians

At the present time the median area is paved with asphaltic concrete and is striped with yellow lines from Prospect Place (Station 10+00) to Roseland Drive (Station 45+00). Beginning at Roseland Drive, there are raised medians as shown in the photo below that continue east to the end of the project. the raised medians should be left or replaced to assure that vehicles from La Jolla Shores Drive don't try to cross traffic to make an illegal left turn. The beginning of the raised median to the west is shown in Picture 2721 below.

Picture 2721 - Raised Median at Roseland Drive

The recommended median type(s) must provide a suitable level of safety for its intended use. Maintenance is also an important consideration. Raised medians are not safe when the intended use is emergency vehicles, which would have a difficult time crossing over them. Depressed medians may create a safety issue if drivers inadvertently wander into the depressed medianand lose control causing

an accident. Grasscrete requires some maintenance and watering, which would be difficult and costly in the project area. Therefore these three alternatives are not considered further.

The three remaining alternatives are: double yellow striping, double yellow striping with grooved pavement (or similar effect), and stamped concrete in a cobblestone appearance.

II.2. Yellow Striping

Currently the pavement median is marked with yellow striping as shown in the Pictures 2361, 3965 and 3966 below. Yellow striping is required to alert motorists of the alignment of the traveled lanes.

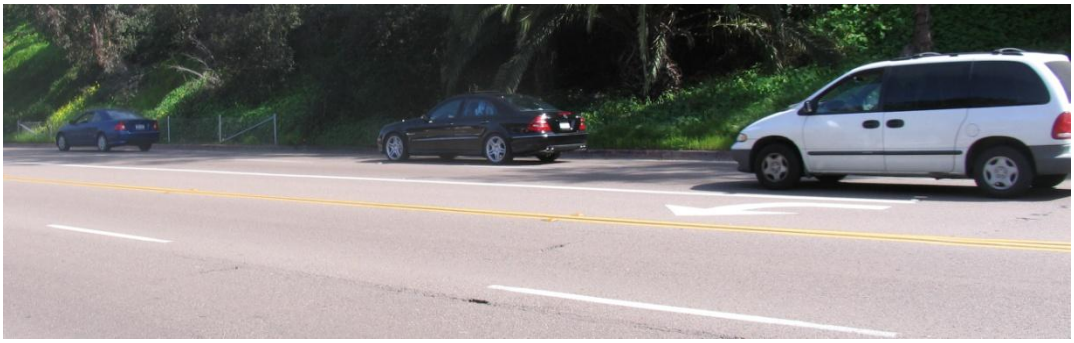
Picture 2361- Two Double Yellow Lines Define the Median

There are solid double yellow lines where there are no houses and no turns are permitted. There is single yellow line and a broken yellow line that defines the median area where turns are permitted for access to driveways. Each of these striping patterns are shown below in the project area.

Picture 3965 - Solid Yellow and Broken Yellow Stripes on Each Side of Median

Picture 3966 - Double Solid Yellow Strips on Each Side of Median

Left turn pockets are marked out in several locations for left hand turns onto side streets as shown in picture 2356 below.



Picture 2356 - Left-Turn Pocket in the Median

Defining the median with striping could be used in the proposed improvement project. It is one of the most common methods and motorists are accustomed to it. It is also the least expensive.

II.3. Grooved (Rumble Strips) Pavement

In order to provide a possible traffic calming effect, provide a more distinct and safer median; grooves could be placed in the pavement as done along edges of highways to warn drivers when they are out of the travelled way. There are many types of groove patterns, including longitudinal, and transverse, and diamond. This is an added precautionary measure since grooves do not eliminate striping of the highway. Regulations require yellow stripes on each side of the median area. Studies performed have shown throughout the U.S. that grooved pavement has reduced accidents and injuries on rural highways by as much as 20%.

If installed correctly many highway departments find low maintenance cost with grooved pavement. Grooves are relatively easy and cost effective to create. The cost to groove pavement is approximately $3 per square yard.

Diamond Grooved Pavement

Grooved Pavement on freeway (also note decorative strip at edge of shoulder)

A Special Effect Material

II.4. Stamped Concrete

Caltrans states that "Patterned (or stamped) concrete is standard concrete pavement that is colored and/or stained and imprinted with a pattern prior to curing. Best uses for patterned concrete pavement are in urban and suburban areas at high visibility locations including road edges, median strips and slope paving. Concrete is a good choice when longevity, visual quality and context adaptability outweigh initial cost considerations."

Stamped concrete could be used, which would provide a very distinctive median. Emergency vehicles could easily go over such a surface if designed correctly. It may also provide a traffic calming effect. There is a wide variety of colors and patterns available for use. Left-turn pockets would not have the stamped concrete, just normal pavement with appropriate arrows and other markings. Regulations would require double yellow stripes on each side of the median area.

Maintenance is required. Stamped concrete should be cleaned and resealed every few years, so maintenance costs would be higher than with other alternatives. Repairs can be difficult to match to original color and pattern.

The stamped concrete shown in picture 7 above also acts as a second rumble strip. This may be a more cost effective alternative to stamping the entire median however it does not compare to the lower cost of grooved pavement.

The cost of stamped concrete is estimated to be from $50 to $100 per square foot.

III. Evaluation and Recommendations

Improvements in Torrey Pines Road involve selecting a safe and effective median for residents and emergency vehicles. Following is a summary of the median

Median Type	Additional Cost to Striping	Advantages	Disadvantages
Yellow Striping	No additional Cost	Easily visible in good weather familiar to motorists	Sometimes difficult to see in poor weather (rain, fog, etc.)
Grooved (rumble strip) Pavement	$1 per foot	Provides alert to drivers who are not alert to their passing into the median. Can be placed on the edge of the median so emergency vehicles do not continuously travel over it.	Must be installed properly
Stamped concrete	$50-$100 /square foot Stamped strip cost = $50-$100/ linear foot	Can be highly attractive when decoration is selected properly.	Costly. Higher maintenance Difficult to repair to match pattern or color

Yellow stripes along both edges of the median are a basic requirement. The addition of grooves is a relatively beneficial and inexpensive addition. Stamped concrete is much more expensive, but provides a special look and may have a traffic calming effect.

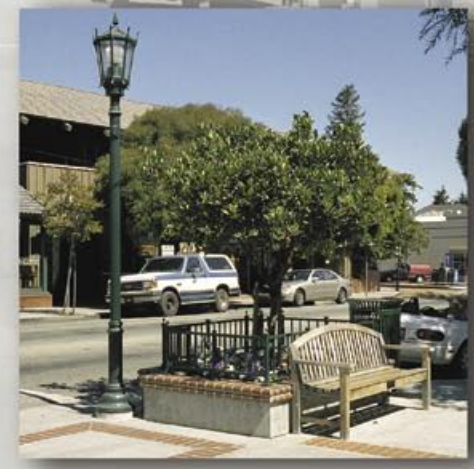
It is recommended to include stamped concrete in the median area if monies are available. Otherwise it is recommended to groove the median area on the edges, and stamped concrete can be kept as an option for the future.

IV. Appendices

1. Caltrans Main Streets: Flexibility in Design & Operations, January 2005
2. A Comparison of Transverse Tined and Longitudinal Diamond Ground Pavement Texturing for Newly Constructed Concrete Pavement by Pennsylvania Transportation Institute Penn State University
3. Design Of Medians For Principal Arterials by Center For Transportation Research the University of Texas at Austin

APPENDICES

Main Streets:
Flexibility in Design & Operations

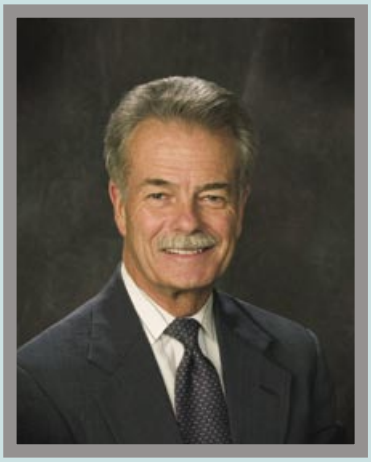


Caltrans

January 2005

Making main streets more livable

January 2005



This booklet emphasizes the California Department of Transportation's (Caltrans) commitment to make state highways that also happen to be local main streets more livable. It is a manifestation of a process that is sweeping rapidly across America – and across California: Context Sensitive Solutions (CSS).

Caltrans recognizes the potential benefits of measures such as reducing the number of lanes through a downtown, reducing lane widths, installing traffic calming devices, lowering speed limits, providing angled parking, wider sidewalks, roundabouts, raised medians and providing other street side amenities that provide a feeling that a town's main street is where you want to be.

None of these measures represent a reduction of Caltrans commitment to safety or mobility; all are within the parameters of the Caltrans Highway Design and Project Development Procedures manuals. Caltrans will continue to require appropriate justification for exceptions to design standards.

Caltrans remains committed to the notion that people live, work and play in the communities through which our facilities pass. It is our duty, by recognizing the needs of both non-motorized and motorized modes of transportation, to assure that living space is a good space in which to live. We are committed to full cooperation with the citizens and elected officials of those communities to find transportation solutions that meet both our duty to protect the safety and mobility of travelers, as well as making main streets an integral part of the community.

Will Kempton

Main Streets:
Flexibility in Design & Operations

Main streets through a community that also happen to be state highways provide access to businesses, residential roads and other nearby properties. Main streets serve pedestrians, bicyclists, businesses and public transit, with motorized traffic typically traveling at speeds of 20 to 40 miles per hour. Main streets give communities their identity and character, they promote multi-modal transportation, support economic growth, and may have scenic or historic value.

The California Department of Transportation (Caltrans) recognizes the value of a main street to a community and understands that planners and designers need to address community values when developing highway improvements where state highways also serve as main streets. Caltrans is committed to early and continuous public participation to accommodate a community's values into the planning and design of projects.

This booklet identifies Context Sensitive Solutions and Livable Community concepts that can assist communities and Caltrans in balancing community values with transportation concerns for safe and efficient operations for travelers, pedestrians, bicyclists, transit users, and highway workers.

Application of Flexibility

Caltrans advocates enhancements to state facilities that promote a community's vision and needs. Recognizing that meeting these needs may require flexibility, a process for approving alternative designs exists. This process evaluates each requested deviation for its potential effects on highway safety, regional needs, and the surrounding environment. Deviations from Caltrans policy or standards to meet community requests may require approval of an exception to a policy or nonstandard feature[1]. As previously mentioned, early communication between the community and District staff will help to identify opportunities to meet community needs. These early consultations will also open discussion about options that may not conform to department policy or standards. Since the approval process for a design-related exception is different from operational related policy, District staff will provide guidance on which approvals may be necessary.

This booklet is not intended to supersede existing Caltrans manuals, procedures or practices, but is a compilation of suggested options that may be used to enhance established traffic engineering and design practices, policies and standards.

Philosophy[2]

The Project Development process seeks to provide a degree of mobility to users of the transportation system that is in balance with other values. In the development of transportation projects, social, economic, and environmental effects must be considered fully along with technical issues, so that final decisions are made in the best overall public interest.

Attention should be given to such considerations as:

- **Need for safe and efficient transportation**
- **Attainment of community goals and objectives**
- **Needs of low mobility and disadvantaged groups**
- **Costs of eliminating or minimizing adverse effects on natural resources, environmental values, public services, aesthetic values, and community and individual integrity**
- **Planning based on realistic financial estimates**
- **Safety, construction and ease of maintaining whatever is built**

Proper consideration of these items requires that a facility be viewed from the perspectives of the user, the nearby community, and larger statewide interests.

Community Involvement

It's appropriate that Caltrans consider community values in the planning and design of state highways that are also main streets. The Transportation Equity Act for the 21st Century (TEA-21) of 1998 is emphatic on the role of public participation in transportation decision-making. In addition, the federal Interim Policy on Public Involvement requires Caltrans to promote an active role for the public in the development of transportation plans, programs, and projects from early stages of planning through detailed project development, construction, and maintenance. The interim policy also encourages Caltrans public participation programs to aggressively seek out and involve those traditionally underserved.

Extensive community involvement should guide the early planning and design of projects to ensure that projects address local issues and enhance the livability of communities. Identifying stakeholders and forming early partnerships are key to the success of these planning and design efforts.

Partnerships - Funding and Responsibilities

Successful implementation of Livable Community concepts and Context Sensitive Solutions (CSS) depends on a commitment to the principles of partnership. Although each partner has different roles and responsibilities, the community and Caltrans must commit to working together to develop the best solutions and share responsibility for decisions.

Partnerships are expressed through collaborative transportation problem definition, shared decision-making and a mutual commitment to implementation. Traditional and non-traditional stakeholders must invest in the partnership with an expectation of receiving a return on their investment.

Caltrans recognizes that the construction and operating costs that may occur with the implementation of some livable community and CSS principles are a shared responsibility. The degree of financial contribution is a negotiated process based on roles and responsibilities of each stakeholder.

Early in the planning process, stakeholders should determine their financial commitment for the various elements proposed as part of the highway improvement. Additionally, stakeholders should agree to their role in the maintenance of the main street.

For further information and funding options, please contact the local Caltrans District Office[3] or the Regional Transportation Planning Agency (RTPA).

Performance Measures

Community support for a highway project is always important, particularly when implementing design concepts such as those discussed here. Caltrans considers public participation a vital part of early project planning and desires full engagement with community members who express interest in implementing a community vision. The level of community support for a project is usually apparent in the planning and project development process. Local funding for elements of construction and maintenance or a commitment to implementing measures such as improvements to adjacent city streets or access management along the main street is a clear indication of community support.

For state highway main street projects, indicators that help determine and confirm compatibility with community values include:

- **Lower motorized operating speeds and improved Level of Service (LOS)[4]**
- **Reduced congestion levels and reduction of motorist delay**
- **Improved pedestrian access and mobility**
- **Improved access to schools and businesses**
- **Improved safety**
- **Improved bicycle accessibility and mobility**
- **Protecting and preserving scenic and historic qualities and attributes**

Traffic Calming Measures

"Traffic Calming is the combination of mainly physical measures that reduce the negative impacts of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users."[5]

An important tenet of public participation is that communities understand what traffic calming tools are available, and have input in determining which traffic calming features are considered. Traffic calming measures discussed throughout this booklet can be used to enhance livability of community main streets on state highways.

Reducing the Number of Lanes

Reducing the number of lanes can provide space for features such as wider shoulders, bicycle lanes, sidewalks, and medians, or the addition of left turn lanes or parking. Reducing the number of lanes may reduce the potential for collisions or may decrease speeds and smooth traffic flow. However, reducing the number of lanes may also reduce the facility vehicular level of service, which may be acceptable to the community.

This strategy is typically considered as a highway transitions from rural to downtown conditions. The main street will typically have an Average Daily Traffic (ADT)[4] of fewer than 10,000 vehicles with approaching and departing two-lane segments and a four-lane facility through town. Consideration should be given to mobility impacts, congestion, collisions, maintainability (particularly sweeping and snow removal), pedestrians, bicyclists, and transit users, as well as adjacent land uses such as schools, parks, libraries, homes and businesses. It's important that strategies such as these be identified as early as possible in the planning and design process.

Reducing Lane Width

Lane width plays an important role for both motorized and non-motorized users. Wider lanes tend to improve driver comfort. The operations and physical dimensions of cars, recreational vehicles, trucks and buses, the classification or use of the highway and prevailing speeds, all influence the selection of the appropriate lane width. For highways that serve as main streets, particularly those that operate at lower speeds, lane widths narrower than the standard 12 feet may be appropriate. Reduced lane widths in combination with other traffic calming measures may encourage slower speeds, which is desirable for a main street. Where existing right of way is limited, reducing lane widths can provide adequate shoulder width for bike lanes and sidewalks. When considering use of narrower lane widths, the designer should recognize that the narrower lane reduces vehicle separation. A standard 12 -foot outside lane width is preferred where there is significant recreational vehicle and truck traffic or the main street is a designated bus or truck route. The gutter pan is not considered part of the traveled way.

Lane width below 12 feet is a non-standard design feature, which must be approved on a case-by-case basis. A design exception will be required for all cases where lane width is below the minimum standard.

Transverse Rumble Strips

Transverse Rumble Strips (TRS) are to be used selectively on approaches to a main street where a speed reduction is desired and where speed limit or warning signs are installed. On a state highway, a speed reduction will typically occur in a transition from rural to downtown conditions. The traffic operations personnel should consider a TRS that is compatible with motorcycle and bicycle use.[6] TRS will increase noise for the surrounding areas. Additionally, drainage should be considered, as a TRS might trap water, which could pond in the roadway. Raised TRS should not be used in snow areas because of the potential formation of ice patches. Speed bumps or humps are not approved for use on state highways and are appropriate only for residential, non-state highway use. There is a safety concern that drivers may swerve toward the shoulder to avoid them, decreasing safety for pedestrians, bicycles, and other non-motorized modes of transportation. Many vehicles (especially emergency services vehicles) may detour to other streets to avoid them, which simply shift traffic to other routes and slows emergency service response times. Speed bumps also increase noise for the surrounding area.

Visual Cues

Visual cues help drivers recognize that they are entering an area of increased pedestrian, bicycle or other non-motorized activity, and in combination with other traffic calming measures may reduce vehicle speeds. Visual cues encourage motorists to park and experience the main street amenities. Examples of visual cues that can reinforce this transition include:

- **"Gateway" treatments, which are typically signs or monuments (see "Gateway Monuments" Section)**
- **Sidewalks, typically accompanied by curb and gutter, to designate portions of the roadway for motorized and non-motorized users**
- **Raised medians or traffic islands, typically installed as an access management technique and to provide a pedestrian refuge area or accommodate landscaping**
- **Landscaping in medians, sidewalk planting strips and planters**
- **Ornamental lighting, planters, benches, trash receptacles, light poles, traffic signals, overhead banners, artwork, bus shelters and other street furniture**
- **Pedestrian signs**
- **Textured crosswalks or intersection pavement**
- **Stop lines set back from crosswalks**
- **Transportation Art (see "Transportation Art" section)**

NOTE: All design elements that can be classified as fixed objects shall be located beyond the minimum horizontal clearance distance[7] or outside the clear recovery zone,[8] whichever is appropriate. Horizontal clearance varies, depending on whether or not the fixed object is adjacent to the sidewalk or the curb in the median.

Roundabouts

Many communities are beginning to recognize the traffic calming effect of properly designed and located circular intersections. Although their use has been promoted primarily to improve safety, the modern roundabout can provide numerous advantages over conventional intersection traffic control treatments.

Roundabouts can reduce the number and severity of collisions for all highway users. Additionally, roundabouts help to address other benefits such as those described in the bulleted items.

Additional information on roundabouts can be found in Caltrans Design Information Bulletin (DIB) No. 80-01[9] and the FHWA publication: "Roundabouts: An Informational Guide," dated June 2000.[10]

- **Reduce speeds of vehicles**
- **Improve access and traffic circulation**
- **Reduce delay**
- **Reduce the number of through and channelization lanes**
- **Provide more space for bicycle and pedestrian facilities**
- **Improve pedestrian mobility**
- **Reduce fuel and/or energy consumption**
- **Lower vehicle emissions**
- **Provide unique opportunities for landscaping and other aesthetic treatments**
- **Have the unique ability to serve as a physical and operational interface or gateway between rural and urban areas where speed limits change**

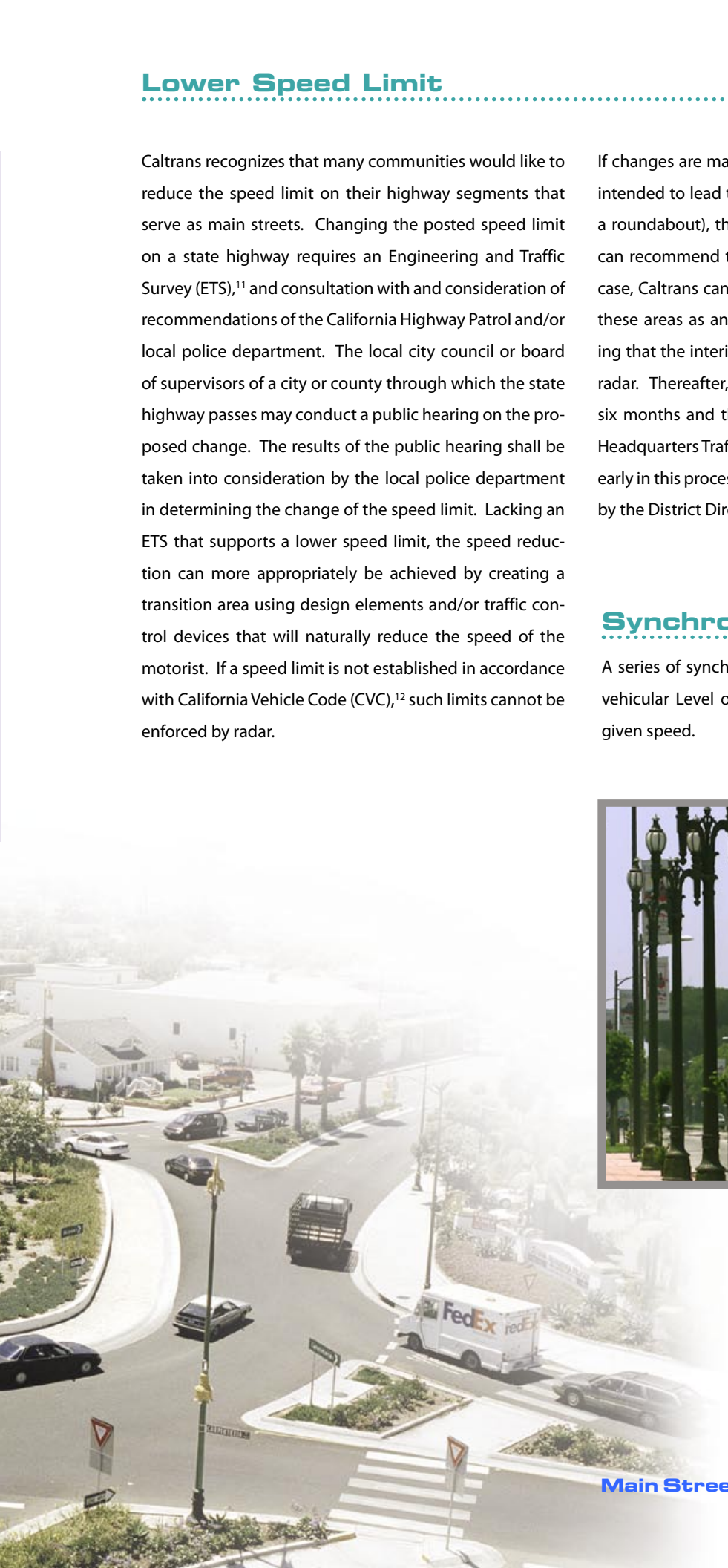
Lower Speed Limit

Caltrans recognizes that many communities would like to reduce the speed limit on their highway segments that serve as main streets. Changing the posted speed limit on a state highway requires an Engineering and Traffic Survey (ETS),[11] and consultation with and consideration of recommendations of the California Highway Patrol and/or local police department. The local city council or board of supervisors of a city or county through which the state highway passes may conduct a public hearing on the proposed change. The results of the public hearing shall be taken into consideration by the local police department in determining the change of the speed limit. Lacking an ETS that supports a lower speed limit, the speed reduction can more appropriately be achieved by creating a transition area using design elements and/or traffic control devices that will naturally reduce the speed of the motorist. If a speed limit is not established in accordance with California Vehicle Code (CVC),[12] such limits cannot be enforced by radar.

If changes are made to a section of the highway that are intended to lead to a speed limit reduction (for example, a roundabout), the District Division of Traffic Operations can recommend that the speed limit be reduced. In this case, Caltrans can place speed limit reduction signage in these areas as an interim solution with the understanding that the interim speed zone cannot be enforced with radar. Thereafter, Caltrans must complete an ETS within six months and the signage must comply with the ETS. Headquarters Traffic Operations staff should be consulted early in this process, and any changes should be approved by the District Director.

Synchronized Signals

A series of synchronized traffic signals can maintain the vehicular Level of Service and facilitate traffic flow at a given speed.



Parking

On-street parking may have a traffic calming impact. While parking is necessary to support business and main street uses, parked vehicles cannot be allowed to obstruct a driver's clear line of sight to an intersection. This is especially important for bicyclists traveling on the outermost portion of a roadway and pedestrians or disabled persons who may not be tall enough to be seen above a parked vehicle.

Some communities have expressed interest in angled parking to accommodate more parking spaces on the main street. Angled parking can be forward (nose-in) or reverse (back-in). However, it can create problems due to the varying length of vehicles and sight distance limitations associated with backing up against oncoming traffic.[13]

Angled parking is most feasible when an adequate buffer zone exists that allows vehicles to enter or exit the space without interfering with a bicycle lane[14] or, if there is no bicycle lane, the traveled way of the main street. A painted island is preferred, to separate the buffer area from the through traffic and bicycle lane. If a sufficient buffer area is not available, parallel parking should be used.

Raised Median Islands

Communities often request raised median islands for several reasons: they provide pedestrian refuge, reduce the scale of the main street, and with added landscaping, make the public space more beautiful. Raised medians also channelize left turn lanes and create a unique visual identity to the corridor. Raised median islands help reduce conflicts between pedestrians and vehicles by allowing pedestrians to cross only one direction of traffic at a time. Raised median islands should be designed to provide enough refuge for pedestrians crossing the street at intersections and designated mid-block crosswalks.

A raised median island may be placed to divert all through traffic from side streets and all left turn movements to the nearest signal or intersection where turns are permitted. Designers must conduct proper analysis to ensure that these intersections can accommodate the added turning movements. Adequate left turn pockets will be needed to provide storage space for the additional vehicles making the left turns and U-turns. Circulation from the side streets may be affected, which could impact local businesses and neighborhoods.

Any enhancement in the island that can be classified as a fixed object, such as a tree, boulder, bollard, monument, signpost, or light pole, must be set back from the island curb face.[8]

Where the island width is insufficient to accommodate enhancements such as those previously described, other design considerations may include eliminating lanes, using vertical curbs, or planting large multi-stemmed shrubs rather than trees. The District Landscape Architect should be consulted about these types of plants. Landscaping within the raised island should not restrict sight distance.[16] The District Traffic Liaison must approve pedestrian crossings and end treatments that use high barriers or vertical curbs as a planter.

Access for maintenance workers and their equipment should be considered in the design of median islands and in the selection of paved surface treatments, plant materials and irrigation systems.[15] Maintenance-efficient curb island design, which may include using water-efficient plantings, is encouraged. Additionally, paving narrow areas less than four feet wide lessens maintenance personnel exposure. It is also important to minimize obstructions that may impair sight distance. Paving the island far enough back from the intersection to provide adequate sight distance can do this.

Areas that receive regular snowfall require careful evaluation for islands due to snow removal considerations.

If the curbed island includes a gutter pan, a shoulder of at least two feet shall be provided from the left edge of traveled way (ETW) to the face of the island curb. The ETW should be delineated with a yellow stripe. The nose of the island shall terminate so that vehicles can easily complete turning movements without obstruction.

Sidewalks[17] - For most communities, the preferred sidewalk width in a downtown environment is 10 feet. This width allows pairs of pedestrians to walk side by side or to pass comfortably. More width is desirable to accommodate high volumes of pedestrians, bus shelters, sidewalk cafes[18] and other outdoor users. Any improvements within the Caltrans right of way must follow state law. In general, the wider the sidewalk, the more pleasant the pedestrian experience. All sidewalks and curb ramp design must meet accessibility requirements of the Americans with Disabilities Act (ADA) of 1990.[19]

In general, the use of sidewalks for bicycle travel is not desirable due to conflicts between pedestrians and bicyclists. However, when a sidewalk is designated for bicycle use,[20] it is important to recognize that an extremely wide sidewalk does not necessarily add to the safety of all users. Wide sidewalks encourage higher bicycle speeds and can increase potential for conflicts with motor vehicles at intersections as well as with pedestrians and fixed objects. Also, wider sidewalks may draw other users, including skateboarders, push scooters and in-line skaters.

On-street parallel parking and landscaped sidewalk planting strips can provide a buffer between pedestrians and moving vehicles.

Pedestrian Crossings - The principles and practices described in this section apply to pedestrian crossings. However, they also may apply to other types of non-motorized crossings, such as equestrians and bicycles. This section does not apply to school crosswalks.[21] Pedestrian crossings include: markings, signing, overhead signing where the main street displays numerous business signs and other distractions, raised islands for pedestrian refuge, and traffic control systems (e.g., flashing beacons with warning signs or in-roadway warning lights).

Intersections: Pedestrian crosswalk markings may be installed where they are needed to channelize pedestrians into a preferred path at intersections. This is typically done when the intended course is not readily apparent or when, in the opinion of the engineer, the crosswalk would minimize pedestrian-auto conflicts. Pedestrian crosswalk markings are not required at every intersection and should not be used indiscriminately.

Mid-Block Crossings: Mid-block pedestrian crossings are generally unexpected by motorists and should be discouraged unless, in the opinion of the engineer, there is clear and reasonable justification. Particular care should be given to roadways with two or more traffic lanes in one direction as a pedestrian may be hidden from view by a vehicle yielding the right-of-way to the pedestrian.

Textured Pavement in Pedestrian Crossings:[22] In general, stamped concrete and asphalt concrete are preferred over brick or unit pavers when a textured/aesthetic surface treatment is desired. Brick or unit pavers are discouraged because of potential problems related to pedestrians, bicycles and ADA requirements for a continuous, smooth, vibration-free surface. Brick or unit pavers may cause more noise, have a higher initial cost, and in particular, have a potential high cost of maintenance. Installation and maintenance of brick pavers requires skilled labor, storage of replacement materials, extended traffic control, more worker exposure, and replacement will result in added public inconvenience. Any textured or aesthetic cross-

walk surface treatment must also have painted crosswalk markings. The use of textured surface treatments for crosswalks may be considered but requires approval from the District. Proposed textured/aesthetic surface treatment must meet structural section requirements as specified by the District Materials Engineer.

In-Roadway Flashing Lights:[23] In California, crosswalk-warning systems such as In-Pavement Flashing Lights are considered traffic control devices. They can be installed in the pavement to warn highway users of a condition that is not readily apparent and may require the road user to slow or come to a stop.[24] Such systems should be considered for use on a state highway only after consultation with the Headquarters Traffic Operations Liaison.[25]

Sidewalk Bulbouts (Curb Extensions): Sidewalk bulbouts are extensions of the sidewalk into the roadway at intersections. They are designed to give pedestrians greater visibility as they approach the intersection crossing, decrease the distance they must cross and slow traffic. They often have textured/aesthetic surface treatment and are integrated into the streetscape design.

Sidewalk bulbouts are to be approved for use on a case-by-case basis if they do not meet design standards. A design exception will be required for all cases where a bulbout reduces shoulder width below the minimum standard. Where a bicycle lane exists or is planned in the future, the bulbout shall be designed so as not to extend into the area reserved for the bike lane. It must provide the proper turn radius so that trucks can turn without driving over the curb. It must allow for adequate drainage to avoid ice, leaf and road debris buildup and to allow street sweeper accessibility. In areas of regular snowfall, curb extensions must be marked with objects visible to plow operators. Areas that receive regular snowfall require careful evaluation and may not be good candidates for sidewalk bulbouts due to snow removal considerations.

In areas that serve local schools, a state grant program, Safe Routes to School (SR2S),[26] has been established to fund projects where communities have developed an interest in engineering safer neighborhoods. One of the six categories of projects includes pedestrian and bicycle crossing improvements.

Street Lighting

Main streets should have adequate lighting for pedestrians to feel secure at night. Decorative lighting fixtures enhance a downtown's unique sense of place. Decorative lighting or traffic signal fixtures may be used provided they meet current federal and state safety standards.[27] Poles and signal controller boxes must be placed outside of the pedestrian area of the sidewalk. Poles in the median must meet specific traffic safety standards. Caltrans staff will provide the appropriate information on safety requirements for lighting fixtures.

Caltrans is mainly involved in lighting for safety as warranted by federal guidelines. Continuous main street lighting that is not warranted by Caltrans is the responsibility of the local agency. Selection of decorative lighting fixtures should involve the local community and local agency. It will be the local community's responsibility to determine the type of fixtures and the local agency's responsibility to secure funding for installation, operation and maintenance of continuous main street lighting.

Furnishings

Street Furnishings include benches, kiosks, bollards, bike racks, planters, etc. Street furnishings provide pedestrians a place to rest and socialize. To enhance pedestrian activity, a main street may include places to sit, such as benches, low walls, planter edges or wide steps. The presence of pedestrian gatherings reminds motorists that streets have other public uses. Furniture layouts for sidewalks must place these objects away from the pedestrian path. Tables for dining are not appropriate within Caltrans right of way except under a special event permit.

Bike racks and bollards should be placed beyond minimum horizontal clearance requirements[7] and away from the pedestrian area of the sidewalk. Bollards must be tall enough so they do not create a tripping hazard to pedestrians.

Furnishings must not compromise ADA requirements. If there is lack of adequate street lighting, the furnishings may have to be lighted by other means to avoid being a tripping hazard.

Street Landscaping

Street landscaping makes downtowns more livable, beautiful and unique to the town. Quality landscaping along the roadway, close to the highway or in medians can increase driver awareness of the immediate environment and may alter driver behavior, resulting in slower speeds and a safer main street. A row of trees may calm traffic by making the road appear narrower. Street trees add an attractive canopy over the main street and may increase comfort for pedestrians. They create comfortable spaces

and soften lighting. They cool streets in the summer, and provide a windbreak in the winter. Trees also create distinctive identity and seasonal interest. However, caution should be exercised while considering trees along the roadway that might extend over the traveled way in snow areas. Snow accumulation may cause branches to break and fall. Also, shade from trees may cause "black ice" conditions in areas where freezing temperatures are prevalent.

For visibility, trees must be located and maintained properly, and not impair corner sight distance. Avoid blocking visibility for turns into and from intersections and driveways, obstructing driver's line of sight to oncoming traffic, blocking visibility of stop signs or other roadside signs, and decreasing visibility for pedestrians and bicyclists at intersections. Trees must also conform to Caltrans minimum setback requirements for clear recovery zones.[8]

Trees planted along a main street must not present a barrier for any mode of transportation on the highway. The District Landscape Architect should review any proposed plant material and recommend appropriate installations related to aesthetics, safety, cost, and maintainability.

The characteristics, growth habits, and species are very important when selecting street trees and other plant material. Special consideration should be given to the root system and the characteristics of the tree at maturity. All plant material requires regular maintenance. Contact the District Landscape Architect for technical expertise on plant characteristics that will suit specific site locations. Proper selection of plant material will ensure reduced maintenance problems and increase safety for highway users and workers.

Banners and Decorations[28]

Caltrans reviews submittals and issues permits for the erection of banners, decorations and temporary signing over and within conventional highway rights-of-way for events sponsored by local agencies and nonprofit organizations. Banners, decorations and temporary signing must be placed beyond minimum horizontal and vertical clearance requirements.

Authorized banners and decorations over the roadway must have a minimum vertical clearance and be suspended securely from permanent structures or poles. Temporary supports are not allowed and the use of state facilities, including but not limited to intersection signals, overhead signs or light poles, is prohibited.

Permanent overhead signs or arches may not be erected or suspended over any state highway.

Non-Decorative Banners are intended to convey a message such as the occasion of an event or activity. Caltrans issues permits for non-decorative banners to local agencies or nonprofit organizations sponsoring an event the local agency has approved. Banners displaying private advertisements are not allowed except when used as part of an event's official title (e.g., Kellogg's Napa Valley Marathon).

Districts may issue biennial permits to local agencies for installation of non-decorative banners for recurring events. The local agency then authorizes each banner installation, notifies the state's representative, and provides traffic control.

Decorative red, yellow or green lights or decorations that may be confused with any traffic control device shall not be placed where they could interfere with the driver's perception of traffic signals.

Decorative Banners are intended to convey brief text or logos identifying the local agency. Decorative banner permits may be issued by a local agency for enhancement of its main street. As a minimum, decorative banners shall:

- **Be used exclusively on conventional state highways**
- **Not contain advertising whether in text or logo format**
- **Remain in place for periods up to two years - the normal biennial permit duration**
- **Have an approved Caltrans encroachment permit where the local agency is the applicant**

Decorations that extend beyond the curb line or cross the highway shall have a minimum vertical clearance above the highway pavement. Decorations attached to a non-state vertical structure such as power, telephone or light poles, or buildings are not to project beyond the curb line and meet the minimum vertical clearance requirements above the sidewalk. Decorations shall not be attached to State owned facilities such as traffic signals.

Holiday decorations are permitted on conventional state highways.

Gateway Monuments[29]

A gateway monument is defined as any freestanding structure or sign, not integral or otherwise required for the highway facilities that communicates the name of a region, community or area.

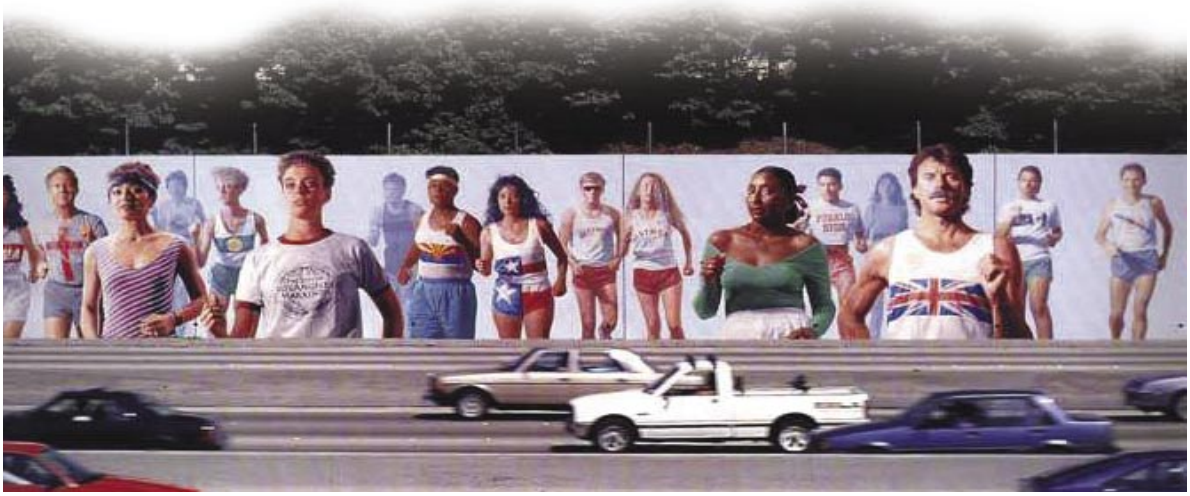
Guidelines for Gateway Monuments, issued in 2005, contain additional information.

Transportation Art[30]

There is often a local desire to make existing transportation facilities more context sensitive to the local community to reflect the aesthetic, cultural and environmental values of the community through which the facility runs. Transportation Art is defined as authorized artwork created, constructed, or painted on structures or other facilities or spaces within Caltrans right-of-way.

It is Caltrans intent, by means of its Transportation Art Program, to encourage others to use its facilities, structures and right-of-way spaces for creative expression through the visual arts. Well-conceived art forms, properly located, can enhance the experiences of those using transportation facilities and enrich the environment of neighboring communities.

Placement of such artwork is conditional on appropriate maintenance agreements and assurance that its maintenance does not create safety concerns on the state highway.



For Internet Access to references visit Caltrans websites:

Design Information Bulletins, Highway Design Manual, or Project Development Procedures Manual:
http://www.dot.ca.gov/hq/oppd/guidance.htm

Encroachment Permits Manual:
http://www.dot.ca.gov/hq/traffops/developserv/permits/encroachment_permits_manual/index.html

Traffic Manual:
http://www.dot.ca.gov/hq/traffops/signtech/signdel/trafficmanual.htm

FHWA Manual on Uniform Traffic Control Devices (MUTCD), 2003 Edition and the MUTCD 2003 California Supplement:
http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/supplement.htm

For Internet Access to this booklet visit Caltrans website:
http://www.dot.ca.gov/hq/oppd/context/main-streets-flexibility-in-design.pdf

References:

[1] Highway Design Manual Topic 82

[2] Highway Design Manual Topic 81

[3] Caltrans District Local Office website at: http://www.dot.ca.gov/localoffice.htm

[4] For a definition of Level of Service (LOS) and Average Daily Traffic (ADT), see Traffic Manual, Section 1-04

[5] ITE Journal, July 1997, p.23

[6] For further information on Transverse Rumble Strips (TRS), see MUTCD, 2003 Edition and MUTCD 2003 California Supplement, Section 3B.106

[7] Highway Design Manual Topic 309.1(3) (c)

[8] Highway Design Manual Topic 309.1(2)

[9] For more information, see Design Information Bulletin (DIB) 80-01 website at: http://www.dot.ca.gov/hq/oppd/dib/dib80-01.htm

[10] FHWA "Roundabouts: An Informational Guide" (June 2000) and other Roundabout guidance are available on FHWA's website at: http://www.tfhrc.gov/safety/00068.htm

[11] FHWA MUTCD, 2003 Edition and MUTCD 2003 California Supplement, Chapter 2B

[12] California Vehicle Code (CVC) section 22354 and 22354.5 at Department of Motor Vehicle's website: http://www.dmv.ca.gov/pubs/vctop/vc/tocd11c7a1.htm

[13] FHWA MUTCD, 2003 Edition and MUTCD 2003 California Supplement, refer to Parts 1A, 2B, 3B, 6C

[14] Highway Design Manual, Chapter 1000 – Figure 1003.2A for bike lane and parking configurations

[15] Highway Design Manual, Index 902.1(1) (b) and (c)

[16] Highway Design Manual, Index 902.2(2)

[17] Highway Design Manual, Topic 105

[18] Check with the District Encroachment Office for Permit Requirements at: http://www.dot.ca.gov/hq/traffops/developserv/permits/pdf/manual/Appendix_G_(WEB).pdf

[19] American Disabilities Act Title 28 of the Code of Federal Regulations (CFR) Part 35, all pedestrian facilities constructed must meet accessibility requirements

[20] Highway Design Manual, Index 1003.3

[21] FHWA MUTCD, 2003 Edition and MUTCD 2003 California Supplement, Part 7

[22] Must meet criteria specified for crosswalks in FHWA MUTCD, 2003 Edition and MUTCD 2003 California Supplement

[23] Chapter 4.L. "In-Roadway Lights" of the FHWA MUTCD, 2003 Edition and the MUTCD 2003 California Supplement

[24] For additional information see North Carolina Highway Safety Research Center Report on In-Pavement Flashing Lights Crosswalk Warning System, April 1998.

[25] For the appropriate Headquarters Traffic Operations Liaisons contact the District Traffic Office

[26] For more information on the Safe Routes to School (SR2S) Program see the website at: http://www.dot.ca.gov/hq/LocalPrograms/

[27] Caltrans adheres to lighting requirements as warranted in the FHWA MUTCD, 2003 Edition and MUTCD 2003 California Supplement

[28] Encroachment Permits Manual, Sections 501.7

[29] Encroachment Permits Manual, Section 501.3F
Project Development Procedures Manual, Chapter 29, Section 9

[30] Project Development Procedures Manual, Chapter 29, Section 6

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A Comparison of Transverse Tined and Longitudinal Diamond Ground Pavement Texturing for Newly Constructed Concrete Pavement

Prepared for:

The Transportation Research Board

November 2001

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ABSTRACT

The purpose of this study is to provide a comparison of longitudinal diamond ground and transverse tined pavement surface texturing for newly constructed Portland Cement Concrete Pavement (PCCP). The study area is located along a test-section of I-190 in Buffalo, New York. The two PCCP surface treatment types being evaluated in this report are compared based on safety, noise, construction cost, service life, rideability, handling, and maintenance requirements. This paper documents the initial evaluation and also analysis of follow-up noise and skid resistance measurements conducted approximately one year later.

Analysis of the initial testing indicates that the relative skid resistance of the experimental longitudinal diamond ground surface is as good or better than that of the transverse-tined surface. The results of the noise analysis indicate that the longitudinal diamond ground surface is 2 to 5 decibels quieter depending primarily on the traffic vehicle mix. Noise and skid resistance measurements conducted one year later showed little change. While less construction time was required for the transverse tined pavement as compared to the diamond ground pavement, the actual cost difference is not quantifiable. However, a higher initial cost for longitudinal diamond grinding would likely be partially offset by an extended service life.

INTRODUCTION

Surface texturing of concrete pavement is required on projects funded by the Federal Highway Administration (FHWA) to reduce skidding under wet pavement conditions. PCCP surfaces are often finished with a transverse tined texture during construction to increase skid resistance. Alternate pavement surface treatments are occasionally considered in an effort to reduce the tire-pavement noise associated with the traditional finish. However, a compromise in the safety or a reduction in the effective service life along with significant added construction costs would be undesirable side effects resulting from efforts to achieve a reduction in traffic-generated noise levels.

As part of a New York State Thruway Authority (NYSTA) highway reconstruction contract, a new PCCP surface texturing technique was implemented along portions of the Niagara Section of the NYS Thruway, Interstate 190 (I-190). The experimental surface treatment (longitudinal diamond ground texturing) was implemented adjacent to noise-sensitive areas in lieu of the conventional transverse tined concrete surface texturing method currently approved by the FHWA.

The purpose of this study is to provide a comparison of key performance characteristics between longitudinal diamond ground and transverse tined pavement surface texturing for newly constructed PCCP.

The test section of the highway included newly constructed segments of both traditional transversely tined PCCP and the experimental longitudinal diamond ground PCCP. Sample sections of both pavement types were included on both northbound and southbound lanes. The test-section of northbound pavement was opened to traffic in December of 1999. The test-section of southbound pavement was opened to traffic in December of 1998.

Approach

The two PCCP surface treatment types evaluated in this study are compared based on safety, noise, construction cost, service life, rideability, handling, and maintenance requirements. Comparisons are made on a section of highway of the same construction (other than surface treatment) and exposed to the same traffic and weather conditions.

Skid testing and accident reports are used to evaluate safety characteristics. Noise measurements and analytical modeling are used to compare the traffic generated noise levels. The unit price bid by the awarded construction contractor is used to compare relative construction costs. User surveys are used to obtain feedback from highway maintenance personnel, state police and the general traveling public to assess differences in rideability, handling, and maintenance requirements. Each of the aforementioned characteristics will be monitored over a period of five years to assess the service life of each PCCP surface treatment.

This paper reports the results and analysis of construction cost data and the initial set of noise and skid resistance measurements plus follow-up measurements conducted approximately one year later. Additional follow-up noise and skid-resistance measurements will be conducted annually through 2005 in order to continue documenting changes in pavement properties.

MATERIALS AND CONSTRUCTION DETAILS

Construction practices and materials used for the pavement test sections were kept as consistent as possible between the two pavement types except for the actual surface treatments, as detailed below.

Materials

Characteristics of the PCCP used on the portions of the I-190 relative to this study are typical of new PCCP construction in this region.

Construction

Paving

The unreinforced PCCP has transverse joints spaced at 5.5 meters. The transverse joints were saw-cut at a width of approximately 11 mm. Transverse joints were then beveled and a preformed neoprene joint sealer was installed leaving a 6.5 to 9.5 mm finished joint depth. The joint width and depth was kept as small as practical to help reduce wheel noise sometimes referred to as "tire-slap".

Transverse Tined Texturing

Transverse tined texturing was performed as per NYSDOT Special Specification: *Item 25502.070299 - Cement Concrete Pavement, Unreinforced, Class C, Profilographed*.

Immediately after finishing operations were completed and prior to the application of curing compounds, the surface of the concrete was textured with a set of randomly spaced spring steel tines in a direction perpendicular to the centerline of pavement (transverse). The individual tines were 3.1 mm wide, 0.71 mm thick, and 127 mm long. The tine spacing, size, and depth is a result of research that has been performed in an effort to minimize tire-pavement noise or "wheel-whine" characteristic of tined pavement surfaces (*1*). Although acoustical spectral data is not presented in this paper, we note that the randomly spaced tining effectively prevented audible whine and other tonal characteristics.

Longitudinal Diamond Ground Texturing

The longitudinal diamond ground texturing was performed as per NYSDOT Special Specification: *Item 25502.5010 - Full Diamond Grinding and Texturing of Concrete Pavement / Profilograph*ed.

Diamond grinding involves the removal of a thin layer of the cured concrete surface using a machine with closely spaced diamond-coated circular saw blades. The diamond blades are spaced such that the thin fins of concrete left between the blade cuts break off during the grinding process, leaving a level surface with longitudinal texture. The grinding head contained 166 saw blades (3.18 mm thick), set at 2.67 mm spacing.

Construction Duration and Cost

Both construction duration and bid price were compared to determine the cost differential between the two pavement surface treatments. Construction duration is an important factor because additional construction time would result in additional delays to the traveling public. Also, the contractor would include the cost of extended construction duration in the bid prices for maintenance and protection of traffic (MPT) and related construction items.

Construction Duration

For the subject contract (TAN 97-91), less construction time was required for the transverse tined pavement as compared to the diamond ground pavement.

The operation of tining was automated. It was performed from the same work-bridge and during the same work operation as the floating/finishing. Therefore, the production rate is only slightly increased over that where no tining is required (as would be the case in preparing the surface for diamond grinding).

The rate of the diamond grinding process varies depending on equipment horsepower, aggregate hardness, condition of the cutting blades, and the depth of the cut. For this project, the grinding rate was approximately 0.6 lane-Km per day (0.4 lane-miles/day). In addition there was a 7-day minimum curing time required prior to grinding. The diamond grinding process was completed over continuous highway sections during an independent construction sequence.

Cost

From the information available on the subject contract, there is inadequate information to determine the precise cost difference between the two surfacing techniques.

The price bid for the diamond grinding item on this project was $\$3.15/m^2$ ($\$3.75/yd^2$). The average industry cost is $\$2.10/m^2$ ($\$2.50/yd^2$) (*2*). The increased cost above the industry average is likely due to the fact that diamond grinding is a relatively new industry to the area. The subcontractor was brought in from out-of-state, and the test areas for grinding were relatively small, both of which cause the cost per square yard to be higher. Also, additional time to grind or float finish the pavement is sometimes needed to achieve required tolerances before tining.

PAVEMENT NOISE ANALYSIS

Research has shown that different commonly used pavement materials and treatments can have a significant influence on highway-generated noise levels (*3*,*4*). The pavement noise analysis for this study uses a combination of noise measurements and analytical noise modeling to evaluate the relative acoustical performance for the two candidate pavement types for both empirical and theoretical highway traffic conditions.

Noise Measurements

A series of traffic noise measurements were conducted along the northbound lanes of the test section between April 11 and April 20, 2000. Noise measurement and analysis procedures were consistent with specifications in *Measurement of Highway-Related Noise* (*5*) and *Development of National Reference Energy Mean Emission Levels for the FHWA Traffic Noise Model* (*4*). The measurement program included single vehicle pass-by measurements, drop-off vehicle noise measurements, and aggregate traffic noise measurements.

Single Vehicle Pass-by Measurements

Single vehicle pass-by measurements were conducted for both longitudinal ground, and transverse tined pavement types. Measurements were conducted between 11 PM and 6 AM, in order to better capture isolated individual vehicle events.

The single vehicle pass-by measurements were conducted in accordance with documented procedures for the development of Reference Energy Mean Emission Levels (REMEL's) used in the FHWA Traffic Noise Model. Due to project terrain constraints, the

recommended 15 meter (50 foot) reference measurement positions were not available for both pavement types. Therefore, the single vehicle pass-by measurements were conducted at a distance of 7.5 m (25 ft) and adjusted to the 15 m (50 ft) reference distance using the measured drop-off correction.

The results of the single vehicle pass-by measurements (adjusted for the reference distance) were graphed to show individual vehicle data points. Linear regressions representing each pavement surface type were calculated for automobile, medium truck, and heavy truck types. An example of the data and regression curves for autos and light trucks care shown in Figure 1. Similar graphs were generated for medium trucks and heavy trucks.

Drop-off Noise Measurements

The primary single vehicle measurement site, near the interface of the two pavement types did not allow for the required 15 meter wayside measurement position due to an existing embankment. A secondary measurement location was selected in order to measure the single vehicle drop-off correction. An average drop-off correction value of 6.2 dB was measured for all vehicle types.

Aggregate Traffic Measurements

Long-term (24 hour) aggregate traffic noise measurements were taken in order to determine the loudest hour of the day for the study area.

Short-term (1-hour) aggregate traffic noise measurements were collected during the loudest hour of the day concurrently with classified traffic counts to identify time-averaged noise level for both pavement types and associated traffic mix.

Traffic Noise Model Analysis

The FHWA Traffic Noise Model (TNM) is a Windows computer based analytical model that predicts traffic generated noise levels. The program predicts hourly average noise levels in A-weighted decibels (dBA) based on traffic volumes and mix, roadway and landscape topography, and other factors. The program uses Reference Energy Mean Emission Levels (REMELs) for a variety of vehicle types (autos, medium trucks, heavy trucks, buses and motorcycles) for a number of standard pavement types, including standard PCCP, dense grade asphalt, open grade asphalt, and an average of all pavement types. The program also provides for the input of user-defined REMELs for special vehicle types.

TNM User Defined Vehicles Parameters

Using single vehicle pass-by measurement data for each pavement type, parameters required to specify user-defined vehicles in FHWA's Traffic Noise Model (TNM) were developed for each of the three primary vehicle types (autos, medium trucks, heavy trucks) . User-defined vehicle parameters were developed for both pavement types. Table 1 summarizes input parameters developed from the noise measurements, along with 95% confidence limits for the linear regression of each vehicle/pavement type.

The "minimum level" parameter specified in Table 1 is representative of low speed vehicle noise, where the noise level is assumed to be dominated by engine/exhaust noise (independent of tire-pavement noise contributions). Because the data collected for this study is limited to vehicles traveling at highway speeds (80 to 140 km/h), the published TNM standard minimum levels for each of the three vehicle types is used.

TNM runs using new REMEL parameters for the candidate pavement types were validated to within approximately one decibel when compared to aggregate noise measurements.

TNM Vehicle Mix Scenarios

Four theoretical traffic mix scenarios were developed as a comparison parameter for pavement noise levels as follows:

1. Parkway: 100% autos and light trucks.
2. Light truck usage: 95% autos and light trucks, 5 % medium and heavy trucks.
3. Moderate truck usage: 80% autos and light trucks, 20 % medium and heavy trucks.
4. Heavy truck usage: 60% autos and light trucks, 40 % medium and heavy trucks.

TNM Predicted Noise Levels

Employing the user-defined vehicle parameters generated from the pavement specific pass-by data (presented above), TNM was used to predict traffic noise levels for a variety of conditions. The scenarios evaluated include variations of the following factors:

- Pavement Type - Two candidate pavement surfaces (longitudinally ground and transverse tined) plus the standard TNM "average" pavement type.

- Vehicle Mix - Four different vehicle mix scenarios, as defined above. All vehicles are assumed to be traveling at a steady cruise speed of 108 km/h (65 mph).

- Receiver Distance - Receiver distances of 30, 60, and 90 meters from mainline traffic lanes.

- Line of Sight Obstructions - For each pavement type and receiver distance, both obstructed and unobstructed line of sight conditions are evaluated. For the unobstructed case, a clear line-of-site from traffic to the receivers is assumed. For the "obstructed" case, a typical 1 meter high "jersey barrier" at the edge of the pavement between the traffic and the receivers is assumed. Aside from the jersey barrier, all other elements (roadways, receivers) are modeled at zero elevation (all receivers are modeled to be 1.5 meters above the nominal elevation).

For modeling purposes using TNM, it is assumed that a total of 6000 vehicles per hour split evenly between northbound and southbound directions. Table 2 shows the predicted TNM noise levels at the modeled receiver locations for each of the modeled scenarios.

The results of the TNM modeled scenarios are shown in Figures 2, 3 and 4. Figure 2 shows the relative difference in noise level as a function of receiver distance from the roadway centerline. Two curves show the predicted difference for an unobstructed observer's view of the roadway and for a view partially obstructed by a 1 meter high jersey barrier at the near edge of the roadway. Figure 3 shows the relative difference in noise level as a function of average vehicle speed, with difference curves for each of the four vehicle mix scenarios. Figure 4 shows the noise level difference as a function of percent heavy truck usage for typical highway speed.

Noise Data Analysis and Results

The results of the analysis conclude that the longitudinally ground pavement is quieter than the transverse tined pavement by approximately 2 to 5 dBA, depending primarily on the vehicle mix.

The short-term aggregate traffic noise measurements conducted along the study test section during the peak noise hour (which generally corresponds to a light to medium truck usage mix scenario) show that the longitudinal ground pavement is about 3.0 dBA quieter than the transverse tined pavement. Aggregate traffic noise measurement conducted approximately one year later showed essentially no change in absolute or relative noise levels.

The single vehicle pass-by regression analysis indicates that the longitudinally ground pavement does not provide the same acoustic benefit to all vehicle types uniformly. The longitudinally ground pavement provides approximately 5 dBA noise improvement for automobiles and light trucks relative to the transverse tined pavement, but only about 2 dBA improvement for medium and heavy trucks. This result was expected since automobile noise levels are dominated by tire-pavement noise at highway speeds, while engine and exhaust noise (which is independent of pavement type) makes a significant contribution for heavy and medium trucks at highway speeds. This suggests that higher percentages of heavy and medium trucks using the roadway would diminish the relative acoustical advantage of the longitudinally ground pavement. This conclusion is supported by the TNM predicted noise levels, which indicate that the longitudinal ground pavement would be approximately 5.4 dBA quieter than the transverse tined pavement the parkway scenario (100% autos) but only about 2.2 dBA quieter for the heavy truck usage scenario (Figure 4). A 2 dBA difference in noise level is generally below the threshold of a perceptible difference to the average human ear.

The comparison of TNM predicted noise levels also suggests that receiver distance and small line of sight obstructions (such as a jersey barrier) play a lesser role in the relative noise levels of the two pavement types (Figure 2). The presence of a jersey barrier reduced the relative benefit of the longitudinally ground pavement by less than 0.5 dBA. The influence of distance on the relative difference in noise levels of the two pavement types was 0.3 dBA or less. The influence of vehicle speed on relative noise level was generally less than 0.5 dBA depending on vehicle mix, over the range of typical highway speeds (Figure 3).

SKID TESTS AND MACROTEXTURE MEASUREMENTS

Skid resistance and macrotexture measurements were performed in April, 2000 and June, 2001. Tests were conducted on the longitudinal diamond ground and transverse tined PCCP surfaces in the northbound lanes (constructed in 1999) and the southbound lanes (constructed in 1998). Tests were performed in both the driving lane and passing lane.

Skid resistance measurements were made at 67, 83 and 100 km/h (40, 50, and 60 mph) on each surface treatment with both blank and ribbed test tires. Skid resistance is defined as the retarding force generated by the interaction between a pavement and a tire under a locked-wheel condition (*6*). To ensure that measurements made at various times and places can be compared with each other, a standardized tire was used and a standard amount of water was applied to the dry pavement ahead of the tire. The details of the skid resistance test procedure are described in the *ASTM E 274* (*7*). The details of the blank and ribbed standard test tires are described in the *ASTM E 524* (*8*) and the *ASTM E 501* (*9*) respectively. A minimum of five measurements per test section were conducted and used to calculate an average for each test section. The results of the pavement skid test are reported in Table 3 as the skid number (SN).

The values reported in Table 3 are reasonable and are considered accurate in accordance with ASTM standards. The effect of speed is consistent and as expected (SN decreases when speed increases) for the average SN. The acceptable precision of SN units

can be stated in the form of repeatability. ASTM E 274 suggests an acceptable standard deviation of 2 SN units.

The two different test tires were used to measure two different pavement surface characteristics. Tests performed using the blank (smooth) test tire represent the pavement's macrotexture, while measurements made with the ribbed test tire best represent the pavement's microtexture. In general, microtexture provides the frictional capability of dry pavement. Macrotexture provides the drainage capability at the tire-pavement interface and therefore how effective the microtexture will be when the pavement is wet.

Good microtexture is obtained by using suitable aggregate in the pavement surface. Fine aggregates containing a minimum of 25% siliceous sand; durable non-polishing coarse aggregates, a low water to cement ratio, adequate air content, adequate cement factor, and good curing practices are all necessary to obtain high-quality durable concrete (*10*).

To further investigate the pavement surface's macrotexture, mean texture depth (MTD) measurements were performed. This measurement involves spreading a known volume of glass spheres on a clean, dry pavement surface, measuring the area covered, and calculating the average depth between the bottom of the pavement surface voids and the top of surface aggregate. Ten mean texture depth measurements were made in each of the eight test sections. The tests were conducted in accordance with *ASTM E 965* (*11*). The average mean texture depth for the longitudinal diamond ground surfaces was 0.58 mm in 2000 and 0.46 mm in 2001. The average mean texture depth for the transverse tined surfaces was 0.58 mm in 2000 and 0.53 mm in 2001. Data for both surfaces indicate a small drop in macrotexture for the one-year period.

The standard deviation of repeated MTD measurements by the same operator on the same surface can be as low as 1% of the average texture depth. The standard deviation of different measurements within the same site (pavement surface) may be as large as 27% of the average texture depth (*11*).

Analysis of Data

Skid resistance becomes a major factor in traffic safety when the pavement is wet. However, skid resistance is not the only factor affecting wet pavement safety. Other factors include: traffic characteristics (speed, density, percentage of trucks), road geometric configuration (horizontal curvature, vertical alignment, and super-elevation), driving difficulty (signalization, presence of turning lanes and weaving movements, surrounding land use, and number of access points), and pavement wet time (average period of time during a year when the pavement is wet) (*12*). All of these factors interact in a manner that is very difficult to analyze in quantitative terms. This is the main reason for the lack of nationally accepted minimum skid resistance values that could be used as safety thresholds.

Having recognized that skid resistance alone does not determine the level of wet pavement safety, the ranges of 35 to 40 for ribbed tire skid resistance and 20 to 25 for blank tire skid resistance, (both measured at 65 km/h) have been recommended in the past as the minimum values that should apply to highway pavements in general (*13*). These values were based on a trend that was observed in a study of wet-to-dry pavement accidents versus skid number in the State of Kentucky. The Pennsylvania State Department of Transportation uses the recommended lower values (35 and 20) in addition to certain accident criteria as thresholds to erect "Slippery When Wet" signs until the pavement surface friction characteristics could be improved. All sites in this study have skid resistances above those ranges.

When arranging the mean texture depth data in an order from the most to the least exposure to traffic, the 2000 MTD data of the experimental longitudinal diamond ground

surface demonstrate a decline from 0.71 to 0.53 mm. The transverse tined surface remained virtually unchanged at 0.56 mm. The data from 2001 testing shows the same trend for the experimental longitudinal diamond ground surface (0.51 to 0.43 mm); however, the transverse-tined surface demonstrates a reverse trend (0.48 mm on the least-traveled surface to 0.56 mm on the most-traveled surface). It should be noted that the operators reported a large variability in the surface macrotexture within a single test section. The 2001 measurements were obtained in the section as the previous year, but not in the exact same location (as it is difficult to locate the lock-up in the precise same location from year to year). However, many actual skid tests were performed within each section and were averaged to give the nominal values for the corresponding sections. The difference between 2001 measurements on all surfaces might simply demonstrate the variability of the surfaces rather than a trend related to traffic level. Initially, it appeared that the experimental surface was being affected more by traffic than the transverse tined surface. However, it is too early to speculate whether this is representative of a trend that might continue or level out over a period of time.

As seen in Figure5, the skid resistance levels of the driving lane ($SN_{D)}$ are generally lower than the skid resistance levels of the passing lane ($SN_{P)}$. This relationship is illustrated by the fact that almost all data points on the graphs are above the line traversing the plot at a 45-degree angle which represents the points at which the SN_P and SN_D are equal. This data is consistent with the general trend that higher average daily traffic levels are found in the driving lane rather than in the passing lane. Larger average daily traffic levels increase the rate at which the pavement surface becomes polished and thereby lowers the microtexture value of the surface at a faster rate.

As shown in Figure 6, there is an equal distribution of the ribbed tire SN data points about the line traversing the plot at a 45-degree angle. The line represents the points at which the $SN_{Longitudinal}$ and $SN_{Transverse}$ are equal. The 2000 blank tire SN data points are consistently higher for the longitudinal diamond ground pavement compared to those of the transverse-tined. The 2001 blank tire SN data show a general shift toward the line of equality with the exception of the data for the southbound passing lane. This suggersts that LDG macrotexture starts out better that TT but deteriorates more quickly, so that after one year, LDG and TT macrotextures are more equal."

In summary, initial results show a greater loss of macrotexture (MTD and SN_B) for the experimental longitudinal diamond ground surface than for the transverse tined surface. However, the relative skid resistance of the experimental longitudinal diamond ground surface tends to be higher than that of the transverse tined surface using a blank tire (representative of the surface macrotexture / resistance to wet pavement accidents). There is no significant difference in the skid resistance measured with the ribbed tire (representative of the surface microtexture), as would be expected since both pavements were constructed using the same mix design.

DISCUSSION OF RELATIVE SERVICE LIFE

The pavement skid resistance is expected to change over a period of several years. Comparing the data for the experimental longitudinal diamond ground surface constructed in 1998 with that constructed in 1999 yields no significant difference in mean SN value (Table 3). Comparing the data for the transverse-tined surface constructed in 1998 with that constructed in 1999 yields a small difference in mean SN. The 2001 data shows even less difference in mean SN between the different construction years for the transverse tined surface. This would indicate that the small difference in skid resistance between the northbound surface and the southbound surface is diminishing.

Another consideration is the life-cycle cost. Similar studies (*14,15*) have shown a long-term benefit from diamond grinding. The studies speculate that the benefit is realized from reduced pavement joint fatigue that results from the smooth surface created by diamond grinding. Profilograph readouts from this project show that the diamond grinding creates a significantly smoother profile, so the diamond grinding process may show a long-term (20+ years) benefit due to the increased service life.

Note that this data was collected from 177 rehabilitated highway sections in 26 states throughout the country. To date no known data is available on the longevity of newly constructed diamond ground pavements, which may differ from the rehabilitated highways in that the concrete is harder due to the additional curing time.

FUTURE RESEARCH (YEAR 2001)

Pavement noise and skid resistance testing is to be continued over the next several years on an annual basis in order to further document changes in these parameters over time. The data should be measured at the same time of the year (i.e., spring) to avoid changes in measured values caused by short-term and long-term seasonal variations. Traffic volumes and accident data will also be collected. Interviews with various highway users such as state troopers, maintenance personnel, and others will be conducted to determine if there are noticeable differences in maintenance requirements, vehicle operation, or rider comfort while traveling over the different pavement surfaces.

CONCLUSIONS

Construction Time and Cost

The longitudinal diamond ground pavement will require more construction time and will cost more than transverse tining. However, a higher initial cost for longitudinal diamond grinding would likely be partially offset by an extended service life.

Pavement Noise

The longitudinally diamond ground pavement was shown to be 2 to 5 dBA quieter than the transverse tined pavement, depending mostly on the percentage of heavy trucks in the vehicle mix. The longitudinally ground pavement was approximately 3 to 4 dBA quieter for typical highway traffic mix and speed. Aggregate traffic noise measurements made after approximately one year showed virtually no difference in relative or absolute noise levels.

Skid Resistance

Initial measurements show a greater wet skid resistance for the longitudinal diamond ground surface than for the transverse tined surface. The difference was shown to be less after about one year, but with the longitudinal diamond ground pavement still superior. The dry skid resistance for both pavement surface treatments was essentially the same.

ACKNOWLEDGEMENTS

This study was administered by Christopher Waite, P.E., Director of Design, New York State Thruway Authority, and was funded by the New York State Thruway Authority and the Federal Highway Administration.

REFERENCES

1. FHWA PCC Surface Texture Technical Working Group Findings - www.bts.gov/ntl/docs/79_tpave.html.
2. American Concrete Pavement Association, "*Diamond Grinding and Concrete Pavement Restoration*", ACPA Technical Bulletin TB-008P, 1990.
3. Wayson R.L. *Relationship Between Pavement Surface Texture and Highway Traffic Noise*, NCHRP Synthesis 268, TRB, National Research Council, Washington D.C. 1998.
4. Fleming, G.G., A.S. Raposa, and C.S. Lee. 1995. *Development of National Reference Energy Mean Emission Levels for the FHWA Traffic Noise Model (FHWA TNM), Version 1.0*. Cambridge, MA: John A. Volpe National Transportation Systems Center, Acoustics Facility. FHWA-PO-96-008
5. Lee, C.S. and G.G. Fleming. 1996. *Measurement of Highway Related Noise*. Cambridge, MA: John A. Volpe National Transportation Systems Center, Acoustics Facility. FHWA-PO-96-046
6. American Society for Testing and Materials, "*Standard Definitions of Terms Relating to Traveled Surface Characteristics, Designation: E 867*," in Annual Book of ASTM Standards, Vol. 04.03 (Philadelphia, PA: ASTM, 1999).
7. American Society for Testing and Materials, "*Standard Test Method for Skid Resistance of Paved Surfaces Using a Full-Scale Tire, Designation: E 274*," in Annual Book of ASTM Standards, Vol. 04.03 (Philadelphia, PA: ASTM, 1999).
8. American Society for Testing and Materials, "*Standard Specification for Standard Smooth Tire for Pavement Skid-Resistance Tests, Designation: E 524*," in Annual Book of ASTM Standards, Vol. 04.03 (Philadelphia, PA: ASTM, 1999).
9. American Society for Testing and Materials, "*Standard Specification for Standard Rib Tire for Pavement Skid-Resistance Tests, Designation: E 501*," in Annual Book of ASTM Standards, Vol. 04.03 (Philadelphia, PA: ASTM, 1999).
10. U.S. Department of Transportation Federal Highway Administration, "*Portland Cement Concrete Mix Design and Field Control*," FHWA Technical Advisory T 5080.17, - 1994.
11. American Society for Testing and Materials, "*Standard Test Method for Measuring Pavement Macrotexture Depth Using a Volumetric Technique, Designation: E 965*," in Annual Book of ASTM Standards, Vol. 04.03 (Philadelphia, PA: ASTM, 1999).
12. B. T. Kulakowski, et. al. Skid Resistance Manual, Report No. FHWA-IP-90-013 (Washington, DC: Federal Highway Administration, 1990).
13. W. E. Meyer and J. J. Henry. "*Tire-Pavement Traction, Demand and Availability*," SAE Technical Paper Series, Paper No. 840071, 7 pp., 1984.
14. Snyder, M.J. Reiter, K.T. Hall, and M.I. Darter, "Rehabilitation of Concrete Pavements, Volume I: Repair Rehabilitation Techniques," Report FHWA-RD-88-071, 1989.
15. S. Rao, H.T. Yu, and M.I. Darter, "*The Longevity and Performance of Diamond-Ground Pavements*," Research and Development Bulliten RD118, 1999.

LIST OF TABLES

LIST OF FIGURES

TABLE 1 TNM User-Defined Input Data

Pavement Type	***Vehicle Type***	***Min. Level***	***Intercept***	***Slope***	***95% Confidence Limit (dB)***
Longitudinally Diamond Ground	Auto	50.1	31.6	25	± 0.15
	Medium Trucks	68.0	66.3	9.5	± 0.90
	Heavy Trucks	74.3	8.6	43.7	± 0.30
Transverse Tined	Auto	50.1	28.3	29.8	± 0.12
	Medium Trucks	68.0	59.6	14.2	± 0.64
	Heavy Trucks	74.3	15.9	40.7	± 0.23

TABLE 2 Predicted Absolute Noise Levels

Prediction Scenario		***Receiver***					
		Unobstructed			***Jersey Barrier***		
Pavement	***Traffic Mix***	***30m***	***60m***	***90m***	***30m***	***60m***	***90m***
TNM Average	Parkway	72.0	67.4	64.7	69.8	64.2	60.3
TNM Average	Lt. Truck	73.8	69.6	66.9	72.2	67.2	63.9
TNM Average	Med. Truck	76.8	73.0	70.4	75.7	71.3	68.2
TNM Average	Hvy. Truck	79.1	75.4	72.9	78.2	73.9	71.0
Longitudinal Ground	Parkway	72.2	67.6	64.9	70.1	64.4	60.6
Longitudinal Ground	Lt. Truck	74.6	70.4	67.8	73.1	68.3	65.0
Longitudinal Ground	Med. Truck	78.1	74.3	71.7	77.0	72.7	69.7
Longitudinal Ground	Hvy. Truck	80.6	76.9	74.4	79.7	75.5	72.6
Transverse Tined	Parkway	77.6	73.0	70.3	75.5	69.8	66.0
Transverse Tined	Lt. Truck	78.7	74.4	71.7	76.9	71.8	68.4
Transverse Tined	Med. Truck	80.9	77.0	74.4	78.6	75.1	72.0
Transverse Tined	Hvy. Truck	82.9	79.1	76.5	81.9	77.6	74.6

TABLE 3 Summary of Calculated Skid Numbers.

Test Tire	Lane	SN_{40}				SN_{50}				SN_{60}			
		LDG		TT		LDG		TT		LDG		TT	
		2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
Blank	SB DRV	37.2	35.7	30.6	33.7	30.5	24.4	23.8	20.0	27.0	18.6	24.2	20.1
	NB DRV	37.6	29.9	32.5	29.1	31.6	24.6	27.7	25.6	25.8	19.3	22.7	19.4
	SB PAS	44.7	39.8	33.7	29.9	37.1	36.7	26.5	24.9	31.3	23.8	22.4	19.1
	NB PAS	46.8	34.6	34.4	34.3	36.3	31.2	31.7	27.6	29.1	22.3	30.5	21.3
	Average	41.6	35.0	32.8	31.8	33.9	29.2	27.4	24.5	28.3	21.0	25.0	20.0
Ribbed	SB DRV	41.5	38.0	40.6	39.7	39.2	35.0	38.9	35.6	35.4	31.2	36.2	33.0
	NB DRV	41.4	40.9	42.9	42.1	38.4	35.5	43.4	36.9	40.1	34.2	38.1	34.7
	SB PAS	48.5	45.3	43.5	45.5	43.2	43.9	39.7	42.9	38.5	35.6	38.8	38.0
	NB PAS	49.1	45.0	49.7	46.8	44.6	40.5	47.4	43.3	40.0	38.0	45.0	43.4
	Average	45.1	42.3	44.2	43.5	41.4	38.7	42.4	39.7	38.5	34.8	39.5	37.3

LDG = longitudinal diamond ground
TT = transverse tined
SB = southbound
NB = northbound
DRV = driving lane
PAS = passing lane

Southbound lanes opened to traffic December, 1998.
Northbound lanes opened to traffic December, 1999.

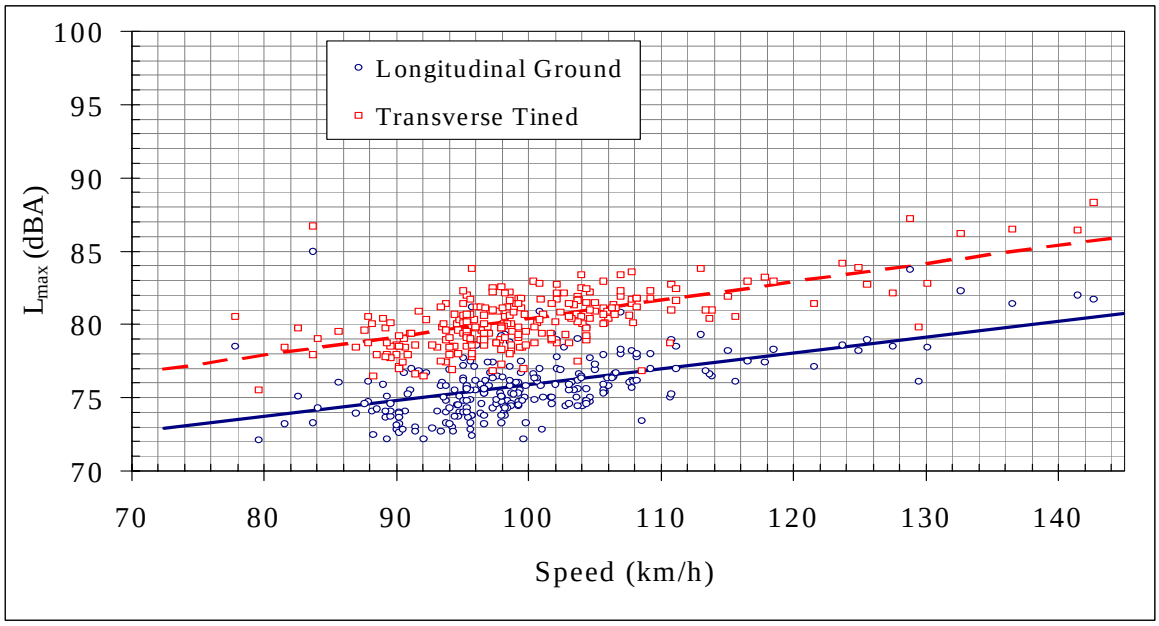

FIGURE 1. Single Vehicle Pass-by Noise Measurements for Automobiles

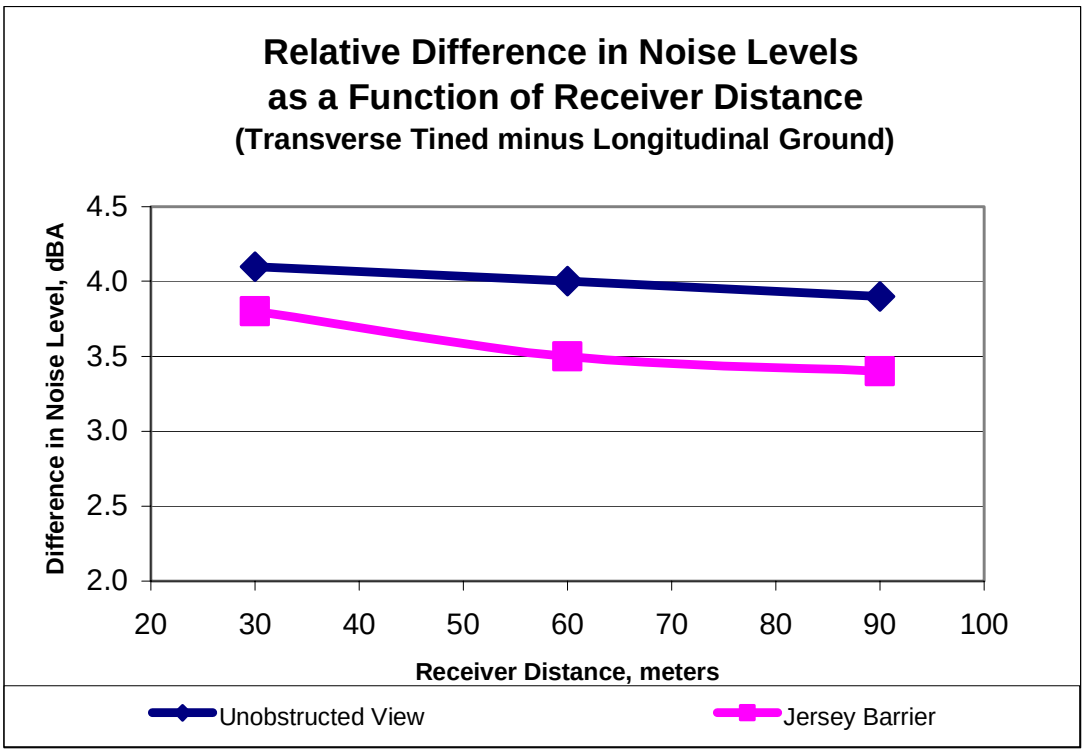

FIGURE 2. Relative Difference in Noise Level as a Function of Receiver Distance

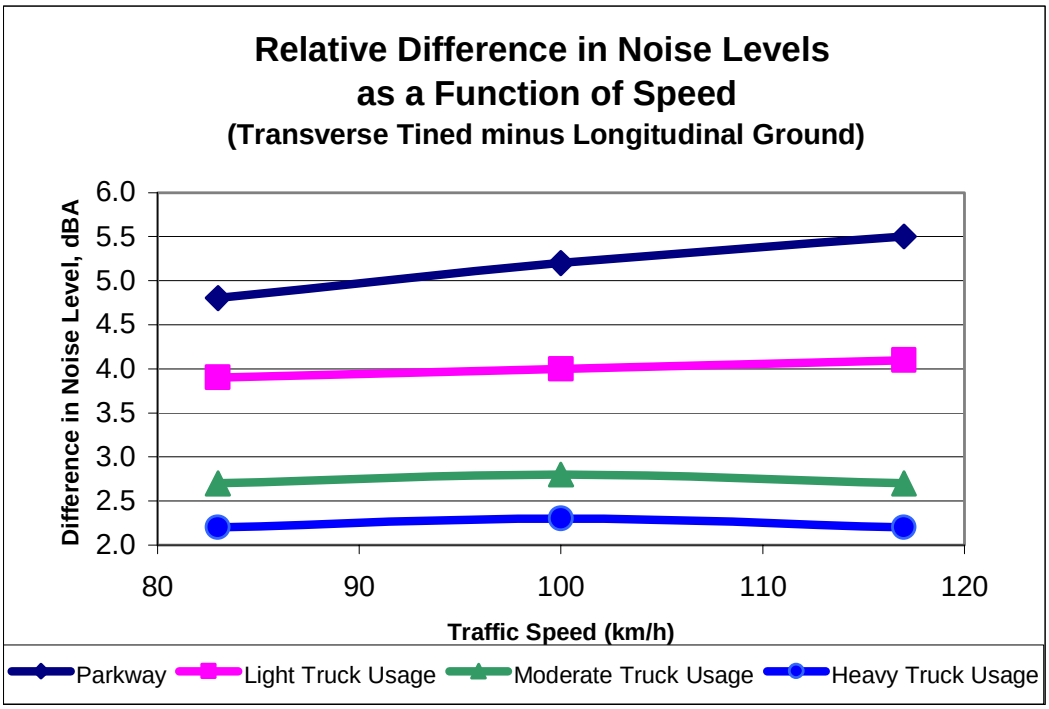

FIGURE 3. Relative Difference in Noise Level as a Function of Vehicle Speed

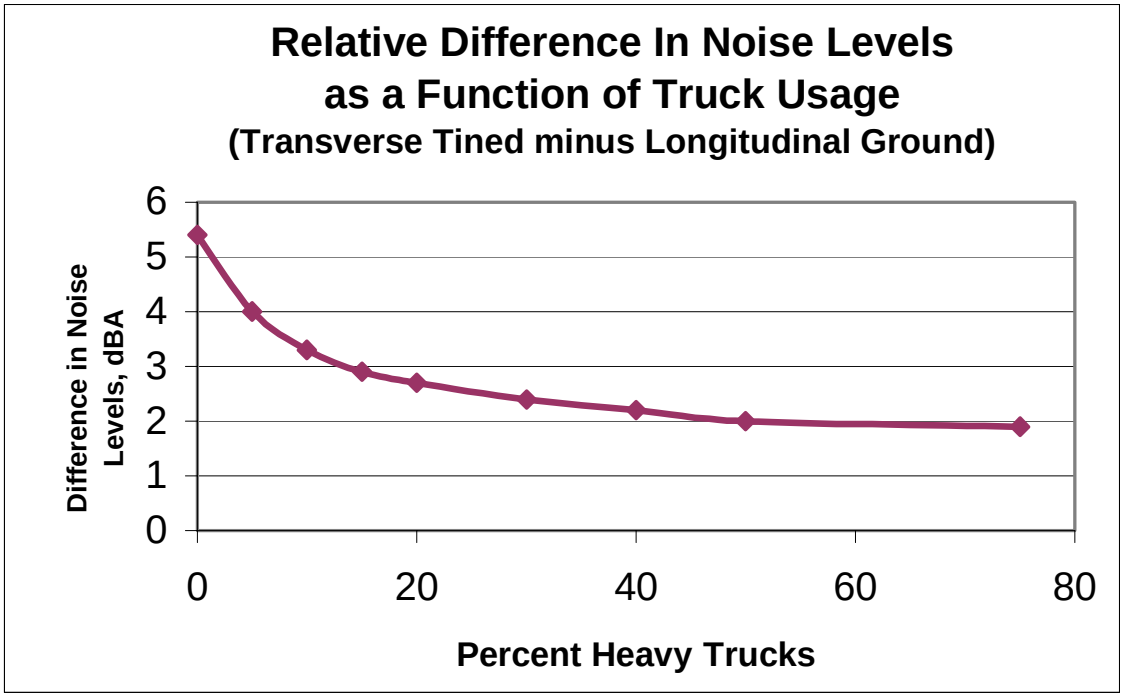

FIGURE 4. Relative Difference in Noise Level as a Function of Heavy Truck Usage

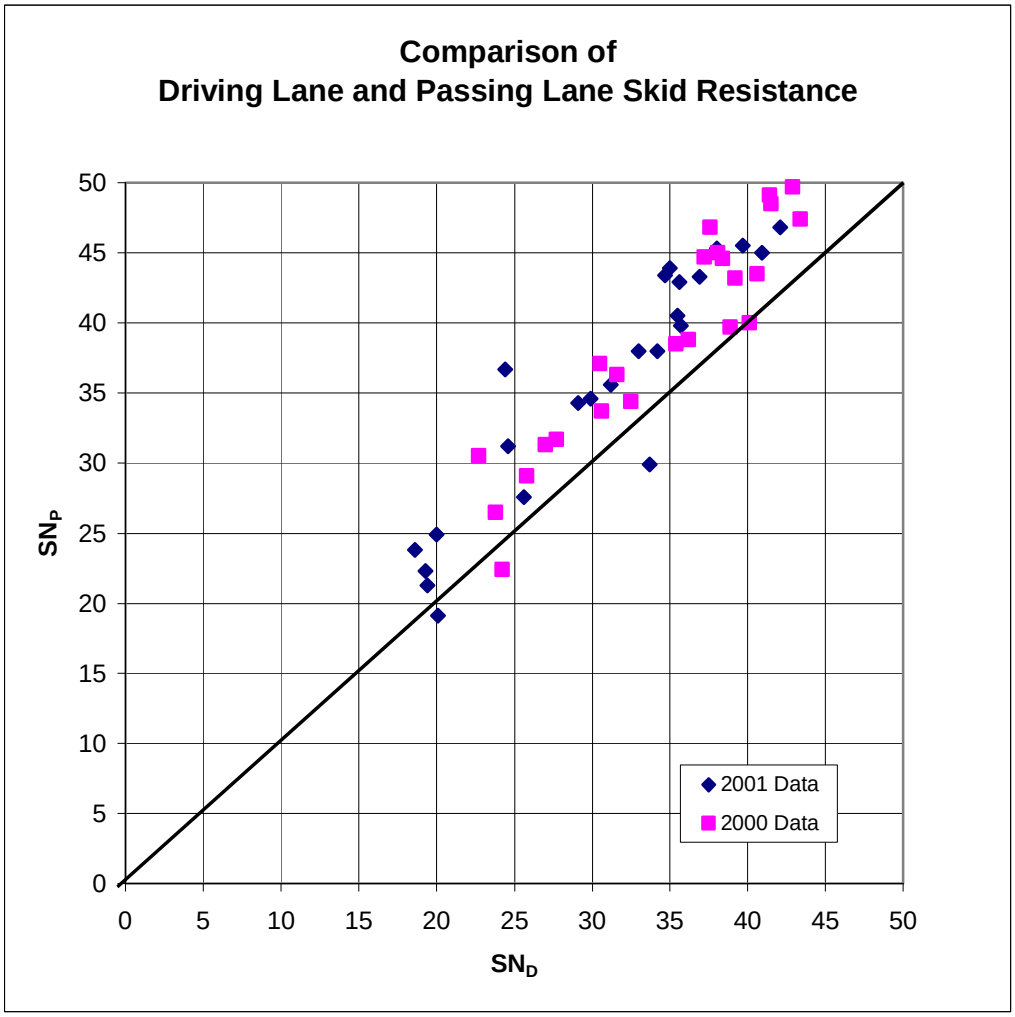

FIGURE 5. Skid Resistance for Driving Lane versus Passing Lane

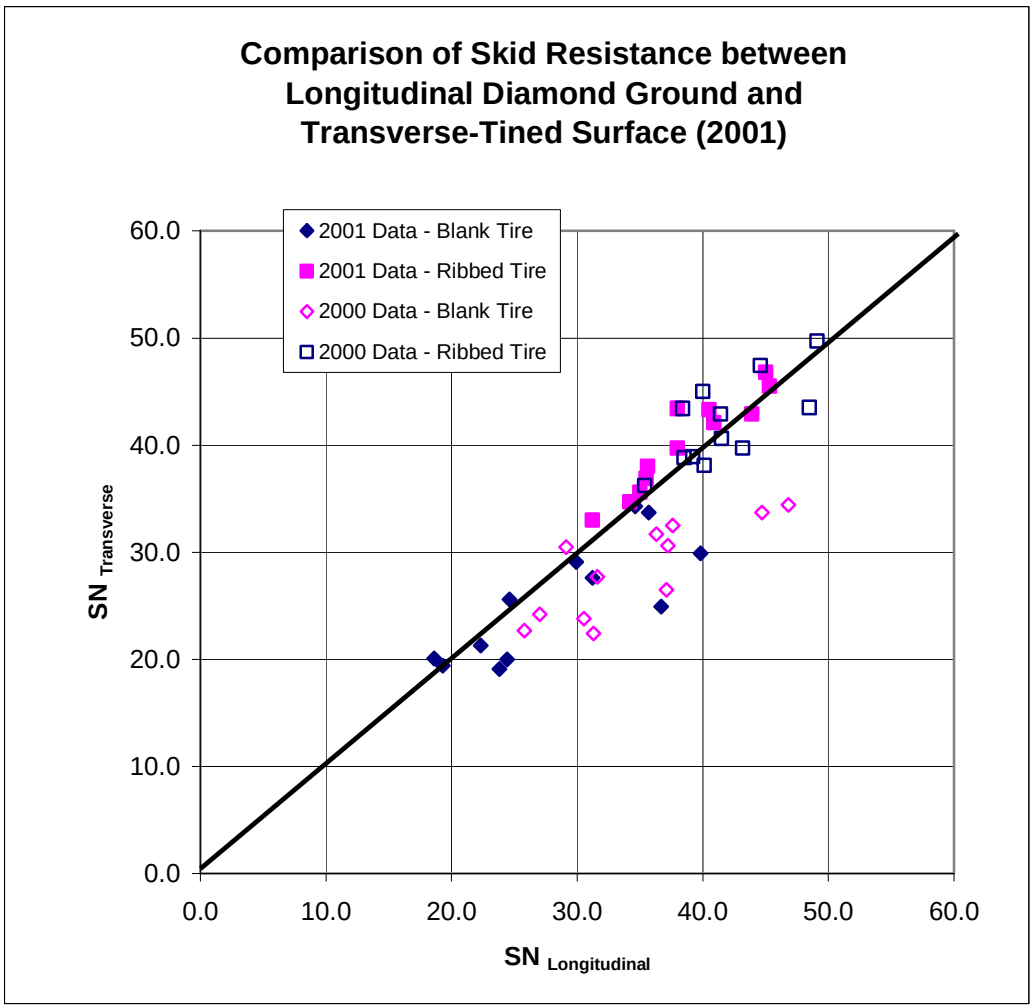

FIGURE 6. Skid Resistance for Longitudinal Diamond Ground versus Transverse Tined PCCP

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THE UNIVERSITY OF TEXAS AT AUSTIN

Center for Transportation Research
The University of Texas at Austin

Project Summary Report 0-1846-S
Project 0-1846: Development of Design Guidelines for the Provision of Median Access on Principal Arterials
Authors: Jillyn K. O'Shea, Thomas W. Rioux, Randy B. Machemehl
August 2001

PROJECT SUMMARY REPORT

DESIGN OF MEDIANS FOR PRINCIPAL ARTERIALS

WHAT WE DID ...

Public highways and streets have dual but competing roles: to provide property access and to move through traffic. Highway functional classification systems recognize the competition between access and flow, generally specifying that principal arterial streets primarily move traffic and secondarily provide access, while local streets primarily provide access and secondarily move traffic. Access provision is problematic for traffic flow because right turns, and especially left turns, into and out of driveways create traffic stream friction that often totally blocks through movements. Practical ways of controlling flow potential loss include limiting the number of property access driveways, restricting left-turn opportunities, and using good driveway geometric standards. Although the current criteria are appropriate, they lack the specificity needed by busy designers dealing with property owners and developers. This study provides specific guidance about safety, mobility, and economic impacts regarding:

1. Divided roadway and continuous center left-turn lane treatments,
2. Acceleration and deceleration lane design,
3. Raised and flush median treatments, and
4. Spacing between adjacent access points.

This process is applicable to four-lane, two-directional cross sections. The application method will follow a step-by-step instructional pattern that mimics the decision process that would be executed by a designer.

WHAT WE FOUND ...

Necessary Information

Information required to complete the application process includes:

- Directional 24-hour volume (two-lanes)
- Arterial speed
- Left-turn demand
- Driveway location(s) and distance(s) from the upstream intersection

This process assumes that the necessary right-of-way is available for left-turn treatment if it is required.

Task 1: Determining Whether Left-Turn Treatment is Required

The first step in median design, provided that the necessary right-of-way is available, is to determine whether left-turn treatment is required, given the roadway and adjacent driveway characteristics. There are several ways to accomplish this task.

1a: Safety Criteria

Several studies have determined that median treatment, regardless of type, is a safer alternative to no median treatment (Stover 1994). Therefore, if a disproportionate number of accidents occur in the vicinity of the driveway location as a result of left-turn-related maneuvers, then left-turn treatment is warranted without regard to operational criteria.

The Manual on Uniform Traffic Control Devices (MUTCD) uses five or more accidents within a 12-month period as a threshold for intersection signalization. Therefore, the four accidents per year criterion could appropriately be applied to an unsignalized inter section consisting of a driveway and a street.

If the left-turn-related accident rate is equivalent or exceeds 4/year, median treatment is warranted. If the safety criterion is satisfied, then proceed to Task 2; otherwise continue with 1b.

1b: Operational Criteria

The researchers developed three sets of decision charts to indicate if median treatment is required based on operational criteria. One chart set addresses excessive delay problems experienced by left turners.The delay threshold considered as excessive is average left-turn delays exceeding 35 seconds per vehicle (sec/veh). A second chart set relates

operational problems incurred by the through-traffic stream. These charts identify conditions causing unacceptable through-traffic delay increases.

If a box is shaded, median treatment is warranted. If the operational criterion is satisfied, then proceed to Task 2.

1c: Calculation of Capacity and Delay

The designer may wish, however, to obtain more detail or may be unsure of the results given by the charts. In this situation, the decision can be made through a series of calculations that have been developed in this research effort. The first step is to determine the left-turn capacity of the driveway opening, which may be determined by using provided equations. Once the capacity of the driveway has been determined, the utility ratio (UR), which is the left-turn driveway demand divided by the capacity, is calculated. In cases where left-turn driveway demands have been unknown, the ITE Trip Generation Manual has been used to estimate left-turn driveway demands for selected land-use scenarios.

If the UR is equivalent to or exceeds 1, left-turn treatment is warranted. The designer should proceed to Task 2.

The next step is to predict the delay that will be experienced by left-turning vehicles or through traffic. This step is accomplished through the use of two sets of equations that were developed through the study. The designer can use either set of equations to determine if treatment is warranted or choose to compute both delays to identify a "worst case" scenario.

If $Delay_L$ or $Delay_T$ is equivalent to or exceeds 35 sec/veh, median treatment is warranted. The designer should proceed to Task 2.

Task 2: Raised Median or Flush Median Design

There are several criteria one should consider when selecting a raised median or a flush median design. Many attempts have been made to quantify the choice of median design, but there are many characteristics that are difficult to measure. Both types of designs have positive attributes and both have drawbacks.

Overwhelmingly, studies have favored raised medians over TWLTLs for safety considerations. However, all agree that some median treatment is better, in terms of both safety and operations, than the undivided cross section. Operationally, both designs are equivalent under low driveway density, low traffic volume, and moderate speed conditions. The literature states that raised medians are generally preferred when through volumes and driveway densities are high. TWLTLs are preferred under lighter through-volume conditions, though there is some debate surrounding the preferred driveway spacing and left-turn volume.

2a: Safety Considerations (Raised vs. Flush Median)

Flush median designs, continuous one- or two-way left-turn lanes (OWLTL, TWLTL), are not recommended where through-traffic speeds exceed 45 mph. A study of accident occurrence on continuous-turn lanes found accident rates only marginally higher compared to raised median sections. However, that study recommended limited continuous left-turn lane use under high-speed conditions because of the potentially catastrophic results of high-speed accidents.

If through-traffic speeds are greater than 45 mph, the designer should choose the "raised median" design.

As previously mentioned, research efforts have also shown that raised medians are safer at higher traffic volume conditions than TWLTLs. One criterion that has been used as a threshold value for choosing median designs is a 24-hour design volume of 24,000 vehicles.

If the 24-hour design volume is equivalent to or exceeds 24,000 vehicles, the designer should choose the "raised median" design.

2b: Operational Considerations

Flush median designs are generally not recommended along facilities that have significant traffic congestion. Since potential flow along arterials is limited by intersection capacity, congestion usually propagates upstream and downstream from intersections. One criterion for congestion identification is queues of more than ten vehicles in all intersection approach lanes or queues that cannot be dissipated during the green signal phase.

If intersection queues are greater than ten vehicles or queues are not dissipated during the signal green time, the designer should choose the "raised median" design.

If the median design is being developed for a new facility, or for any reason queues cannot be counted, congestion potential can be estimated using the ratio of demand to capacity. *The Highway Capacity Manual* is recommended as an easier way to estimate intersection capacity. If expected demand approaches calculated capacity, significant queues can be expected and conditions would likely exceed the threshold for significant congestion. Experience indicates, however, that a demand-to-capacity ratio exceeding 0.9 for a planned facility should be adequate justification for choosing a raised median design.

If intersection demand-to-capacity ratio exceeds 0.9, the designer should choose the "raised median" design. For the flush median design, proceed with tasks followed by an F and for raised median designs follow tasks marked with an R.

Task 3R: Determining the Necessity of Left-Turn Bays at Intersections

The flow of traffic on the network should take precedence over midblock turning movements. Therefore, once the general type of median design has been determined, it is important to establish the necessity of a left-turn bay at the intersection because it will affect the design of upstream median

openings. This task can be accomplished by a number of means. Criteria for determining the requirement of left-turn bays have been outlined in numerous documents, such as the Highway Capacity Manual, Center for Transportation Research Report 258-1, and many state agency design manuals. The complete procedure described in the CTR 258 study is included in the 1846-1 report.

If left-turn demand is greater than the warranted left-turn volume Q_W, a left-turn bay is required at the intersection. The designer should proceed to the next task. Otherwise skip to task 5R.

Task 4R: Calculating the Length of the Intersection Left-Turn Bay

If a left-turn bay is necessary at an adjacent intersection, then it is important to size the bay before proceeding with median design, as this will directly impact driveway openings and placement along the roadway. Once again, this procedure has been well documented in other research efforts. The procedure that was developed in Research Report 258-1 from the Center for Transportation Research at The University of Texas at Austin is included in the complete 1846 report.

Task 5R: Assessment of Midblock Opening

In determining the location of a midblock opening, the designer must first ensure that the proposed opening will not infringe on the left-turn bay that has been established for the intersection. The placement of a median opening is infeasible if the proposed median location encroaches on the intersection left-turn bay. Provided that the median opening is viable, the operational characteristics of the driveway can be examined. There are three criteria to consider: the delay incurred by the left-turning vehicle, the storage area, and the distance between the intersection and other median openings.

Task 5Ra: Delay to the Left-Turner

Theoretically, if a left-turner waits for a traffic-stream gap in a bay or storage lane, then operationally there is no reduction in the level of service to the network through traffic if the vehicle driver waits indefinitely to complete his/her maneuver. Realistically, however, the driver will become impatient after a period of time and risk an accident by choosing a gap of insufficient size. The researchers developed a series of decision charts based on delays incurred by the left turner. These charts describe conditions under which unacceptable levels of delay are experienced.

If box is shaded, the designer should not provide a median opening; left-turn delays will likely exceed 96 seconds/vehicle.

If the designer is unsatisfied with the results of the charts because roadway conditions require interpolation between shaded and unshaded boxes, then he or she may calculate the left-turn delay with equations that were also developed.

If $Delay_L$ equals or exceeds 96 sec/veh, the designer should not provide a median opening.

Task 5Rb: Storage Area or Bay Length

Adequate procedures for determining the length of storage for the medians are similar to those used in determining the left-turn bay length at the intersection. The pocket length should be sized according to the entrance speed and to the ability of a vehicle to come to a stop before reaching the end of the queue. If the left-turn demand is unknown, estimates based on the *ITE Trip Generation Manual* are provided. See Task 4R for instructions on proper left-turn bay sizing.

Task 5Rc: Distance to the Intersection or Additional Median Opening

No median opening should be allowed to interfere with the functional area of another median opening or intersection left-turn bay. The functional area is defined as the distance required for channelization markings, queuing, and storage of vehicles wishing to complete a left-turn maneuver. Additionally, median openings should be prohibited in locations where a queue from an adjacent intersection would habitually form across the opening. The Florida DOT has defined a classification system of its roadways that is based on function. Using these access classes, the Florida engineers have set the following minimum median opening spacing criteria for arterials with both directional and full movements.

Task 5F: (OWLTL or TWLTL) Choosing One-Way or Two-Way Left-Turn Lanes

Few studies have been conducted concerning the choice between OWLTL and TWLTL. A TWLTL is generally chosen in areas of strip commercial development. An OWLTL is more beneficial at major intersections having high left-turn demand or where there are driveways on only one side of the street.

THE RESEARCHERS RECOMMEND ...

This document summarizes a process that can be used by the practitioner to design median treatments for a four-lane, bi-directional arterial roadway. The tasks required to complete this process are described with supporting information.

For More Details ...

Research Supervisor: Dr. Randy Machemehl, P.E., phone: (512) 232-3107, email: rbm@mail.utexas.edu

TxDOT Project Director: Gustavo Lopez, P.E., Pharr District Office, phone: (956) 702-6159, email: glopez@dot.state.tx.us

The research is documented in the following reports:
Report 1846-1, *Design Guidelines for Provision of Median Access on Principal Arteries,* Draft February 2001

To obtain copies of the report, contact: CTR Library, Center for Transportation Research, phone: 512/232-3138, email: ctrlib@uts.cc.utexas.edu.

TXDOT IMPLEMENTATION STATUS AUGUST 2001

The research developed new design guideline criteria to aid in the decision making process for selecting the proper median type for principal arterials.

The research resulted in a decision tree and implementation guide for the application of various types of median design and geometric guidelines for median openings. The median design decision tree is being incorporated into TxDOT geometric design practices.

For more information, please contact Bill Knowles, P.E., Research and Technology Implementation Office (512) 465-7648 or email: wknowle@dot.state.tx.us.

YOUR INVOLVEMENT IS WELCOME!

DISCLAIMER

APPENDIX D

Technical Memorandum for

FENCES

TORREY PINES ROAD PRELIMINARY ENGINEERING STUDY

TECHNICAL MEMORANDUM FOR

FENCE CONSIDERATIONS

By

TRAN CONSULTING ENGINEERS

January 2011

I. TOPIC DESCRIPTION

Technical items in Torrey Pines Road are being evaluated for a proposed improvement project between Prospect Place and La Jolla Shores Drive. Within the project area, numerous fences in the public right of way exist along the project alignment; most of these fences are chain link type fences in various conditions with the majority in poor condition. Fences in private property are not included in this study. Fence locations are shown in Figure 1 below.

II. DISCUSSIONS OF FINDINGS

II.1. Why Fencing?

Fences act as a pedestrian barrier to protect private property and provide safety to pedestrians from falling down slopes greater than 30-inches. Fences are not generally used to stop vehicles from running off the road however barriers that also act as fences can be designed for such purposes. When locating fences, sometimes there is a requirement to limit view heights to 42 inches or below eye level of pedestrians to preserve view corridors. The San Diego Regional Standards only address chain link fence which in the corridor study was recommended to be replaced. Options for fencing will be investigated and evaluated below.

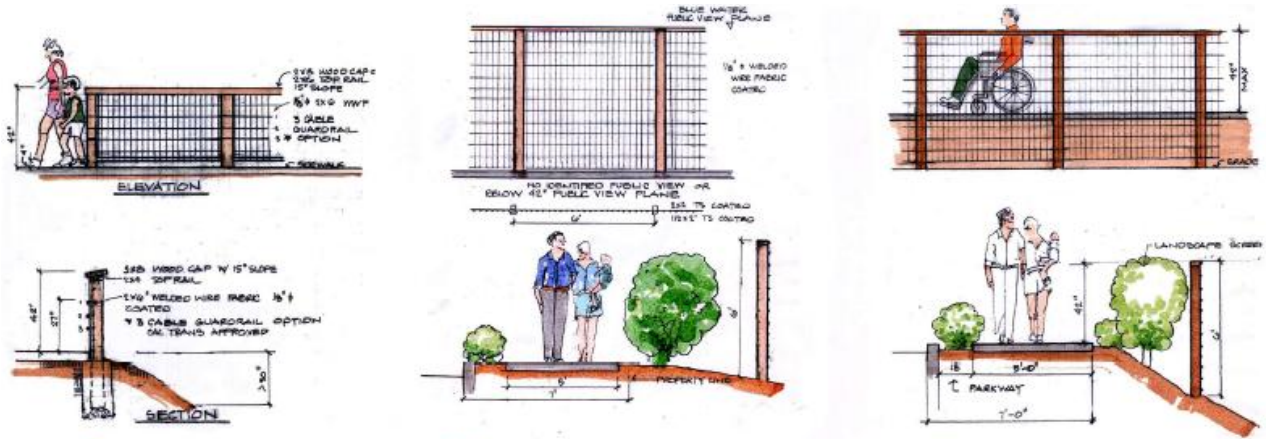
II.2. Other Studies In and Near the Project Area

TCE is not aware of other studies of fencing in the in or near the project area with the exception of the Corridor study for this project.

II.3. Fence Options

The existing fencing that dominates fencing in the public right of way in the project alignment is chain link fencing which is a standard fencing type throughout the San Diego area and is specified in the San Diego City and Regional Standard Drawings. In a few locations in the project area this fence material has been planted to cover the metal fabric. The fences appear to have been pruned in some locations to provide a suitable barrier, however this has caused obstructions of the view as well. Because of the absence of discussion in the corridor study about this type of fence it is not considered an appropriate fence type for the project area.

The corridor study recommended a fence composed of wooden posts and coated 2 by 4 wire fabric. Some examples of this fence are shown below.



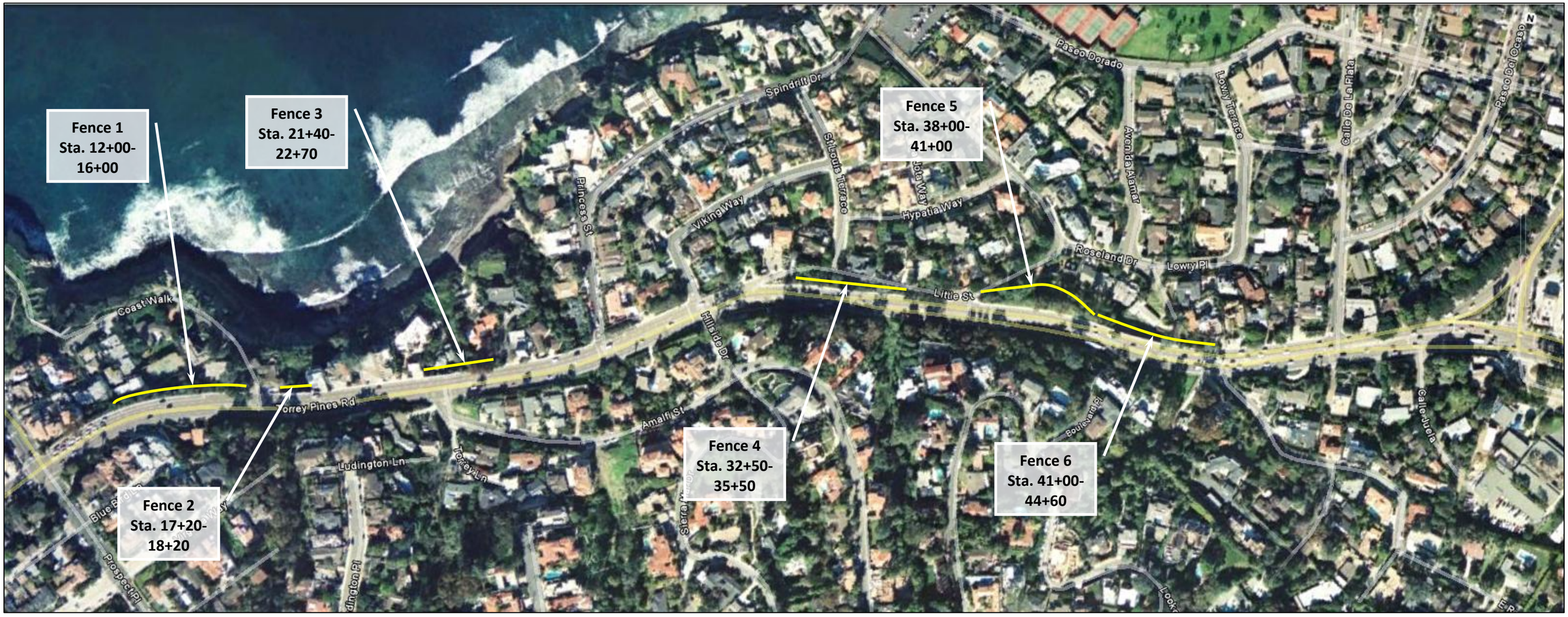


FIGURE 1

Aerial View of Project Showing Proposed Locations of Fences

(Yellow lines represent locations of proposed fences. Line locations are approximate and line widths are not intended to represent the wall size)

In areas where a slope is planted and there is adequate right of way beyond the width of the sidewalk, the fence could be placed at a lower grade to allow for an unobstructed view by the disabled as shown below. A disadvantage of locating a fence away from the sidewalk can be that trash and debris could accumulate behind the shrubs at the fence over a period of time creating an unsightly condition. The wire spacing is not beneficial to preventing letter from migrating through this fence fabric into private property. Although this fence will be described as a wood and wire fabric fence, this fence should be constructed from a material that will last longer than typical wood fences to reduce maintenance and prolong the life of the fence. Coating of the wire is vital to increase the life of the wire fabric because of the proximity to the ocean. A hot dipped galvanized coating topped with a plastic coating would be best.

Example of a 42-Inch High Wood Fence with Wire Fabric

In instances where a wood barrier or privacy fence is required such as where a view is not available and homes are located at grade with the fence, a plastic fence such as the one shown at right is suggested. Colors should be suitable to the application.

Example of a privacy fence

In some fence locations guardrail has been recommended in the corridor study because of past instances where cars have driven off the road at lower speeds, such as across Torrey Pines Road from the intersection with Amalfi Street, a decorative parapet approximately 3 to 3.5 feet high may be constructed in these locations. The parapet wall would be topped with either a railing or, to provide an added barrier, a piece of clear Plexiglas material, from 1 to 3 feet high. The Plexiglas would afford a clear view while providing a barrier to lessen littering and trespassing. The parapet could be designed like a decorative guardrail. Two examples of this type of fence approach are shown below. A concrete or concrete block parapet would replace the stucco parapet shown in the picture

Example of cement block wall parapet with Plexiglas top. Parapet is on top of a retaining wall in 4S Ranch area

Example of cement block wall with surface treatment and Plexiglas top in Point Loma overlooking Sunset Cliffs

II.4. Fence Locations

In general the fences in the public Right of Way of the project area have not been well maintained as evidenced in the photo below. Many of the chain link fences are rusted and sagging. Most should be replaced.

Many of the fences along the project are on private property, are privately owned, and generally are in good condition, although conditions vary widely. This project does not plan to affect fences placed outside the right of way which are privately owned.

II.4.1. Fence 1

The fence in the scenic view area between Prospect Place and Coast Walk Station 12+00 to 16+00 will be approximately 400 feet long, replacing the current chain link fence overgrown with plant materials – see Pictures 2752 and 3959 below. The slope in this area will be modified to accommodate a wider sidewalk and an 18 inch parkway with plants and/or trees. It is suggested that this fence be a 72 inch high fence, high enough to prevent access down the slope and limiting the amount of litter that is tossed down the slope, which is a problem according to residents. A shorter 42 inch fence could increase unwanted trespassers and litter problems. A steep embankment is located here and therefore a retaining wall will also be required. Additionally the corridor study had recommended a guardrail barrier to prevent cars from running off the road. Therefore part of this fence could be integrated into a decorative guardrail/parapet with a high Plexiglas wall to open this area as a view corridor to travelers. Retaining walls, view corridors and guardrail are the topics of other technical memoranda; please see these technical memoranda for additional recommendations and details.

If retaining walls can be avoided in some portions of this location and shrubs can be placed down the embankment another suggested alternative is that this fence be a 72 inch high wood with metal fabric fence that is set down the slope approximately 4 feet so the view is not obstructed.

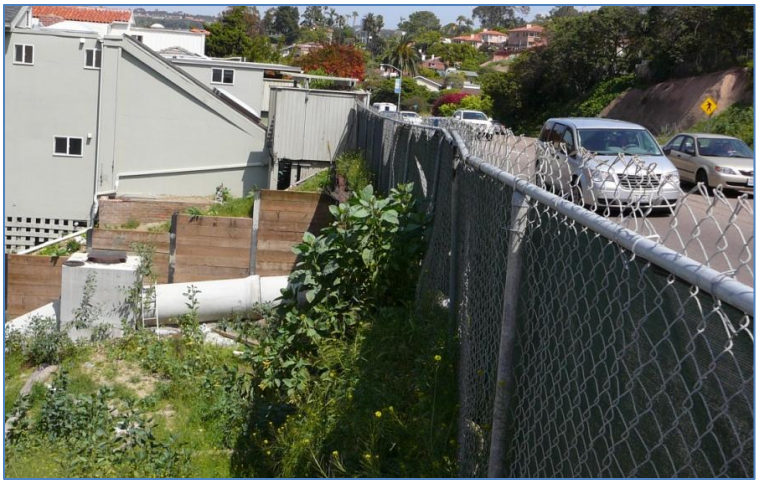
Picture 2752 - Overgrown Fence near Prospect Place

Picture 3959 - Fence Looking Southwest

II.4.2. Fence 2

Between Station 17+20 and 18+20 an existing retaining wall supports the sidewalk and road. There is a drop of at least 10 feet over the retaining wall. Currently, a chain link fence is mounted on the retaining wall with a green plastic woven cover as shown on Pictures 3957, 2742 & 2741. This is a view corridor, so the fence should be replaced. If a wood and steel wire fabric is utilized here, steel posts may be needed instead of wooden post for structural reasons, depending on how the posts are to be installed in the retaining wall. It would be unsafe to install a shorter fence here. At this location, a concrete parapet with Plexiglas material that reaches a total height of 72-inches could be integrated into the existing retaining wall.

Picture 3957- View through Opening in Fence



Picture 2742 - Behind the Chain Link Fence Looking East

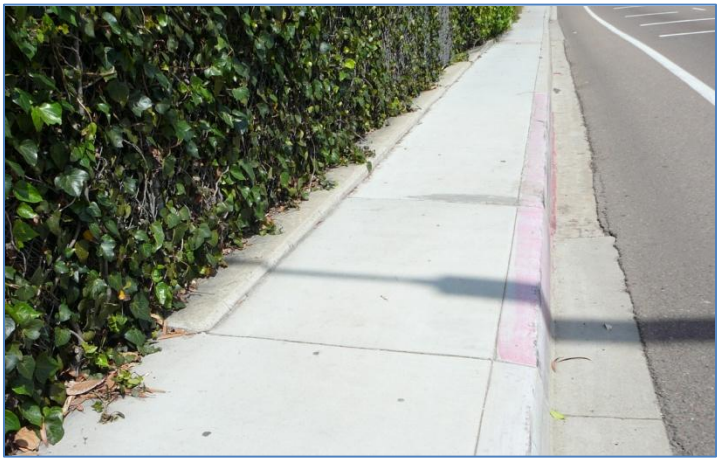
Picture 2741 - Behind the Chain Link Fence Looking West

II.4.3. Fence 3

Another special fencing case between Station 21+40 to 22+70 (Charlotte Street, a paper street) across from Amalfi St. where there is a concrete retaining wall with a chain link fence constructed on top, along the edge of the sidewalk as shown in pictures 3398, 3399, 2735 & 3951 below. The existing chain link fence is overgrown with ivy and the ocean view is not visible from the sidewalk or the road. The corridor study recommends a guardrail across from Amalfi to prevent cars from running off the road. A 72-inch fence is recommended for safety in this area because there is more than a 10-foot drop. It would be dangerous to install a shorter fence here. A parapet with a Plexiglas top is recommended here to provide a proper barrier while providing a view through the Plexiglas.

Picture 3398 - Charlotte Street Fence

Picture 3399 - Charlotte Street Fence Overgrown with Ivy



Picture 2735 - Charlotte Street Fence, Top of Retaining Wall and Sidewalk

The Charlotte Street chain link fence continues to the east and is supplemented with a privately built wood fence directly behind it as shown in the photo below. It is recommended to leave this portion of the fence as-is since it is in good condition, or remove the city's chain link fence, leaving the private fence. If a public fence is required and not a chain link fence for this area, a wood and wire fabric fence is recommended.

Picture 3951 - Continuation of the Charlotte Street Fence

II.4.4. Fence 4

A 300-foot fence from Station 32+50 to 35+50 needs to be replaced. This fence, located above St. Louis Terrace is in poor condition as shown in Pictures 3925 and 3926 below. A 72-inch high wood and wire fabric fence is recommended for this location.

Picture 3925 - Fence above St. Louis Terrace

Picture 3926 - Fence above St. Louis Terrace

II.4.5. Fence 5

Between Little Street and Roseland Drive, from Station 38+00 to 41+00, there is an area without a fence between the sidewalk and private homes below as shown in Picture 3977 below. This flat unused land area is adjacent to the sidewalk and described in the Corridor Study as being the location for Little Street Park. It is recommended that a fence be installed around the top of the slope. Since this is a view corridor with a partially obstructed view of the ocean and beach area a 42-inch high wood and wire fabric fence is recommended however this should be further discussed in the park development not included in this preliminary design.

Picture 3977 - No Fence near Little Street at Station 40+00

II.1.1. Fence 6

It is recommended that the old 300-foot long fence from Station 41+00 to 44+00, shown in Picture 3915 below, be replaced with a 72-inch high fence. Although this is not a view corridor a view of the ocean over existing homes is provided from this location the 72-inch fence could be set down the hill from the sidewalk to enhance the view. A wood and wire fabric fence could be utilized for this area.

The continuation of the chain link fence above, from Station 44+00 to 44+60, shown in Picture 3914, is also on City Right of Way. It is overgrown with bamboo and plants that should be cleaned up and a new fence installed.

Picture 3915 - Old Existing Fence

Picture 3914 - Approximate Station 44+ 60 that Needs New Fence

II.5. Fence O&M Considerations

From the perspective of operations and maintenance of fences, the fence that provides the least effort to keep it looking its best is the best fence for the application. Since the project location is a highly saline environment the material must be noncorrosive or coated to prevent corrosion. Use of high quality materials during the capital improvement will lessen the operation and maintenance.

As stated before, for ferrous materials like the wire fabric it is best to protect the metal with a hot dipped galvanized coating followed by plastic coating that provides color variety and additional corrosion protection. Similar material located on Coast walk near the project area is coated with plastic and is showing signs of corrosion and will need to be replaced in the near future. Ideally a plastic with carbon black would resist degradation by ultraviolet sunlight. Also stated above, the fence posts and structural members would last longer if a composite material composed partly of plastic materials was used. This material has shown signs of good durability and service life over wood.

To protect concrete parapets from corrosion due to salinity, it is recommended that the cement used be type 2 or 5 which protects concrete from sulfide attack.

II.6. Fence Cost Estimates

Costs for work in this area could be higher due to additional costs for architectural features colors, patterns, etc. Costs are estimates based on 2010 costs.

Based on a split block wall cost of $22 per square foot and assuming a 42 inch parapet the cost for a the block parapet wall would be approximately $75 per linear foot. The addition of 2.5 feet of Plexiglas ½ inch thick is a unit cost of approximately $90 per linear foot for a total wall cost of $180 per linear foot.

A reinforced concrete parapet such as at a location where it replaces guardrail at Amalfi St would cost approximately $100 per linear foot. Adding the Plexiglas cost the total cost is approximately $190 per linear foot

The a typical wood and metal wire fabric fence costs could cost approximately $25 per linear foot installed and could be more depending on the quantity of fence constructed. Fabric should be special hot dip galvanized, not electroplate galvanized followed by coating with the plastic material. This special coating system will cost more but save on maintenance in the long run. Including special coatings and materials the cost per foot should be approximately $30 per linear foot.

Privacy fences composed of vinyl coated or vinyl composite can cost as much as $30 per foot for materials only. A total cost would be approximately $50 per foot

III. RECOMMENDATIONS

Improvements to Torrey Pines Road between Prospect Place and La Jolla Shores Drive will involve replacement of various fences throughout the project alignment. The project as laid out on the Project plans and locations for fences have been identified. Further detailed selections and designs of fences should be carried out during detailed design to refine the approach to be taken at each fence area. There are six locations where fences were identified and one of those locations is split with two recommendations provided. These are shown on the project plans and Figure 1. Our recommendations are provided below:

Fence No. & Station	Approx. Length	Estimated Cost	Notes & Comments
Fence 1 12+00-16+00	400’	Parapet /Plexiglas: $76,000	Integrate guardrail protection or parapet and Plexiglas top to provide fence and barrier. If a guardrail type barrier is not required in specific areas, a 72-inch wood and wire fabric fence is recommended down slope to provide an unobstructed view.
Fence 2 17+30-18+20	90’	Parapet /Plexiglas: $16,200.	Recommend 72-inch high parapet and Plexiglas top. Parapet would be approximately 42 inches high and Plexiglas approximately 30 inches high.
Fence 3 21+40-23+00	160’	Parapet /Plexiglas: $30,400	Recommend 72-inch high parapet and Plexiglas top. This location must be designed to prevent cars from crossing Torrey Pines Road from Amalfi street and running down the embankment
Fence 4 32+50-35+50	300’	Wood & Metal Fabric: $9,000	A 72-inch high wood and metal fabric fence is recommended for this location
Fence 5 38+00-41+00	300’	Wood & Metal Fabric $9,000 to be determined by Park Designer	This is the location of the proposed Little Street Park indentified in the Corridor study. Initially the recommendation is for a wood and wire fabric fence. However fence style and location should be coordinated with the designer of this park. Recommendation is for locating a wood and metal fabric fence around the top of the slope.
Fence 6 41+00-44+00	300’	Wood & Metal Fabric: $9,000	Recommend replacing the existing chain link fence with the wood and metal fabric fence
Fence 7 44+00-44+60	60’	Privacy Fence: $3,000	Recommend placing a privacy fence here because of the location of a nearby home at grade with the road here.

APPENDIX E

Technical Memorandum for

GUARDRAILS AND BOLLARDS

TORREY PINES ROAD PRELIMINARY ENGINEERING STUDY

TECHNICAL MEMORANDUM FOR

GUARDRAIL AND BOLLARDS

By

TRAN CONSULTING ENGINEERS

January 2011

I. TOPIC DESCRIPTION

Technical items in Torrey Pines Road are being evaluated for a proposed improvement project between Prospect Place and La Jolla Shores Drive. Within the project area some areas have been identified for installation of barriers to protect the safety of pedestrians and motorists in the project area by installing guardrail and/or bollards. Guardrail and bollards are discussed in the corridor study between Prospect Place and Coast walk and guardrail at the tee intersection with Amalfi Street on the north side of the road.

Two locations have been identified in the project area that require guardrail. These locations are shown in Figure 1 below.

This technical memorandum looks at providing safety to pedestrians and motorists while identifying decorative guardrails and making guardrail recommendations at specific locations.

II. DISCUSSIONS OF FINDINGS

II.1. Why Guardrail and Bollards?

Guardrails are needed along portions of the project for safety reasons. In locations where a steep drop off occurs on the north side of the road, a guardrail could prevent out-of-control vehicles from falling over the side. On the other hand, there is no evidence that this has been a problem in the recent past as evidenced by the old chain link fences in such locations that are undamaged.

Upon project completion, pedestrians will walk in sidewalks along both sides of the road. An 18" parkway is planned between the road curb and the sidewalk in several locations that may allow for construction of guardrails. But in approximately 50% of the project the sidewalk will be adjacent to the roadway curb without any space for guardrail.

Guardrails are recommended by TCE over bollards to prevent occasional out-of-control vehicles. Bollards are common where a clear delineation between slow moving vehicular traffic (such as in parking areas) and pedestrians is desired, and where bollards are removable to provide occasional access to an area (such as maintenance vehicles or fire trucks). Bollards are not recommended along Torrey Pines Road.

II.2. Standards for Guardrail

The City's Regional Standard Drawings states, "For Guardrail Standards Use: Caltrans "Standard Plans for Construction of Local Streets and Roads"

Recently Caltrans issued a report on California Highway Barrier Aesthetics which dealt with ways to provide safe guardrail systems that provided a more appealing look on California highways. Guardrails reviewed in this technical memorandum are selected from this report. Several divisions, offices and disciplines such as State Landscape Architecture, Headquarters Traffic Operations, and Division of Engineering Services, Materials Engineering and Testing Services, Office of Structural Materials provided input into various guardrail systems.

Any modifications to Caltrans standards must be approved prior to moving forward with construction

FIGURE 1

Aerial View of Project Showing Proposed Locations of Guardrails

(Yellow lines represent locations of proposed guardrail; Line locations are approximate and line widths are not intended to represent guardrail size)

II.3. Guardrail Options

II.3.1. Embankment Guardrails

Portions of Torrey Pines Road are adjacent to steep embankments. According to the Traffic Manual, Chapter 7, Traffic Safety Systems, embankment guardrails should be considered at locations with a history of accidents or high accident potential. The accident history, which can be an important factor whether to use guardrail or not, was not available for this study. The factors that are considered for high accident potential are given on pages 7-4 and 7-5 of the traffic manual. Four of these factors pertain to this project:

1. Volume of Traffic – Torrey Pines Road has a high volume of traffic, and the speed limit is higher than a normal city street.
2. Roadside Recovery Area – the embankments do not leave much width for recovery.
3. Climatic Conditions – Dense fog is one of the conditions that are definitely present along the coast that could contribute to accidents.
4. Severity – According to Figure 7-1 guardrails are generally less severe when the embankments are 7 feet high with a 1:1 slope, or 10 feet high with a 1.5:1 slope. Two locations on this project meet this condition.

II.3.2. Guardrail Alternatives

The alternatives considered are those approved by Caltrans, which are the following types:

- Thrie Beam Barrier
- Three-Cable Barrier
- Concrete Barrier (Type 60)
- Timber Guardrail
- Precast Concrete Guardwall

Information regarding each of these approved guardrails is given in the publication *California Highway Barrier Aesthetics*, by Caltrans, June 2002, and is a major source of the comparison below.

II.3.2.1. Thrie Beam Barrier

The Thrie Beam Barrier is shown below and is common on California highways. It is relatively less expensive than other types of barriers, but may not be visually compatible in metropolitan areas. The construction cost is approximately $80/foot.

Thrie Beam Barrier along a highway

II.3.2.2. Three Cable Barrier

The Three-Cable Barrier is not a good choice for Torrey Pines Road because of several disadvantages: higher maintenance costs compared to other types of barriers, special trained maintenance personnel, and large space needed for installation.

II.3.2.3. Type 60 Concrete Barrier

The Type 60 concrete barrier offers several positive attributes, including long life and durability, low maintenance costs, less exposure for maintenance workers, a clean urban character, and aesthetic surface treatment capabilities. Some communities consider these barriers to have a negative visual impact because the mass and form of the common K-type temporary rail barrier is not compatible with the surrounding landscape. The cost is approximately $300 per foot.

Type 60 Concrete Barrier with aesthetic treatment

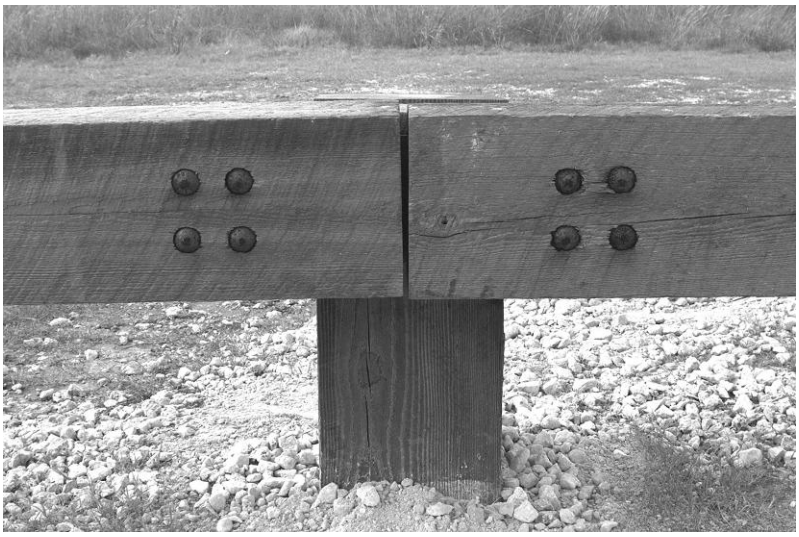
Caltrans approves the use of color admixtures, chemical staining, painting, acid etching, textures, and spraying with bituminous emulsion for a faux “granite” finish to improve the appearance of concrete barriers. Aesthetic treatments, such as sandblasting painted concrete to reveal graphic images have been used to enhance the barrier appearance and respond to local concerns for context sensitive solutions.

The type 60 barrier has a unique guardrail in that when a car runs into it at a 25 degree horizontal angle or less to the line of the barrier and at 60 mph or less the car will safely return to the street because kinetic energy becomes potential energy as the wheel rises up the inclined surface of the barrier.

II.3.2.4. Timber Guardrail

The Timber Guardrail is a rustic alternative to the standard metal beam guardrail. A steel plate provides the needed tensile strength with the wood members providing a rustic appearance. The wood block-outs help with the crash worthiness of the system. It is approved for design speeds of 60 miles per hour and less. The cost is approximately $100 per foot.

This guardrail has no approved terminal design. The end treatment will need crash cushions, must be buried in the embankment, or will require some other approved terminal design.



Timber Guardrail Post Detail

Timber Guardrail Installation

II.3.2.5. Precast Concrete Guardwall

The Precast Concrete Guardwall has been approved by Caltrans, but it is not used much due to its very high construction costs. The cost is approximately $500 per foot. Like the Timber Guardrail this guardrail has no approved terminal design. The end treatment will need crash cushions or will require some other approved terminal design.

The finish treatment is a simulated stone surface on both sides and ends of the guardwall. The surface of the guardwall is stained to simulate individual stones. To meet federal standards, the Precast Concrete Guardwall must be fabricated in a precast concrete production facility certified by the National Precast Concrete Association.

A Precast Concrete Guardwall Installation

III. Guardrail Locations

Per the Caltrans Traffic Manual, page 7-11, "To prevent a vehicle from vaulting over guardrail when it is used in conjunction with a curb or dike, the guardrail face should be on a vertical line with the curb face or on line no more than 2 inches behind the flowline of the dike."

Therefore the location will be directly behind the curb. Between Stations 11+80 to 16+20 the guardrail will be in the parkway area. Between Station 21+40 and 23+50 the guardrail will be between the sidewalk and the curb, which may impact the width of the sidewalk for this short stretch.

The alternative placement of a guardrail away from the road on the far side of the sidewalk would not protect pedestrians, nor would it conform to the State Traffic Manual recommendations.

Therefore guardrail is recommended at the following two locations:

- North side of the road from Station 11+80 to 16+20 where the embankment is almost a 1:1 slope (more than 7 feet high), the road has a high volume of traffic and the speed limit is higher than a normal city street, and occasionally has dense fog.
- North side of the road from Station 21+40 to 23+50 where the embankment is more than a 10-foot drop, the road has a high volume of traffic and the speed limit is higher than a normal city street, and occasionally has dense fog.

IV. Guardrail Analysis for This Application and Estimate of Unit Costs

A Summary of the advantages and disadvantages of the guardrail alternatives is provided below

Type of Barrier	Cost/Ft	Advantages	Disadvantages
Thrie Beam Barrier	$120	Common, easy construction	Not visually compatible Higher O&M than concrete
Three-Cable Barrier	$50	Inexpensive Minimal visual impact	Special O&M, not used in CA. Wide median area
Type 60 Concrete Barrier	$300	Low maintenance cost Various aesthetic treatments	May block views
Timber Guardrail	$300	Minimal visual impact	No approved terminal design
Precast Concrete Guardwall	$1500+	Various aesthetic treatments Long life and durability	Very high cost No approved terminal design

V. Recommendations and Estimated Costs

The three cable barrier is not an ideal alternative for this project for the reasons identified above.

As a scenic urban corridor the thrie beam barrier may be a poor alternative for aesthetic reasons and there is limited space for approach flares at both guardrail locations, however this guardrail is relatively low visual impact.

Although the precast concrete guardwall is highly desirable for aesthetic reasons. The cost far exceeds other barriers that provide the same protection.

A timber barrier in this area will provide adequate protection however the end termination design would require the end of the timber to be buried in the ground. Since this is an urban corridor the aesthetics of the timber guardrail should be evaluated

A type 60 concrete barrier is a very safe barrier for both locations because the design of this barrier makes it safer for traffic to return to the traveled way. From the perspective of cost this barrier is reasonable. With the additional option of providing an aesthetic treatment this would be a highly attractive alternative.

Costs associated with decorative type 60 guardrail for 440 feet at 11+80 to 16+20 and 210 feet at Sta. 21+40-23+50 would be approximately $132,000 and $63,000 respectively.

VI. Appendices to Technical Memorandum

1. Caltrans Report on California Highway barrier Aesthetics June 2002 Edition 1a
2. Caltrans California Highway Barrier Aesthetics Fact Sheet
3. Federal Highway Administration Letter on Aesthetic Guardrail Dec 20, 2002

APPENDICES

REPORT

June 2002
Edition 1a

CALIFORNIA HIGHWAY BARRIER AESTHETICS

Caltrans

California Highway Barrier Aesthetics

This report will familiarize designers with current barrier design options, and encourage appropriate aesthetic considerations to develop visually pleasing context sensitive solutions for highway projects. The development of alternative barriers that are aesthetically pleasing is a continuing process. The Division of Design, Office of State Landscape Architecture, Headquarters Traffic Operations, and Division of Engineering Services, Materials Engineering and Testing Services, Office of Structural Materials will continue to develop technical guidelines and guidance documents for alternative barriers and surface treatments for concrete barriers.

Technical guidelines allow integral color, paint, stain, and subtle textures to be incorporated with concrete barriers placed on highway transportation projects. These guidelines address highway corridor aesthetic issues, and respond to concerns from local communities and agencies for more barrier design alternatives that are context sensitive without compromising safety considerations.

Efforts are continuing to crash test additional aesthetic design solutions to increase the variety of options available for barrier treatments. These tests comply with the National Cooperative Highway Research Program (NCHRP) Report 350 criteria. Crash testing is being performed on various formliner patterns for concrete barriers that mimic stone masonry or provide relief graphics into the surface of the concrete. Patterns and textures with subtle relief, set into the surface of the barrier or limited to the top portion of the barrier, have shown encouraging results and guidelines for their use have been approved. Alternatively, crash test results indicate that some patterns and textures with high relief extending from the base to the top of the barrier may cause excessive passenger compartment deformation to the vehicle. Future use of these high relief surface treatments is doubtful. The technical guidelines for use of textures on concrete barriers will continue to evolve based on crash test results, maintenance and construction issues.

There is additional cost associated with some alternative barriers and surface aesthetic treatments when compared to the Department's standard barriers. Designers should use discretion when selecting alternative designs. Local funding may be required to offset additional costs associated with alternative barrier designs. Barriers are available in several different types and materials providing an opportunity to select the most appropriate barrier for a particular condition. Barrier types and design considerations discussed in this report include:

- Thrie Beam Barrier
- Three-Cable Barrier
- Type 60 Concrete Barrier
  - Approved Concrete Barrier Aesthetics
  - Developing Textures and Patterns
- Timber Guardrail
- Precast Concrete Guardwall
- Stone Masonry Guardwall
- Barriers and Landscaping

The Thrie Beam Barrier and Type 60 Concrete Barrier are available in the Department's Standard Plans and Specifications. The other barrier types will require approval for use until such time they become approved standards. See "Attachment A" for information on the non-standard approval process. For further information on California Highway Barrier Aesthetics and the status of new design alternatives please contact the Office of State Landscape Architecture at (916) 653-3170, Headquarters Traffic Operations at (916) 654-5147, or Materials Testing and Engineering at (916) 227-7000.

Thrie Beam Barrier

The Thrie Beam barrier is widely used as a median barrier on California's roadways. It is relatively inexpensive to install when compared to other barriers. Typically, fewer drainage modifications are required than for placement of concrete barriers. Use of this barrier type may allow for preservation of existing median planting and can minimize visual impacts. Thrie Beam barrier may be aesthetically pleasing to some rural communities because of its less "urban" character. Design modifications to the Thrie Beam barrier, such as placing asphalt or concrete beneath the barrier to eliminate weed growth, are being reviewed by Traffic Operations for approval. Not only will this improve the visual appearance of the barrier, it will also eliminate the need for repetitive manual vegetation control by maintenance forces. To reduce maintenance costs, this barrier should not be used in medians less than 11-meters wide.

This barrier meets NCHRP Report 350 criteria.

Advantages

- Approved by the Department for use
- Standard Plans and Specifications available
- Minimal visual impact
- Rural character
- Accommodates small animal crossing
- Preserves/protects median planting

Disadvantages

- Not visually compatible in metropolitan areas
- Increased construction time
- Life cycle costs higher than rigid/concrete barriers
- Additional roadside maintenance tasks compared to Type 60 Concrete barrier

Costs (November 2001)

- $61.00 per meter for Double Thrie Beam Barrier
- Maintenance cost is $33.00 per meter each year for segments requiring repair (segments average 30 meters)

Three-Cable Barrier

The Three-Cable barrier has not been used in California because of maintenance concerns. Currently, considerations are being made on a case-by-case basis for temporary use only. Three-Cable barrier is flexible, consisting of three steel cables stretched between metal posts. This barrier requires a minimum of 7 meters of flat median area, free of woody or mounding vegetation to allow for deflection movement when hit.

The Three-Cable barrier's primary advantage is quick installation and low initial cost. This system minimizes visual impacts, requires little or no drainage modifications, and fits well visually in rural environments. This system should not be used with median plantings.

The Three–Cable barrier meets the crash test requirements of NRCHP Report 350 criteria, test level 3.

Three-Cable barrier installed in Oregon.

Advantages

- Electronic drawings and specifications are available
- Minimal visual impact
- Rural character
- Accommodates small animal crossing
- Low installation cost

Disadvantages

- Non-standard approval required
- Standard Plans and Specifications unavailable
- Not visually compatible in metropolitan areas
- Life cycle costs higher than rigid/concrete barriers
- Additional roadside maintenance tasks compared to Type 60 Concrete barrier
- Inoperative once hit

Disadvantages of the Three-Cable barrier system are the maintenance costs required, as compared to other barrier types. Some maintenance tasks include routine checking of cable tension and repair of long runs of barrier when hit. Timely repair is necessary because the barrier can become inoperative once hit. The Three-Cable barrier is not recommended on tight curves, high truck traffic routes, or any locations where frequent hits are expected. Maintenance personnel are not trained, nor staffed to manage this type of system. Use of this barrier system may require approval from the Maintenance Division.

Costs (October 2001)

- $26.00 per meter
- Maintenance cost is $24.00 per meter each year for segments requiring repair (segments average 30 meters)
- High life cycle cost when compared to other barrier types

Type 60 Concrete Barrier

Approved Concrete Barrier Aesthetics

The Type 60 Concrete barrier has been used increasingly by the Department as median widths have become narrower. This coincides with safety concerns becoming more prevalent for maintenance workers and motorists. The Type 60 concrete barrier offers several positive attributes, including long life and durability, low maintenance costs, less exposure for maintenance workers, a clean urban character, and aesthetic surface treatment capabilities. Like the Thrie Beam barrier, two rows of Type 60 Concrete barrier can be placed in a wide median to preserve existing median planting.

The Department currently approves the use of color admixtures, chemical staining, painting, acid etching, textures, and spraying with bituminous emulsion for a faux "granite" finish to improve the appearance of concrete barriers. Aesthetic treatments, such as sandblasting painted concrete to reveal graphic images, have been used to enhance the barrier appearance and respond to local concerns for context sensitive solutions.

Concrete barrier with paving to the base allows maintenance to mechanically sweep the shoulder.

Sandblasting creates a seagull motif in a coastal community. This aesthetic treatment cost $17,000 per KM.

Concrete barriers have higher installation costs than Thrie Beam barriers and, in some cases, require extensive drainage modification. Retrofitting an existing barrier with superficial aesthetic treatments is less costly than installing a new barrier.

Some communities consider these barriers to have a negative visual impact because the mass and form are not compatible with the surrounding landscape.

Advantages

- Approved by the Department for use
- Standard Plans and Specifications available
- Aesthetic treatment for context sensitive designs
- Preserves/protects median planting
- Long life and durability
- Low maintenance cost
- Existing barriers can receive aesthetic treatments

Disadvantages

- May require drainage modifications
- High installation costs

Costs (November 2001)

- $150 per meter, aesthetic treatments are additional
- Maintenance cost of aesthetic treatments not known

Type 60 Concrete Barrier

Developing Textures and Patterns

A wide array of design possibilities are being developed and crash tested to allow for textures, patterns, and graphics that enhance the appearance of Type 60 Concrete barriers. Before authorizing textured surface treatments to concrete barriers, the proposed treatments must be tested for safety, and reviewed for constructability and maintainability issues. The Department's Engineering Services Division of Materials Engineering and Testing Services, Office of Structural Materials performs these tests by crashing a vehicle, under controlled conditions, into a section of the textured concrete barrier.

The results of each crash test are analyzed and a determination is made as to whether the textured barrier passes or fails established performance criteria - NCHRP Report 350 criteria, test level 3. From crash test results the Department has developed preliminary technical guidelines for the use of textures on concrete barriers. The Department will continue to perform additional crash tests to further expand these preliminary technical guidelines.

Dry stacked rock design was recently crash tested and received approval for use in California.

Pending approved design guidelines, graphics could become an integral part of concrete barrier design.

The next few pages of this report discuss textures that designers may use to address site specific, context sensitive solutions for concrete barriers. Specific textures will not be approved or disapproved but the depth, protrusions, angle of patterns, etc. will be governed by technical guidelines.

Details of recent test results are contained in the Department Study #F2001Tl17 "*Interim Report, Crash Testing of Various Textured Barriers*." Contact Materials Testing and Engineering at (916) 227-7000 for a copy.

Type 60 Concrete Barrier

Developing Textures and Patterns, continued

The Federal Highway Administration (FHWA) has granted approval (December 2002) of the Department's technical guidelines for textures and patterns for use on Type 60 Concrete barriers. Departmental approval is needed for the use of textures and patterns on every project. The following surface textures and patterns have been crash tested:

- Rock cobble pattern above 610 mm of smooth surface barrier. **PASSED CRASH TEST**
- "Mission Arch" pattern. **PASSED CRASH TEST**
- Dry stacked rock pattern. **PASSED CRASH TEST**
- Fractured granite pattern. **PASSED CRASH TEST**

- Rock cobble pattern on the entire face of the barrier. **FAILED CRASH TEST**
- Diagonal flute pattern. **FAILED CRASH TEST**

The preliminary technical guidelines allow:

Light to heavy sandblast textures.
Any pattern or texture with a maximum relief of 64 mm or less, located 610 mm or higher above the base of the barrier; the lower 610 mm shall be smooth or a "light to heavy sand blast" texture. The pattern or texture on the upper face of the barrier shall have smooth (rounded or beveled) leading edges to prevent vehicle snagging.
Geometric patterns inset into the face of the barrier 25mm or less. Chamfered or beveled edges to prevent vehicle snagging, especially on the downstream edges. Such patterns shall not feature long upward-climbing edges that could contribute to wheel climb.

This is the mission arch design with beveled edge and light sandblast.

Shown here is rock cobble pattern with 610 mm of light sandblast on the bottom of the barrier.

Advantages

- Aesthetic treatment for context sensitive solutions
- Preserves/protects median planting
- Long life and durability

Disadvantages

- Non-standard approval required
- Standard Plans and Specifications not available
- Increases installation costs
- Increases construction time
- Additional repair work to match textures

Costs (June 2002)

- $115 to $150 per meter, depending upon aesthetic treatments and color. The average price of a Concrete Barrier (type 60) is $91.39 per meter.
- Maintenance cost of aesthetic treatments not known

Timber Guardrail

The Timber Guardrail is a rustic alternative to the standard metal beam guardrail. The Timber Guardrail is in use along Federal highways on the East Coast and is approved for use on California highways. A steel plate provides the needed tensile strength with the wood members providing a rustic appearance. The wood block-outs help with the crash worthiness of the system. This guardrail has no approved terminal design. The end treatment will need crash cushions, must be buried in the embankment, or will require some other approved terminal design.

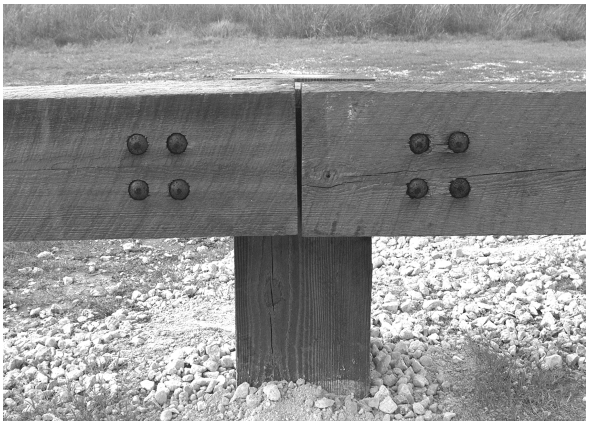
There are two versions of this system, both are accepted for use on Federal highways by the FHWA, and meet the NRCHP Report 350, test level 3:

Type 1 Steel Backed Timber Guardrail (SBTG) with wooden post
Type 2 Merritt Parkway Guardrail (MPG) with steel post

Both the Steel Backed Timber Guardrail and Merritt Parkway Guardrail are approved for design speeds of 100 km/h and less.

The potential for corrosion of the non-galvanized steel elements of the guardrails are a concern in coastal settings or areas with high rainfall. The Department's policy is that in areas of eight inches or greater annual rainfall galvanized steel posts must be used. The galvanized steel may be painted to blend with the timbers. Further information including electronic drawings, specifications and other information on this barrier can be found at www.efl.fhwa.dot.gov.

Contact Headquarters Traffic Operations at (916) 654-5147 with specific questions regarding Timber Guardrails.



Advantages

- Electronic drawings and specifications are available
- Minimal visual impact
- Rural character
- Accommodates small animal crossing
- Preserves/protects median planting

Disadvantages

- Non-standard approval required
- Standard plans and specifications not available
- Life cycle costs higher than rigid/concrete barriers
- Additional roadside maintenance tasks, compared to Type 60 Concrete barrier
- Wood safety devises may be subject to burning

Costs (January 2002)

- $160 per meter. Cost is based on installations in the Eastern US and may vary for California
- Maintenance cost not known; likely to be higher than metal beam guardrail

Precast Concrete Guardwall

This barrier system is being reviewed for approval by the Department's Highway Safety Features New Products Committee for use on California's highway system. This precast concrete guardwall has not yet been used in California due to very high construction costs. This guardrail has no approved terminal design. The end treatment will need crash cushions, must be buried in the embankment, or will require some other approved terminal design.

The finish treatment is a simulated stone surface on both sides and ends of the guardwall. The surface of the guardwall is stained to simulate individual stones. The design details include a precast concrete mowing strip. This strip may be placed in medians that will not be paved to the face of the guardwall. To meet federal standards, the Precast Concrete Guardwall must be fabricated in a precast concrete production facility certified by the National Precast Concrete Association.

The Precast Concrete Guardwall has been crash tested and meets the requirements of NCHRP Report 230. Though never crash tested to NRCHP Report 350 test level 3, the FHWA has accepted this guardwall for use on Federal highways. This artificial stone system is approved for design speeds of 100km/h or less. Further information regarding this barrier, such as electronic drawings, specifications and other information, may be found at www.efl.fhwa.dot.gov.

Advantages

- Electronic drawings and specifications are available
- Rural character
- Aesthetic treatment for context sensitive solutions
- Long life and durability

This guardwall is installed on the Federal highway system in the East Coast.

Disadvantages

- Non-standard approval required
- Standard Plans and Specifications not available
- Requires drainage modifications
- Very high installation costs
- Additional roadside maintenance tasks compared to Type 60 Concrete barrier

Costs (February 2002)

- $740 per meter. Shipping cost to the project site from the manufacturer is not included in this estimate
- Maintenance cost is not known

Stone Masonry Guardwall

The Stone Masonry Guardwall was approved by the Department's Highway Safety Features New Products Committee for use on California's highway system. The Stone Masonry Guardwall has not yet been used in California due to the very high construction cost. The stone fascia, mortared in place, provides a natural appearance and can incorporate local rock to match the surrounding area. The Federal Lands Highway Office must approve any modifications to Federal Lands Highway Standards for the Stone Masonry Guardwall. This guardrail has no approved terminal design. The end treatment will need crash cushions, must be buried in the embankment, or will require some other approved terminal design.

The Stone Masonry Guardwall consists of a concrete core faced and capped with natural stone. The Stone Masonry Guardwall has been crash tested and meets the requirements of NCHRP Report 230 and is accepted by the FHWA for use on the federal highway system. The FHWA has accepted it to meet the requirements of NRCHP Report 350 criteria, test level 3. This barrier system is approved for design speeds of 100 km/h or less.

Specifications define maximum projections to be 38 mm beyond the neat line, 50 mm deep joints, and mortar beds 50 to 75 mm thick. Stone faces with critical dimensions greater than those listed above are not considered crashworthy. A smooth-faced wall with shallower projections, and rake joints and beds is also approved.

Further information on this barrier can be found at www.efl.fhwa.dot.gov

Advantages

- Electronic drawings and specifications are available
- Minimal visual impact
- Rural character
- Context sensitive solutions
- Preserves/protects median planting
- Long life and durability

Disadvantages

- Non-standard approval required
- Standard plans and specifications not available
- Requires drainage modifications
- Very high installation costs
- Increased construction time
- Additional roadside maintenance tasks compared to Type 60 Concrete barrier

Costs (February 2002)

- $830 per meter
- Cost will vary depending upon the type of rock used. Availability of rock and proximity to the project area will be a factor. Labor costs may significantly impact the actual construction cost.
- Maintenance cost not known; likely to be high

Median Barriers and Landscaping

Existing median planting, mostly oleander shrubs, were planted in California beginning in the 1950's and have become an asset to the Department and the communities in which they grow. Median plantings provide glare screening for headlights of oncoming traffic, provide greenery and flowers, and minimize the visual width of the roadway. When roadway-widening projects threaten the removal of these plantings, local communities often voice concerns for preservation of the planting.

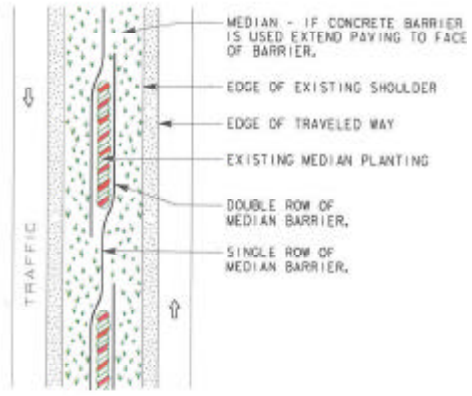
This is a concrete barrier with paving to the face of the barrier and landscaping in the median.

Median planting provides aesthetics in rural areas where no other highway planting exists.

The Department considers median planting to be an asset to the highway corridor and recommends removal only when other viable options are not available. Median barriers are being used when necessary and where feasible to protect these shrubs. Median barriers, regardless of system type, can be installed to preserve plantings, satisfying the desires of communities, and provide safety for maintenance workers and the traveling public. Options to median plantings should be considered, such as replacement of median planting with roadside planting along the right of way. The maintenance costs involved with median plantings are factors that must be considered.

During design of a median, consideration should be given to retaining all or portions of the existing planting. Healthy sections of planting can be protected with two rows of barriers, while unhealthy planting can be removed and a single barrier installed.

Only when the median width allows, the retention of existing median planting can be achieved by installing one row of barrier. When this option is possible, significant cost savings will be achieved for both the construction project and for long-term maintenance. Traffic Operations must be consulted to insure that all current standards are met.



Portions of existing median planting protected by median barrier.

Attachment A

Non-Standard Approval Process

Some of the barriers in this report are currently not approved as standards by the Department for use on California's highway system. However, all of the unapproved barriers included in this report are being reviewed for approval.

There are three categories of non-standard barriers:

1) Barriers that are not in the Standard Plans but which are approved by the Department. For example, this would include Type 60 Concrete barrier with a rock texture called "dry stacked."
2) Barriers that have been accepted by FHWA but have not been approved by the Department. For example, this would include the Stone Masonry Guardwall and Pre-cast Concrete Guardwall.
3) Barriers with merit that have not been crash tested or approved by either agency. This includes any new product that would be proposed as a barrier, or a change or modification to an approved barrier that could affect the safety and crash worthiness of the barrier.

Depending upon the proposal, a series of requirements need to be met prior to receiving approval to install a non-standard barrier on a project. For some proposals, such as texture on a Type 60 Concrete barrier that conforms to the approved guidelines, the proposal would not require steps one through four. A simplified version of the approval process is:

1) The barrier must meet crash test criteria established by NRCHP Report 350.
2) Once a proposed barrier has passed the crash testing criteria then it must be accepted by the FHWA for use on the Federal Highway system. Typically, if FHWA accepts a barrier, they will also participate in the funding of that element when it is included on a capital improvement project that has federal participation.
3) After the barrier has been accepted by the FHWA, then it must be reviewed and approved by the Caltrans Highway Safety Features New Products Committee (HSFNPC) before it can be considered for use on California's highway system. This process allows various Department Divisions, such as, Office of State Landscape Architecture, Headquarters Traffic Operations, Construction, Maintenance, and Structures, the opportunity for review and comment on the proposal. For more information on the HSFNPC and their role, contact the Chairperson of the HSFNPC at (916) 654-2465.
4) Once a non-standard barrier has been reviewed by the HSFNPC, the committee's conclusions and recommendations are forwarded to Headquarters Traffic Operations for a final recommendation. If the proposal is acceptable, a letter of approval for use is signed by the Chief, Division of Traffic Operations. Depending on the proposal, the non-standard barrier may be approved as a pilot or may require a letter of approval to be signed by the District Director.
5) Once a non-standard barrier has been approved for use, non-standard plans and specifications will require review and approval from the various district functional units and the Headquarters office that is the "owner" of the Standards, such as, Structures Office of Design, or Office State Landscape Architect

Once these criteria are met, a non-standard barrier may be included in a highway project.

California Highway Barrier Aesthetics

California Highway Barrier Aesthetics Report

A report titled "California Highway Barrier Aesthetics" is available on the Web at *http://projdel.dot.ca.gov/design/landscape/*
The report identifies current barrier design options for highway projects and encourages appropriate aesthetic considerations that are context sensitive.

Various materials and styles can be used to provide an opportunity to select the most appropriate barrier for a particular condition. Barrier types discussed in the report include: Thrie Beam Barrier, Three-Cable Barrier, Concrete Barrier (Type 60), Timber Guardrail, Precast Concrete Guardwall, Stone Masonry Guardwall, Barriers and Landscaping.

Texture and Coloring of Concrete Barriers

Integral color, paint, stain, and textures for concrete barriers placed on highway transportation projects are allowed.
Caltrans standard Concrete Barrier (Type 60) has been crash tested with various surface textures. This research resulted in guidelines that govern the textural treatment that may be applied to a concrete barrier. Attached is a memorandum of the approved guidelines for applying texture to a Concrete Barrier (Type 60).

Innovative Construction of Textured Concrete Barriers or Walls

This photo depicts Concrete Barrier (Type 60) with color and texture that is being slip formed.
The statewide average cost, based on 2002 data, for a Concrete Barrier (Type 60) is $115 per linear meter. Texture and color would increase this coast by an estimated $50 to $85 per linear meter above the average cost of a non-textured, non-colored barrier.

A potential drawback to providing texture to concrete walls, especially a Concrete Barrier (Type 60), is the construction process. In the recent past, this would require labor-intensive formwork to be used. This problem can be overcome thanks to an innovative slip form concrete texturing process. Today's concrete barriers are commonly built using a machine that can extrude concrete through a slip form that eliminates the need for costly formwork. By adding a drum roller with texture to the typical slip form concrete machine a texturing of an extruded concrete wall can be achieved.

For more information contact
Jack Broadbent at (916) 653-3170
Landscape Architecture Program

Caltrans

U.S. Department
of Transportation
**Federal Highway
Administration**

DEC 20 2002

400 Seventh St., S.W.
Washington, D.C. 20590

Refer to: HSA-10/B-110

Mr. Rich Peter, Chief
Roadside Safety Technology Branch
Materials Engineering and Testing Services
5900 Folsom Boulevard
Sacramento, California 95819-4612

Dear Mr. Peter:

In late September, you sent me one copy of a California Department of Transportation test report dated September 2002 entitled "Crash Testing of Various Textured Barriers" and one set of videotapes showing each of the tests you conducted. Based on the results of these tests, you developed general guidelines for the architectural treatment of single-slope barriers and requested formal acceptance of these guidelines.

All of the textured designs were formed over and parallel to California's Type 60 concrete barrier, which has a constant slope approximately 9 degrees from vertical. Seven different textured designs were tested. Four of these tests met all appropriate Report 350 evaluation criteria at test level 3 and three were considered unsuccessful. A summary (and reference photograph) of each tested design follows:

- Deep Cobblestone design (Enclosure 1) – not acceptable, due to excessive occupant compartment intrusion (2000P vehicle)
- Fluted Rib at 45 degrees (Enclosure 2) – not acceptable, due to rollover (820C vehicle)
- Mission Arch (Enclosure 3) – acceptable performance when tested with 820C vehicle. 2000P test waived
- Deep Cobblestone Reveal (Enclosure 4) – acceptable performance with 2000P vehicle. 820C test waived
- Drystack (Enclosure 5) – acceptable performance with 2000P vehicle. 820C test waived
- Fractured Granite (Enclosure 6) – acceptable performance with 2000P vehicle. 820C test waived
- Shallow Cobblestone (Enclosure 7) – deemed not acceptable due to 2000P vehicle driveshaft separation in crash. Report 350 evaluation criteria were met, however

Based on analysis of all test results, you proposed the following general texture guidelines for use on single-slope concrete barriers in California:

1. Sandblast textures with a maximum relief of 9.5 mm.
2. Images or geometric patterns inset into the face of the barrier 25 mm or less and having 45-degree or flatter chamfered or beveled edges to minimize vehicular sheet metal or wheel snagging.
3. Textures or patterns of any shape and length inset into the face of the barrier up the 13-mm deep and 25-mm in width.
4. Any pattern or texture with gradual undulations that have a maximum relief of 20 mm over a distance of 300 mm.
5. Gaps, slots, grooves or joints of any depth with a maximum width of 20 mm and a maximum surface differential across these features of 5 mm or less.
6. Any pattern or texture with a maximum relief of 64 mm, if such pattern begins 610 mm or higher above the base of the barrier and all leading edges are rounded or sloped to minimize any vehicle snagging potential. No part of this pattern or texture should protrude above the plane of the lower, untextured portion of the barrier.

Based on my staff's review of the information you submitted, I agree that the above guidelines for concrete barrier texturing are acceptable and will not adversely affect the NCHRP Report 350 test level of the barrier to which a texture or pattern is applied. I also agree that any texture or pattern meeting these guidelines can be applied to all crashworthy single slope or vertical wall designs. It is clear from the crash test results that textured barriers can result in more vehicular body damage in a crash due to increased friction even if their crash performance remains within acceptable limits. Although the barriers you tested were 1220-mm and 1422-mm tall, review of the crash and post-crash vehicle trajectories indicate that these guidelines may also be applied to vertical walls as low as 685 mm and to any single-sloped barrier at the standard 813-mm height or higher. These treatments may prove acceptable on New Jersey and F-shape concrete barriers if the treatment is applied only to the upper sloped face of the barriers, but some crash testing would be advisable to verify good performance with these shapes. I understand that anyone wishing detailed design drawings for any of the tested patterns may contact you by telephone at (916) 227-7257 or via e-mail at rich_peter@dot.ca.gov.

Finally, I wish to commend you on this very timely research. Today, more state and municipal transportation agencies are seeking aesthetic traffic barriers that are also crashworthy for use in historic and environmentally sensitive areas. The above

guidelines provide a means for satisfying both goals without additional crash testing and increased project delays and costs.

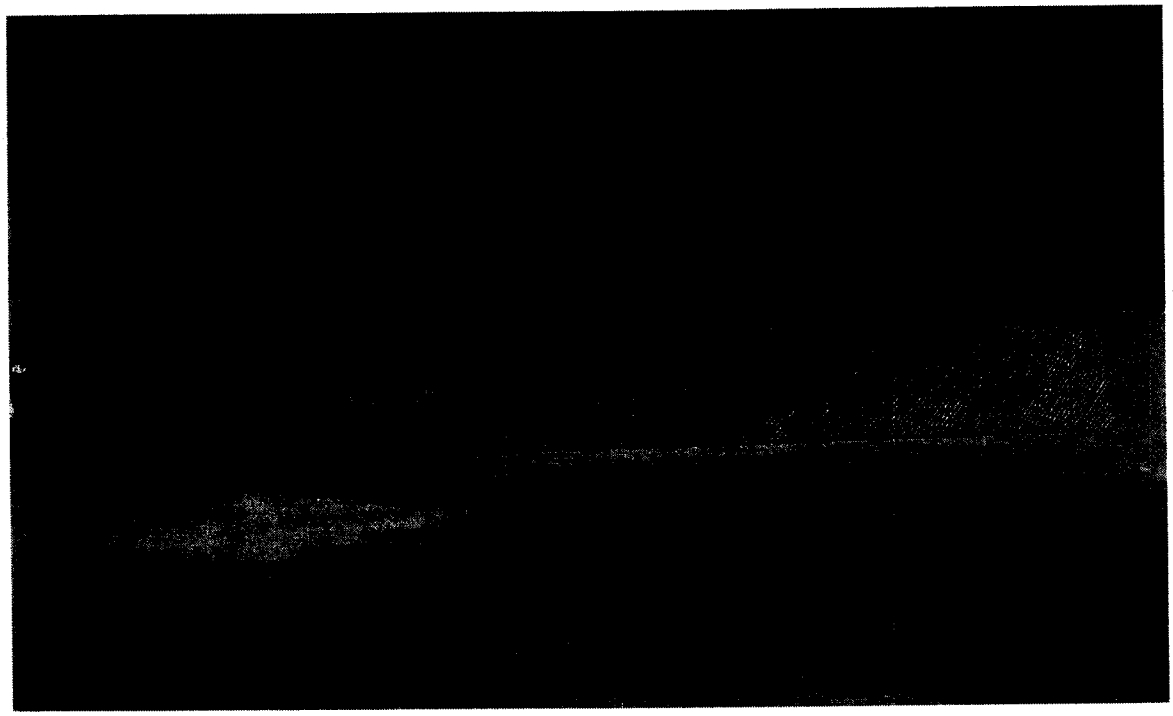
Sincerely yours,

Harry W. Taylor

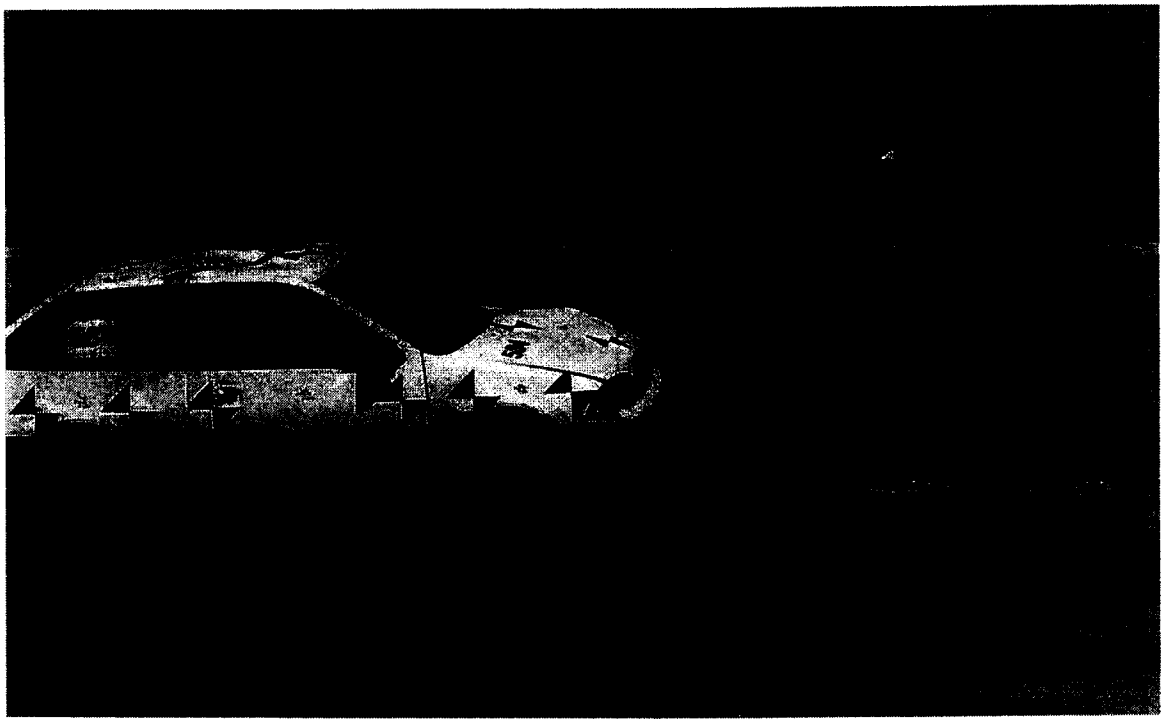
Harry W. Taylor
Acting Director, Office of Safety Design

7 Enclosures

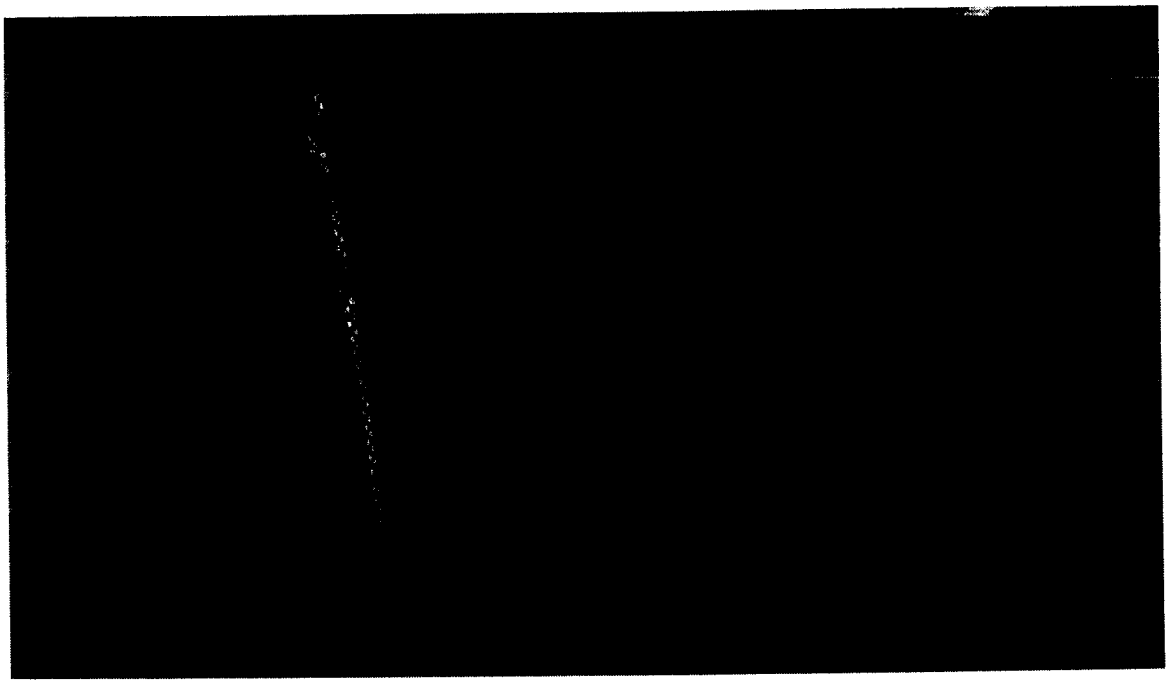
ENCLOSURE 1



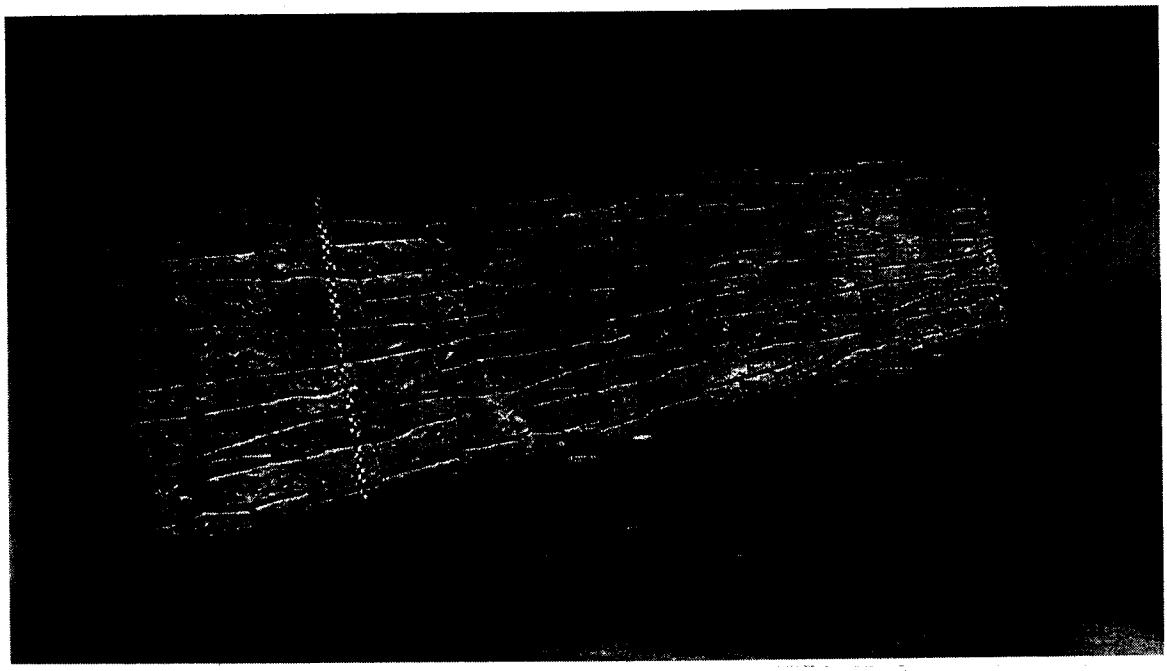
ENCLOSURE 2



ENCLOSURE 3

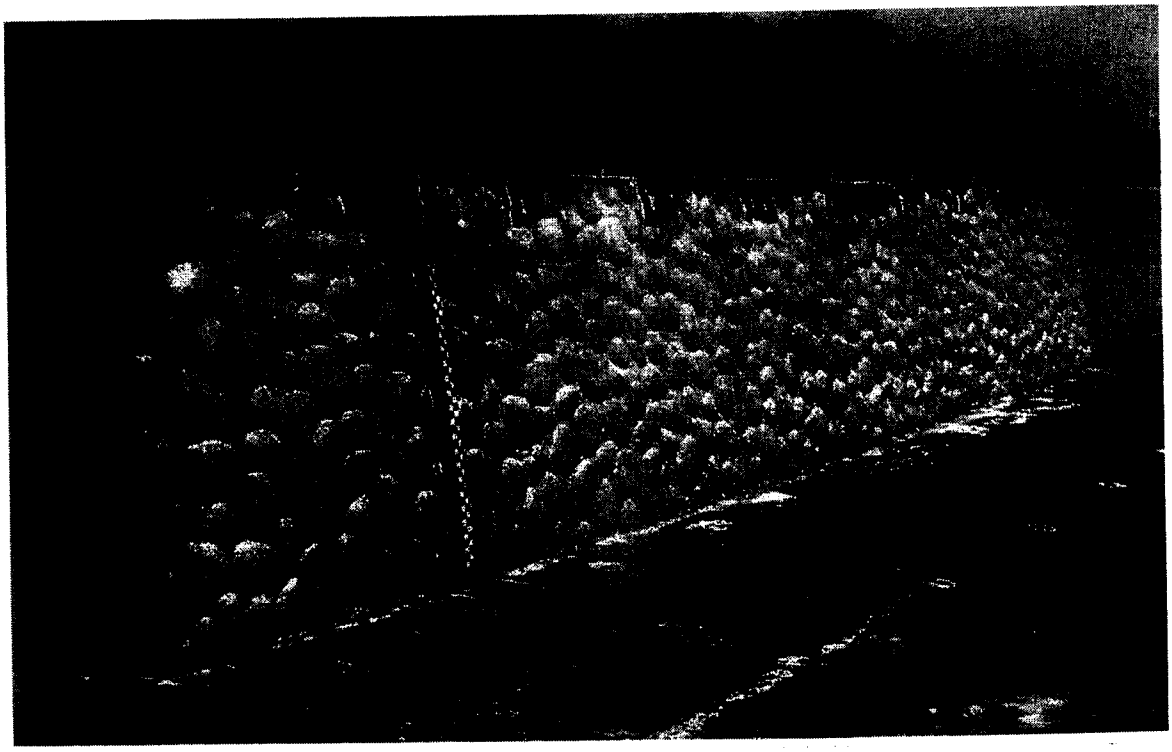


ENCLOSURE 4



ENCLOSURE 5

ENCLOSURE 6



ENCLOSURE 7

APPENDIX F

Technical Memorandum for

TREES

TORREY PINES ROAD PRELIMINARY ENGINEERING STUDY

TECHNICAL MEMORANDUM FOR

TREES

By

TRAN CONSULTING ENGINEERS

January 2011

I. TOPIC DESCRIPTION

Several trees were mentioned in the corridor study for consideration in the project area. Additionally trees are also mentioned in the La Jolla Community Plan. This technical memorandum reviews and indicates which trees would be best suited to the alignment in consideration of the improvements being made in the project.

II. DISCUSSIONS OF FINDINGS

II.1. Which Trees?

The Torrey Pines Corridor Study mentions the following trees for consideration in the parkway between the road and sidewalk: Washingtonia Robusta (Mexican Fan Palm), King Palm, Queen Palm; Tristania Laurina (Water Gum), and Jacaranda. An example of each of these trees is shown below.

The La Jolla Community Plan (page 150) says that the Queen Palm and the Mexican Fan Palm should be used along Torrey Pines Road. It also mentions Eucalyptus and Torrey Pine for special situations. But the Corridor Study notes that Eucalyptus should not be considered.

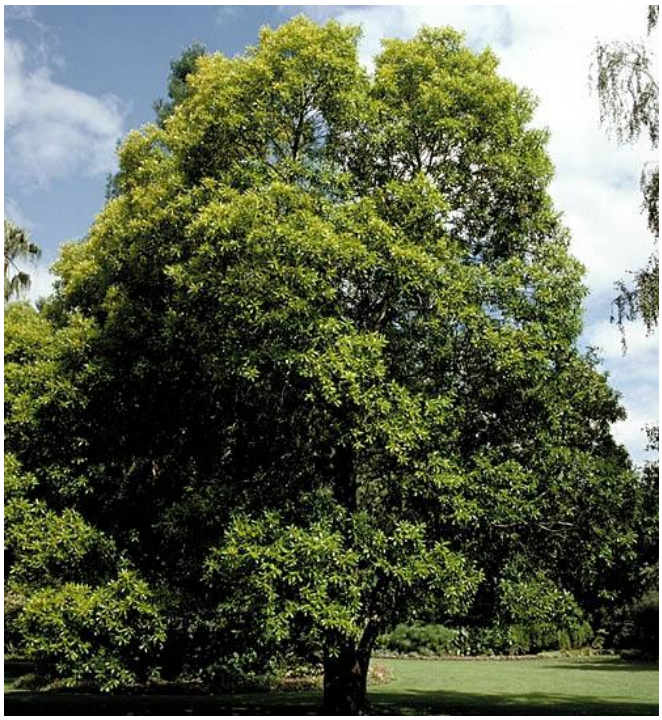
II.1. Tree Locations

The locations of trees in the project area should be selected after proper placement of features that will provide safe travel through the project area. Upon placement of these features in detailed design and selection of planting areas, trees and other plantings can be placed.

Picture 1 - Washingtonia Robusta (Mexican Fan Palm)

Picture 2 - Queen Palm

Picture 3 - King Palm



Picture 4 - Tristania Laurina (Water Gum)

Picture 5 - Jacaranda

Picture 3905 - Palm Trees at the intersection of Torrey Pines Road and La Jolla Shores Drive

Picture 3971 - Palm Trees along Prospect Place

II.2. Tree Costs

Average palm tree costs installed are approximately $3000 for a 24 inch boxed tree. Since the project has constrained parkway strips it is recommended to purchase larger trees to avoid having branches extending into the traveled way.

III. RECOMMENDATIONS

It is recommended that trees in view corridors be limited to Queen Palm and the Mexican Fan Palm, as stated in the La Jolla Community Plan. The palm trees do not obstruct the view and are a common theme throughout La Jolla and the San Diego area. Photos below show palm trees at both ends of the

project; at the intersection of Torrey Pines Road and La Jolla Shores Drive, and along Prospect Place. In other areas the landscape architect may consider the other suggested trees as appropriate.

Tree type	Mentioned in Corridor Study	Mentioned in Community Plan	Recommended for use in Project
Washingtonia Robusta (Mexican Fan Palm)	Yes	Yes	Recommended. Tree provides decoration while limiting obstruction to views
Queen Palm	Yes	Yes	Recommended. Like Mexican Fan Palm, palms are planted in the area and limit obstruction to views.
King Palm	Yes	No	Not Recommended because not listed in the La Jolla Community Plan.
Tristiana Laurina (Water Gum)	Yes	No	Not recommended. Tree has significant foliage that would obstruct views. Project area limitations in width also make this tree unacceptable.
Jacaranda	Yes	No	Not recommended. Tree has significant foliage that would obstruct views. Project area limitations in width also make this tree unacceptable.
Special Situations: Eucalyptus	No	Yes	Not recommended. Obstructs views. High maintenance generates lots of debris.
Special Situations: Pinus Torreyana (Torrey Pine)	No	Yes	Not recommended at this time. Due to constrained widths for plantings in the alignment this tree may not be suitable.

APPENDIX G

Technical Memorandum for

VIEW CORRIDORS

TORREY PINES ROAD PRELIMINARY ENGINEERING STUDY

TECHNICAL MEMORANDUM FOR

VIEW CORRIDOR CONSIDERATIONS

By

TRAN CONSULTING ENGINEERS

January 2011

I. TOPIC DESCRIPTION

Technical items in Torrey Pines Road are being evaluated for a proposed improvement project between Prospect Place and La Jolla Shores Drive. Within the project area some areas have been identified as view corridors. A specific goal of this project is to create and enhance view corridors per the *La Jolla Community Plan* and the *Torrey Pines Corridor Study* (October 2007). Since each view corridor has its own unique features, they are described and addressed individually below, generally starting at the west end and going east end of the alignment.

In the Corridor Study view locations were implied and other areas were noted during Tran Consulting Engineers' field reconnaissance of the project area that were reviewed in this technical memorandum. These areas and the areas cited in the Community Plan are identified in Figure 1 below

II. DISCUSSIONS OF FINDINGS

II.1. Why View Corridors and Scenic overlooks?

Public views from identified vantage points, to and from La Jolla's community landmarks and scenic vistas of the ocean, beach and bluff areas, hillsides and canyons shall be retained and enhanced for public use (*La Jolla Community Plan*, page 50). Views behind covered and overgrown fences are striking in this corridor, to say the least. Furthermore, Torrey Pines Road is designated as a "Scenic Roadway" in the Community Plan with partially obstructed views over private properties and down public R.O.W.s. Since improvements are being planned in this project, this provides the opportunity to follow the directives of the community plan and corridor study to enhance these corridors to the fullest extent practical in full consideration of the safety of the traveler.

II.1. View Corridors and Scenic Overlook Locations

Several locations along the project can be enhanced by removing fences along the right of way and replacing them with barriers that protect adjacent properties while providing views. Another technical memorandum discusses types of fences and at certain locations along the alignment.

II.1.1. Area 1 - Station 12+80 to 16+00

This area is highlighted in the Torrey Pines Corridor Study as an important view corridor. Currently this area has a chain link fence that is covered with ivy and shrubs along the entire length that prevents any view to the ocean as shown in Picture 1333 below. The improvement project will replace the fence to create a magnificent scenic view where there currently is none. See the fences technical memorandum for more information on the fencing. The new sidewalk and planted parkway will be constructed, along with a fence that allows a view of the ocean.

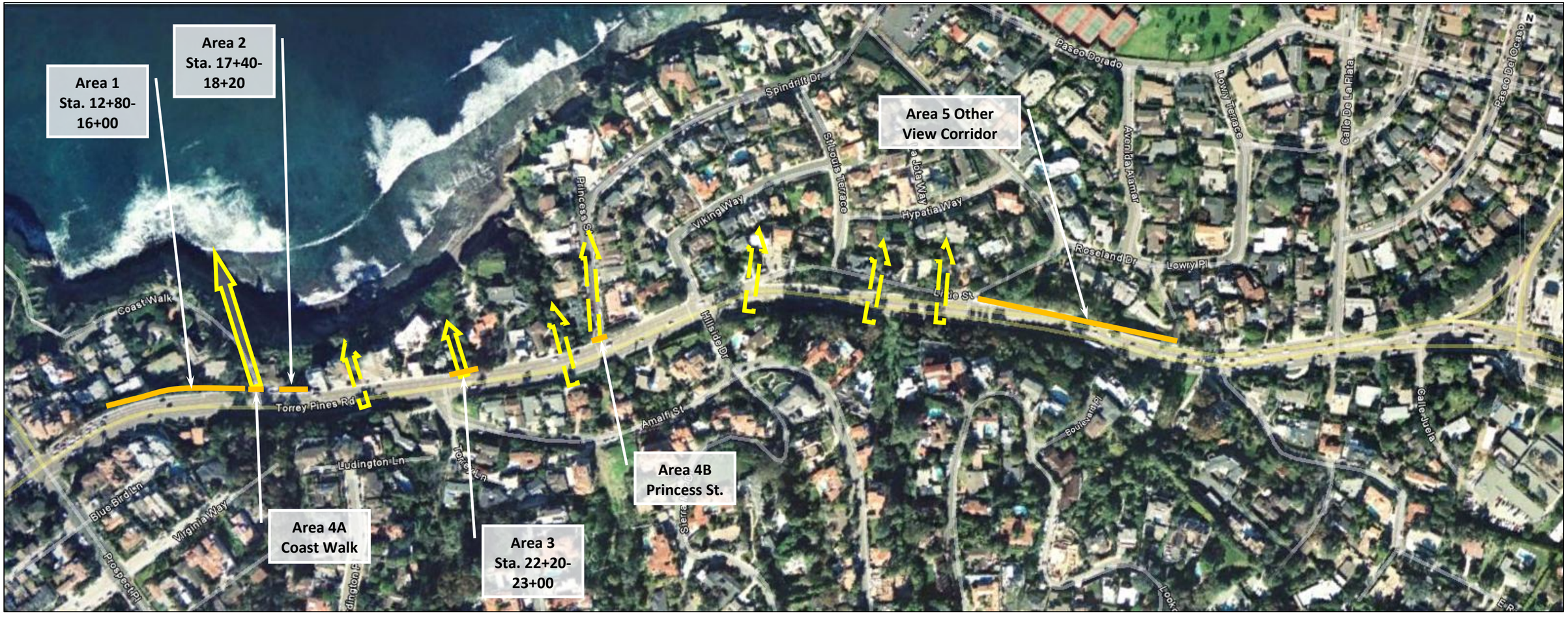


Figure 1

Aerial View of Project Showing Locations of View Corridors and Scenic Overlooks in the Project Area

(Yellow lines represent locations of Visual Access identified in the La Jolla Community Plan affecting Torrey Pines Road; yellow arrow and orange line locations are approximate and all line widths are not intended to represent corridor size)

VIEW CORRIDOR PER COMMUNITY PLAN

SCENIC OVERLOOK PER COMMUNITY PLAN

VIEW AREA DISCUSSED HEREIN

Picture 1333 - View over the Fence and Shrubs

There is a nice ocean view from the road that will be enhanced by the improvements and replacement of the overgrown fence as shown in Picture 2758 below.

Picture 2758 - Ocean View over Area 2

II.1.2. Area 2 - Station 17+40 to 18+20

There is view corridor from Station 17+40 to 18+20 that is currently restricted by a green fence screen over a chain link fence as shown in the Picture 1339 below. This area is noted as a view corridor in the Community Plan. It is recommended that a more attractive fence be installed that allows a better view of the ocean. See the fences technical memorandum for more information on the fencing.

Picture 1339 - Existing Fence and Visual Screen

II.1.3. Area 3 - Station 22+20 to 23+00

Charlotte Street is a paper street, a street in name only. There is chain link fence that is overgrown with ivy so that the view is hidden a shown in Picture 3952 below. This is specially designated a "View Corridor: Unobstructed framed view down a public R.O.W." in the *La Jolla Community Plan*.

Picture 3952 - Ivy covered Fence at Charlotte Street

The improvement plan will replace the chain link fence with a new fence which will enhance the ocean view. The fencing technical memorandum discusses this fence in more detail.

II.1.4. Areas 4A and 4B - View Corridors down Streets

Existing view corridors down streets will remain unaffected by the proposed improvements, including Coast Walk and Princess Street as shown in Pictures 2747 and 2732 below. Although not a part of this project, Coast Walk foliage should be trimmed to provide a better view.

Picture 2747 - Coast Walk View Corridor

Picture 2732 - Princess Street View

II.1.5. Area 5 - Other View Corridor

The area between Little Street and Roseland Drive has some limited ocean views. From Station 41+50 to 42+50 the ocean view will improve when the old chain link fence is replaced. The view is shown in Picture 3916 below.

Picture 3916 - View over Fence at Station 42+00

II.2. O&M Considerations

Proper selection of both fence and plant materials are important to provide adequate barriers for security to local residents and views for the public. Fence O&M considerations are discussed in the Fence technical Memorandum. Existing fences are simple chain link fences that have become overgrown with plant materials. Trees are also discussed another technical memorandum. Plant growth in these corridors must be selected properly to provide minimal maintenance. Plants and trees should not obstruct the sidewalk or the view.

III. Recommendations

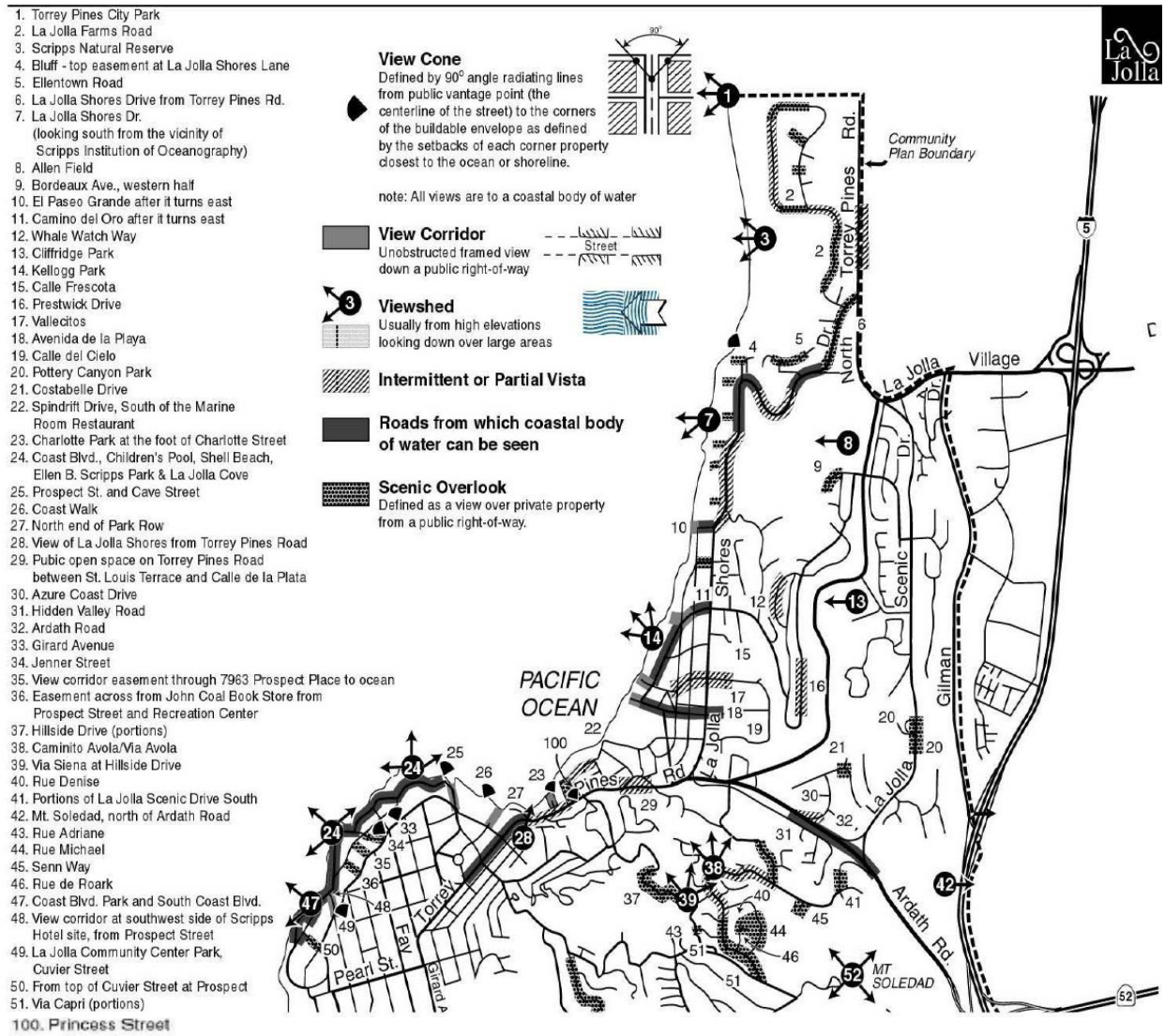
View corridors are a highly important item to the success of this project. Striking views of the surrounding area and the ocean can be found in several locations in the project alignment. By proper identification of view corridors in this technical memorandum, implementation of recommendations discussed above and selection of fences and plantings in the project area these view corridors the project can be successful. Features relative to these view corridors are also discussed in other technical memoranda on fences, and trees.

IV. Appendix

Excerpt of La Jolla Community Plan, Portion of Figure 9 – Identified Public Vantage Points

Excerpt of Appendix G from La Jolla Community Plan and Local Coastal Program Land Use Plan of Subarea D.

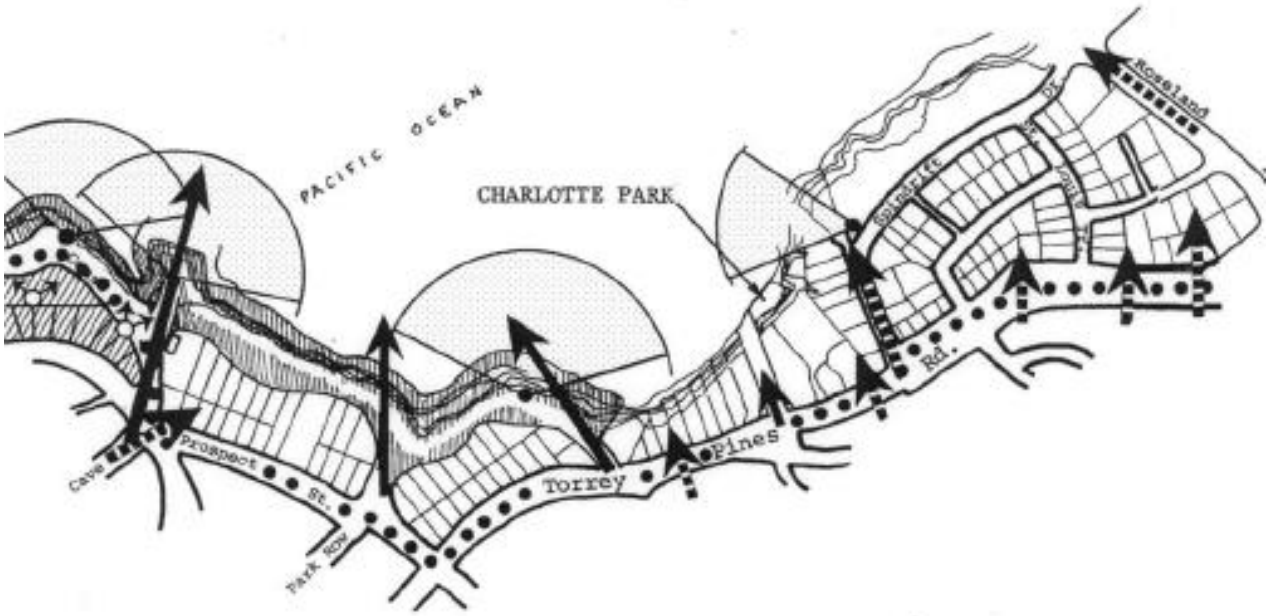
APPENDICES



Identified Public Vantage Points

La Jolla Community Plan
City of San Diego · Planning Department

Figure 9



NOTE: All views are to a coastal body of water

MAJOR VIEWSHED: Unobstructed panoramic view from a public vantage point

VIEW CORRIDOR: Unobstructed framed view down a public R.O.W.

SCENIC OVERLOOK: View over private properties from a public R.O.W.

SCENIC ROADWAY: Partially obstructed views over private properties and down public R.O.W.s

QUASI-PUBLIC VISTA on commercial properties

HIGH POTENTIAL for visual access in commercial development

0 400 FEET

N

Subarea D: Coast Walk - Visual Access

APPENDIX H

Technical Memorandum for

RETAINING WALL CONSIDERATIONS

TORREY PINES ROAD PRELIMINARY ENGINEERING STUDY

TECHNICAL MEMORANDUM FOR

RETAINING WALL CONSIDERATIONS

By

TRAN CONSULTING ENGINEERS

June 2010

I. TOPIC DESCRIPTION

Technical items in Torrey Pines Road are being evaluated for a proposed improvement project between Prospect Place and La Jolla Shores Drive. Within the project area some bluffs and embankments, particularly, but not exclusively on the south side of the road are currently stabilized and some have not.

There are seven locations identified in the project area that will require retaining walls if the proposed improvements are constructed. These locations are shown in Figure 1 below.

The objective of this technical memorandum is to identify locations where new retaining walls would be beneficial to the new road and to recommend a safe and aesthetic retaining wall.

II. DISCUSSIONS OF FINDINGS

II.1. Why Retaining Walls?

Because of the presence of faults in the area, steep bluffs adjacent to the road and the proposed slight widening of the road into the bluffs, proper bluff stabilization is necessary. Existing stabilization systems, consisting of concrete retaining walls or shotcrete walls, appear to have been in service for many years. Some of these walls are showing signs of degradation, evidenced by some of the pictures in this technical memorandum. Improvements in the project area would necessitate improved structural and aesthetic retaining walls.

II.2. Other Studies In and Near the Project Area

A previous report titled "*Report of Geotechnical Evaluation, Torrey Pines Road Slope Repair between Little Street and Roseland Drive, La Jolla, San Diego, California"*, by Geotechics (April 20, 2000), was prepared for a slope stabilization project (that is design complete). It summarized primary geotechnical concerns for bluff stabilization on the south side of the road near the east end of the project from approximate station 37+40 to 41+10 as follows:

1. Loss of support for the existing reinforced concrete Shotcrete facing resulting from piping and erosion of the bluff slope materials,
2. Ongoing erosion of the existing exposed slopes, and
3. Instability of the existing reinforced concrete Shotcrete structure under seismic shaking.

A separate preliminary geotechnical study is also part of this preliminary design project. The preliminary geotechnical study concentrates on items such as the geologic environment of the project including earthquake faulting in the project area and requirements for installing bluff and embankment stabilization.

In order to construct the proposed improvements, the project will require retaining walls in several locations on the south side of the road, as indicated on Cross Sections 3, 4, and 5 of the project plans (contained within this submittal package). Minor retaining walls may also be needed in several other locations. A retaining wall and landscaping walls will be required on the north side of the road as shown in Cross Section 2. This project will require a thorough geotechnical investigation and report early in the final design stage.

Figure 1

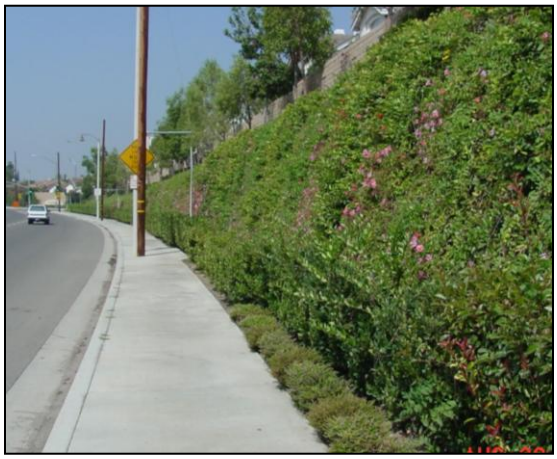
Aerial View of Project Showing Proposed Locations of Retaining Walls

(Yellow lines represent locations of proposed walls; red line represents location of designed wall by others. Line locations are approximate and line widths are not intended to represent the wall size)

II.3. Bluff/ Slope Improvements from Existing

The retaining wall proposed for the south side of Torrey Pines Road between Little St. and Roseland Drive is a soil nailed wall for structural stabilization with a Verdura or Loffelstein style wall face. This wall type leaves openings for plantings, which both provide decoration and the plant roots provide additional soil stabilization at the wall face. Examples of this type of wall are shown below. This wall is recommended because it is a safe soil retaining wall when properly designed, it can be planted to enhance its aesthetic qualities, and it has been selected for an adjacent area along Torrey Pines Road within the project area.

Where small retaining walls are required, a wall could be installed in accordance with the Regional Standard Drawings. Plantings above and/or below these walls to enhance the aesthetics is recommended.



Above, typical example of open block wall with Rosemary and trailing plants

Left and above left, two examples of open block walls covered with plantings along roadways

II.4. Existing Locations Where Retaining Walls will be required

Project plans show the stationing along the project which is used in this section. Locations are also shown in Figure 1 above.

II.4.1. Area 1

Slope stabilization will be required from Station 12+80 to 16+00 on the north side of the road. A new retaining wall is envisioned with landscape plantings to screen the facilities below, but allowing a good view of the ocean (see View Corridors technical memorandum for more information). Minor cuts and fills will be required along the alignment which will require slope stabilization. At Cross Section 2 near

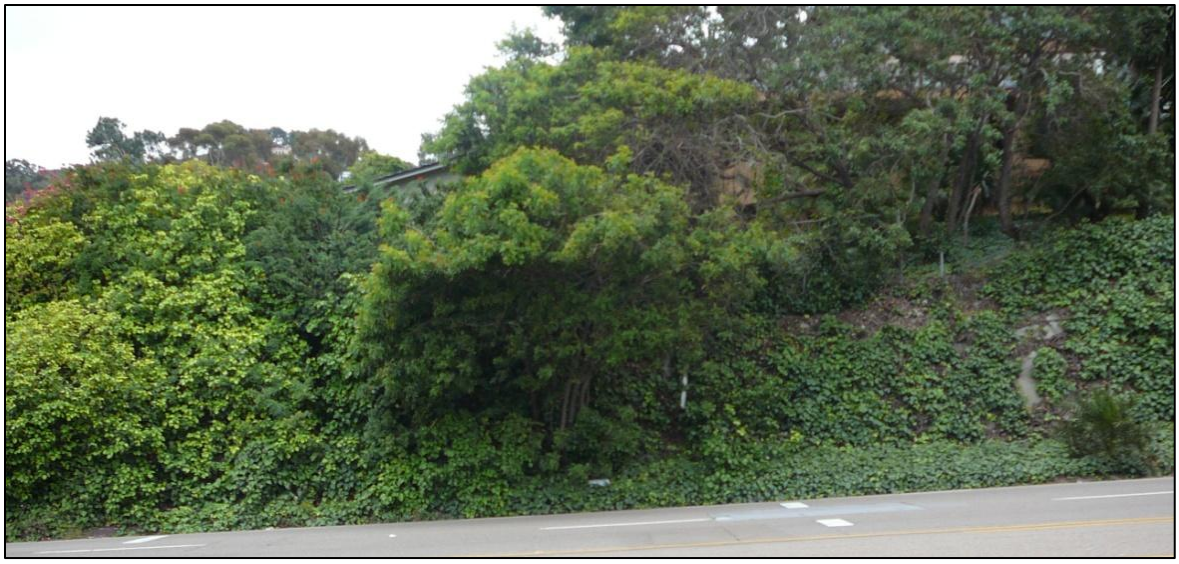
station 13+75 on the project plans, a fence will be installed on top of, or just in front of, the new retaining wall (see technical memorandum on Fences for more information). The segment from Station 11+85 to 13+00 will be challenging due to the steep slope and narrow available R.O.W. An existing private gate in the R.O.W. must be eliminated or relocated. This area was identified in cross sections as having multiple vertical block walls for terraced plantings. The private gate is shown in the Picture 3360.

Picture 3360 - Private Gate

II.4.2. Area 2

A 300-foot long retaining wall on the south side of the road will be required from approximately Station 17+80 to 20+80 (See Cross Section 3 of the project plans). The proposed wall would be required to be just outside the right of way in private property to provide a sidewalk width of 9 feet, although the sidewalk will be within the current right-of-way (ROW). At approximate Station 20+00 a house on the bluff above may impact the retaining wall design, see Pictures 3943 and 3942 below. The 9-foot sidewalk plus landscape width may need to be reduced to 5 feet to fit the wall in the ROW in this location.

Picture 3943 - Station 19+00 South Slope with Existing Gunite Retaining Wall



Picture 3942 - Station 20+00 South Slope Home located behind Dense Tree

Picture 1345 - Concrete Block Retaining Wall near R.O.W.

II.4.3. Area 3

There is an existing concrete block retaining wall on the south side of the road from Station 22+70 to 25+50 – This wall is located in the right of way and will interfere with construction of the new sidewalk therefore a new wall will need to be reconstructed at the edge of the right of way.

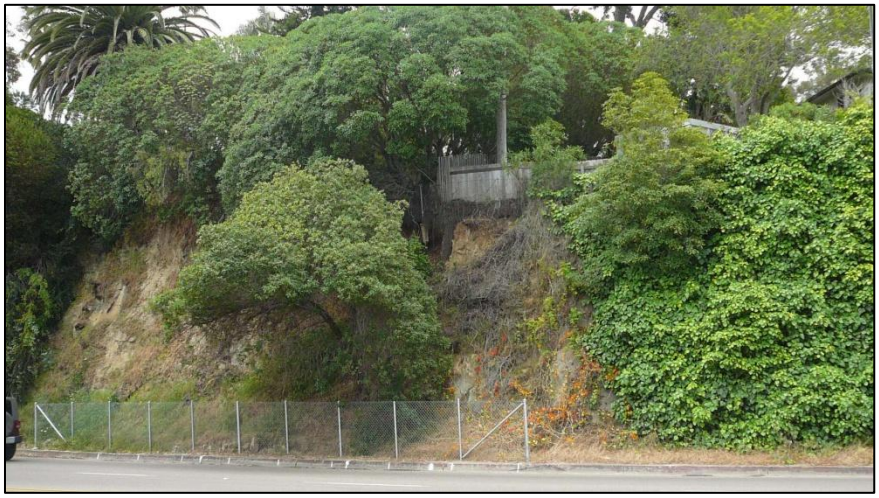
Picture 4 - Slope May Require a Short Retaining Wall

II.4.4. Area 4

A short retaining wall may be necessary from Station 27+80 to 29+10 to accommodate the sidewalk on the south side of the road, see Picture 1345. In lieu of a retaining wall, the adjacent area may be regraded but existing landscaping may be affected.

II.4.5. Area 5

A major retaining wall will be required from Station 30+00 to 37+40 on the south side of the road, with an approximate 70 to 90 foot break around Station 35+00. Pictures 5, 6 and 7 below show the condition of the existing south bluff. Also see Cross Sections 4 and 5 on the project plans.

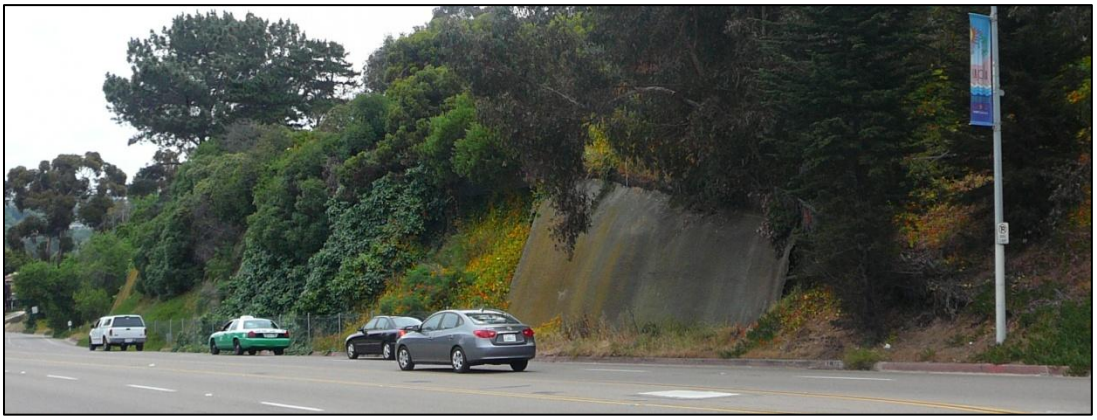


Picture 5 - Bluff at Approximate Station 31+50

Picture 6 - Bluff at Approximate Station 33+00

Picture 7 - Slope at Approximate Station 36+50

At Station 37+40 on the south side of the road the wall will join a 350-foot long wall that has been designed titled, "*Torrey Pines Road Slope Reconstruction between Little Street and Roseland Drive*" by Leighton and Associates (Project #32132, W.O. No. 526740). The area for construction is shown in the Picture 8 below. The design is for a soil nail wall with a facing of Verdura type block that can support landscape plants. It is recommended that a similar type wall be considered for consistent appearance, and because the backcut area is not large, the construction time is less than some other alternatives, and the cost is not excessive. From Station 30+50 to 33+00 the retaining wall will have to be built on private property with a construction easement, or additional ROW will have to be acquired (see Plan for ROW and property lines).



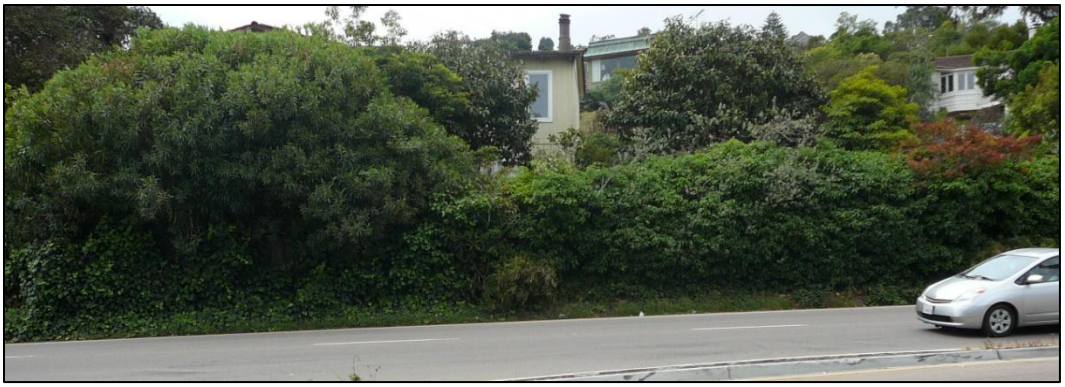
Picture 8 - Location of Proposed Soil Nail Wall to be constructed by others

II.4.6. Area 6

A short retaining wall may be required from Station 41+50 to 43+50 along the sidewalk on the south side of the road. A typical design from the San Diego Regional Standard Drawings can be used.

II.4.7. Area 7

From Station 45+00 to 45+80 there is an existing retaining wall that needs to be replaced and set farther back to accommodate the sidewalk on the south side.



Picture 9 - Existing Wall at Approximate Station 45+50

II.5. Cost Estimates

The following costs for the type of wall have been compiled for preliminary estimating purposes only and not intended to include all costs associated with the project. Costs are in 2010 dollars. The approximate cost of a crib block wall is $32 per square foot. Soil nailing was assumed for 75% of each wall at a cost of approximately $75 per square foot. An average height of approximately 10 feet was assumed for these walls.

For straight masonry retaining walls an approximate cost of $38 per square foot was assumed. An approximate height of 3.5 feet was assumed. Therefore an approximate cost of $140 per linear foot was assumed.

Costs for acquisition of property or easements to place retaining walls outside the right of way are not included.

III. Recommendations

Improvements to Torrey Pines Road between Prospect Place and La Jolla Shores Drive will involve widening the road, which will affect bluffs and slopes on both sides of the road. The project as laid out on the Project plans and locations for retaining walls have been identified. Further detailed geotechnical investigations must be carried out at all locations to confirm assumptions for wall support. There are seven locations where retaining walls are identified. These are shown on the project plans and Figure 1 shown in Section 1 of this technical memorandum and listed below:

Station	Approx. Length	Estimated Cost	Notes & Comments
12+80 - 16+00	320’	See Conceptual Cost Estimate	Remove an existing gate as required. Construct soil nailed wall where necessary and retaining wall. Between Station 11+85 and 13+00 on the north side of the road, the right of way constrains the project.
17+80 - 20+80	300’		Retaining wall requires construction outside right of way on the south side of the road. Recommend soil nail and open block wall. A home is close to bluff and may impact wall support method. Alternatively reduce sidewalk width to reduce wall outside right of way.
22+70 - 25+50	280’		Replace existing block wall on the south side of the road to provide space for new sidewalk. Recommend soil nail and open block wall where necessary. Right of way constrains the project. New wall may be outside right of way.

Station	Approx. Length	Estimated Cost	Notes & Comments
27+80 - 29+10	130’	See Conceptual Cost Estimate	Retaining wall may be required to accommodate sidewalk. Could be City standard block wall. Maximize aesthetic s with cement block color selection
30+00 - 37+40	740’		New retaining wall to provide space for new sidewalk. Recommend soil nail and open block wall right of way constrains project between station 30+00 and 33+00. This wall will meet the wall constructed by others which starts around station 37+40.
41+50 - 43+50	200’		New retaining wall to accommodate the sidewalk. Wall would be short. Recommend City standard block retaining wall or open block retaining wall to allow for planting and to blend with other walls in the area. Maximize aesthetic s with cement block color selection.
45+00 - 45+80	80’		Replace existing block wall to provide space for new sidewalk. Retaining wall could be cement block or open block

TRAN CONSULTING ENGINEERS
Civil, Environmental, Mechanical, Utility Systems and Resource Recovery

January 17, 2011
Mr. Oscar Valdiviso
Associate Engineer
City of San Diego
1010 2nd Ave, Suite 800
San Diego, CA 92101

Subject: Torrey Pines Road Project: Extra Information on Wall Costs and Wall Options

Dear Mr. Valdivieso:

Tran Consulting Engineers performed an additional study (outside scope of work) to find ways of reducing the cost of retaining walls along Torrey Pines Road. First TCE discussed with Caltrans their practice for selecting retaining walls and then has prepared an approach for retaining walls on this project including estimated costs.

A. Caltrans utilizes several approaches to select retaining walls on highways. Several solutions have been experienced with Caltrans landscape architecture group on projects. The following was discussed:

1. **Fill Slopes** – For walls in fill slope Caltrans typically uses MSE walls or Cribwalls. Pictures of these types of walls are shown below.

Typical Crib Wall Arrangement

Typical MSE Wall Construction

2. **Cut Slopes** - For walls in cut slopes Caltrans uses soil nails or tieback anchors and either shotcrete to cover the anchor assemblies and a rock texture or a cast in place concrete retaining wall with decorative treatment. They prefer the cast in place concrete wall because there is better quality control of the finished product. The requirement for a shotcrete treatment is difficult when the contractor is selected by low bid. Caltran's preferred wall type is shown below.

Concrete Retaining wall, soil nail and shotcrete support along Interstate 5

3. **Open Planting Walls –** Landscaping plantings on open wall is not preferred by Caltrans because the plants generally don't thrive, even with regular maintenance. Caltrans planted cribwalls such as on Route 94/125 between Spring Street and Sweetwater Road and the plants have expired with regular maintenance. For attractiveness Caltrans prefers a wall treatment on a straight retaining wall.

Cribwall along Interstate 94 with dead plantings

Dead plantings in open faced wall

B. Wall Approaches for Torrey Pines Road

To reduce costs, TCE investigated costs from bidders on recent Caltrans retaining wall projects to understand wall costs. The result was that the cost of wall support is proportionately smaller in cost than the cost of the face treatment proposed for the wall between Little Street and Roseland Street. As a result, TCE has identified suggested approaches for retaining walls along the project right of way that would serve the purpose while providing an attractive alignment. Each wall design must be evaluated with geotechnical, grading and structural criteria at each wall location during final design.

The suggested approaches are as follows:

1. At walls shorter than 5'-4" height, Utilize a standard Regional Standard Drawing C-2 of C-4 wall suitable for soil surcharge which is common along the alignment. These are common low cost walls that are expected throughout the San Diego region at these heights. *Estimated Cost: $40/square foot*
2. When a 2:1 surcharge slope behind up to a 10 feet high wall can be graded to meet existing grades within the right of way, the wall can be a Regional Standard Drawing C-11 wall. The face of the wall could be provided with an attractive treatment to enhance aesthetics. *Estimated Cost: $150/square foot*

3. For walls over 10 feet height, there are two possible options:
   a. Provide soil nails or tieback anchors and shotcrete to support the slope then provide a straight cast in place concrete vertical retaining wall similar to the preferred Caltrans wall described above. A void at the top of the wall could be filled at a 2:1 slope with soil. This is especially useful for walls along constrained right of way widths. *Estimated Cost: $350/square foot.*
   b. Provide soil nails or tieback anchors and shotcrete to support the slope and provide an open block face for plantings similar to the wall proposed on Torrey Pines Road between Little Street and Roseland Street. However provide a simpler design for the wall to accommodate more efficient and less costly construction. Estimated Cost: *$600/per square foot*
      Following are possible ways to consider reducing costs for a retaining wall similar to that suggested between Little Street and Roseland Street:
      i. The soil nail wall design proposed for the wall between Little St and Roseland Ave. should be looked at from the standpoint of corrosion resistance since the support frame will be in gravel that will cycle between damp and dry increasing oxidation of the carbon steel frame. Stainless steel bar(s) anchored to the shotcrete and soil nails might provide a thinner wall profile and a longer lasting anchorage system.
      ii. The soil nail wall design proposed should be looked at from the perspective of developing a better way to secure the blocks to the shotcrete and soil nails and result in a thinner wall profile possibly eliminating the gravel backfill. The existing design requires the blocks to be secured to a metal frame with geotextile band continuously criss-crossed between the frame and the blocks. The blocks might be secured with a robust plastic tie capable of burial.
      iii. Time involved in installing the blocks and the securing mechanism contributes to time and cost. If the block wall was replaced with a Caltrans type decorative treatment on a retaining wall the cost of the wall would be reduced and maintenance costs would be reduced significantly.

Very truly yours,
TRAN CONSULTING ENGINEERS

Paul Hoa Tran, PE

Cc: File
John Austin

APPENDIX I

Engineering Study for
PROJECT SCHEDULING

TORREY PINES ROAD PRELIMINARY ENGINEERING STUDY

FOR

PROJECT SCHEDULING

By

TRAN CONSULTING ENGINEERS

JANUARY 2011

TABLE OF CONTENTS

I. TOPIC DESCRIPTION

In this study, scheduling of the improvement project along Torrey Pines Road between Prospect Place and La Jolla Shores Drive is being evaluated to identify efficient and effective segments and scheduling sequences using monetary and non-monetary criteria. Improvements will include road widening, retaining wall, guardrail, fences, repaving, striping, etc. Within the project area there must be a certain level of scheduling to minimize community impacts and properly budgeting the project, while effectively completing the work and protecting public safety.

II. PROJECT SCHEDULING

II.1. Why Project Scheduling?

Torrey Pines Road is a congested alignment; the road is the primary means of access to the La Jolla Village area, a highly desirable visitor destination and business hub, and the surrounding area is the location of numerous residences. Public safety requires that the work be properly staged and sequenced for least impact to motorists and to maintain the highest level of public safety, this generally means that a detour that involves little change and is in use for a longer time is safer for the commuter since he can become accustomed to the change in alignment and therefore travel through the work area in a safer manner. This does not relieve the contractor of his obligation to provide traffic control that notifies the traveler well in advance of a temporary realignment of the road. In addition, local residents usually want work completed as soon as possible.

Improvements to this corridor will involve use of features to enhance the local environment which can be costly, therefore scheduling the project so it is constructed over a somewhat longer time period will stagger funding allowing the project to be properly budgeted by the City without significantly affecting other important public improvements in the city.

II.2. Standards for Scheduling

Scheduling road improvements should consider scheduling portions of the project with the highest crash incidents and keeping traffic control transitions back to existing roadways out of areas of high crash incident. Crash incident data was not available to TCE at the time of this report however the final design engineer should request this information for this purpose.

Another criterion is effective scheduling of the segments. For example, if there are areas of right of way that must be acquired from local resident's property, these segments should be performed last or later to provide time for right of way acquisition (temporary or permanent easement or right of way in fee).

Scheduling of segments should consider affects by ongoing litigation that should allow for settlement of the litigation and conclusion of the verdict before progressing with the affected segment construction.

The City established a standard for the project to limit each project segment to $5 Million to allow for proper funding. The costliest project features are the retaining wall units. The road is located above and below expensive homes close to the alignment and geology is challenging, containing active and inactive faults that in some areas result in soil sloughing off of the bluff, therefore retaining walls of varying cost are necessary. A discussion of the geologic hazards is shown in the Report of Geotechnical Reconnaissance as part of the documentation for this project.

II.3. Scheduling Criteria

Scheduling can be flexible however ideally there should be as few segments as possible while satisfying criteria. The following criteria were evaluated in this study:

- **Community Impacts**
- **Financing Constraints**

II.3.1. Community Impacts

The community usually wants the project complete as soon as possible so they can return to their normal routines. The project is best constructed such that as many issues as possible are addressed in this project and future capital improvements construction in the alignment will not take place for a long time. Important to the scheduling of the work is that construction should be scheduled to provide construction of all improvements in the same area at the same time, that advocates a more controlled project area of work. These goals advocate scheduling where work is efficiently carried out to complete all work quickly; a good contractor's construction sequence usually addresses completion ASAP since the contractor is motivated to complete work as quickly and efficiently as possible. As is the case on City of San Diego projects, the work is inspected for quality assurance and quality control.

Safety

The goal of the conceptual design is to improve the safety of the community and to meet the City's standards and requirements for safety

During construction, the design engineer should prepare the bid documents to protect the public's health and safety concerns.

The design engineer shall materialize all applicable standards and requirements on the contract documents so that after construction, all of the constructed work shall meet the City's safety requirements and standards

Traffic

The Traffic engineer for traffic control will make every attempt minimize traffic disturbances. When necessary the traffic engineer may design lane closures, however they shall avoid traffic detours because of the high Average Daily Traffic loads on Torrey Pines Road. Traffic loads on this road cannot be safely diverted to any local street. In all circumstances the construction of all segments will, more or less, create some traffic impacts. Therefore scheduling will be grouped separately for each section of road so that the work will not have to impact the community in the same area again and again.

Noise

To minimize noise impacts, the construction work is best performed during working hours. However for the same reason as described in traffic above, the scheduling should be grouped by alignment segment so the same resident doesn't have to be impacted by the construction noise over several construction periods.

Aesthetics

This conceptual design takes consideration of preserving the view corridor, retaining the prestige of the area and preserving the natural character of the area to the fullest extent possible

II.3.2. Financing Constraints

Monetary constraints were initially set by City staff at approximately $5 Million per segment for construction. Given this requirement, TCE prepared a construction cost estimate for the project elements. During development of the cost estimate, TCE based unit costs on City standard unit costs, Caltrans bid costs from actual projects and ebidboard costs for local projects. The cost estimate also was adjusted to local area costs for the La Jolla area and was reviewed by local contractors.

Costs exceed $5 Million on two segments primarily because of proposed retaining walls on the south side of the road. As a result of high costs for several walls, TCE utilized costs to define segments. The cost estimate assumes known project elements applying average construction costs within the last 2 years from the date of issuance of this study. A contingency of 30% was added to the subtotal of estimated costs to account for items such as overhead and profit, taxes, items not considered in conceptual design that would be selected in detailed design, etc.

Segment	Estimated Conceptual Construction Cost
1	$5.5 Million
2	$5.0 Million
3	$5.4 Million
4	$4.7 Million

II.4. Segment Locations

After development of the cost estimate, TCE evaluated costs to define how the project should be segmented (the engineer's conceptual cost estimate is attached in Appendix A). Segments were defined based on estimated costs and identified as follows:

Segment	Stationing	Description
1	10+00 – 16+80	From the intersection of Prospect St. to Coast Walk
2	16+80 – 29+50	From the intersection of Coast Walk to Viking Way/Hillside Dr.
3	29+50 – 35+00	From the intersection of Viking Way/Hillside Dr. to 200 feet west of Little St.
4	35+00 – 53+00	200 feet west of Little St intersection to La Jolla Shores Drive

Costs were proportioned to keep construction costs of segments at approximately $5 Million. This does not include costs for contract administration, planning, design, land acquisition, or operations and maintenance. The location of each segment is shown on Figure 1.

III. PRIORITIZATION OF SEGMENTS

Project sequencing is equally important and different criteria must be considered in selection of the most attractive sequence of completing the selected segments. The criteria identified are as follows:

- **Level of Achievement**
- **Scheduling of Long Lead Items**
- **Urgency of Safety Improvements**

The three criteria were used to prioritize segments 1, 2, 3 and 4. Each segment has a score for each criterion based on the scoring system. Each segment will be scored from 1 to 10 with one being a low score and ten being the best. The criteria each have different weighted factors. The one that is more important has a higher weighted factor and the less important criterion has a lower weighted factor. Each weighted factor ranges from 1 to 5. The final score for each segment is the product of the score and the weighted factor.

III.1. Level of Achievement

Segment 4 contains over 40% of the project alignment length and the cost of this segment is lower in cost than all the other segments so the segment may be completed more quickly. Completion of this segment would provide the community with a sense that the project is progressing well and would give the community the opportunity to use a large portion of improved roadway more quickly. The community would likely be more appreciative when longer sections are improved. Segments are ranked based on length of the segment relative to segment 4 (1800 feet) as follows:

Segment	Score	Notes
1	4	This segment is approximately 680 feet long
2	7	This segment is the second longest segment (1270 feet) in the project. It should be constructed second based on this criterion.
3	3	This segment is the shortest length at 550 feet.
4	10	This is the longest segment on the project and should be constructed as soon as possible based on this criterion. Completion of this segment would show significant project progress.

III.2. Scheduling of Long Lead Items

On this project, several locations will require acquisition of permanent right of way, permanent or temporary easements . Property acquisition efforts frequently delay projects because of the time required to identify, assess, and obtain approvals for work in those areas. Therefore property acquisition must be identified as early in the project as possible so proper project scheduling can take place. On Torrey Pines Road, right of way is limited so TCE identified the following locations where potential work outside the limits of the right of way may be required. TCE estimated the area of land acquisition as adequate to place retaining walls within ROW. TCE limited the right of way (ROW) area to control costs and protect the adjacent homeowner from potential future power lines, water lines or other utilities in the new ROW nearer their home. As a result of installing the wall, improvement of the adjacent homeowner's land has been accomplished by signature approval of an agreement to perform the work prior to improvements at no additional cost for land acquisition or easements.

No.	Approximate Stations	Segment	Approximate Land Acquisition, ft^2	Description
1	12+80 to 13+25	1	380	For retaining wall on embankment side of road
2	15+50 to 16+60	1	1,620	For retaining wall on cut side of road
3	17+80 to 20+80	2	3,950	For retaining wall on cut side of road
4	22+70 to 25+50	2	3,270	For retaining wall on cut side of road
5	30+70 to 33+50	3	2,300	For retaining wall on cut side of road

West of Amalfi St. intersection, pending litigation between an adjacent homeowner and the City on the south side of the road should be completed before proceeding with work in that area. Pending litigation is alleged for slope stabilization along the cliff area above Torrey Pines Road.

As described in the evaluation above there are several impacts that could impact segments 1, 2 and 3. These include acquisition of easement or right of way in these segments. Based on the discussion above, the segments would be ranked as follows.

Segment	Score	Notes
1	6	Two locations will require acquisition of right of way or easement therefore this may take longer than a segment with one area to acquire.
2	4	There is pending litigation related to a portion of the roadway in this segment. Time required resolving litigation can be longer than easements or right of way acquisition. The segment has two areas requiring easement or right of way acquisition.
3	8	Only one affected area is located in this segment that would require easement or right of way acquisition. Therefore it may be faster to obtain agreements and start this segment.
4	10	This segment is clear of pending litigation as well as easements or right of way required to be acquired prior to construction.

III.3. Urgency of Safety Improvements

Safety improvements reduce risks to the community by installing traffic barriers for protection of pedestrians and potential of accident risks. TCE's evaluation of the segments is presented in the table below.

Segment	Rank	Notes
1	8	This segment contains guardrail along the sweeping curve on the north side of the road. This guardrail is required because a steep embankment on the outside of the curve presents a hazard. The guardrail would protect pedestrians accessing Coast Walk. Coast Walk is a walking area with sweeping coastline views.
2	10	A guardrail is proposed to protect pedestrians on the north side of the road across from the intersection with Amalfi St. An accident was reported to occur where a vehicle crossed the road and ran off the embankment at this location.
3	5	There are no guardrails in this segment and this segment is in the middle of the alignment and short in length (same approximate length as segment 1). No significant improvements to improve safety that aren't also included in other segments.
4	5	There is no guardrail in this segment. No significant improvements to improve safety that aren't also included in other segments.

IV. Conclusions and Recommendations

A Summary of the segments with weighted factors is provided below. Weighted factors were selected based on the importance to the project. Safety takes precedence. Secondary is scheduling lead items because time constraints for acquisition of the property could hold up construction of the affected project segment. Third community sensitivity, or completing the longest segment work first, is considered because it was most likely that completion of segment 4 which has the greatest positive impact to the community would most likely be constructed first.

Criteria	Weighted Factors	Segment			
		1	2	3	4
Level of Achievement	3	4	7	3	10
Scheduling of Long Lead Items	4	6	4	8	10
Urgency of Safety Improvements	5	8	10	5	5
TOTALS		76	87	66	95

TCE's final order of ranking of the segments in the table above has a good chance of providing the least impacts to the community, provide appropriate time for getting long lead items completed and install safe improvements timely. **From the perspective of retaining wall construction, the walls should be constructed within segment construction to minimize community disturbance.** Therefore the sequence for retaining wall construction is recommended to correspond with each segment's prioritization.

Figure 1 below shows an illustration of the arrangement of segments in the project alignment.

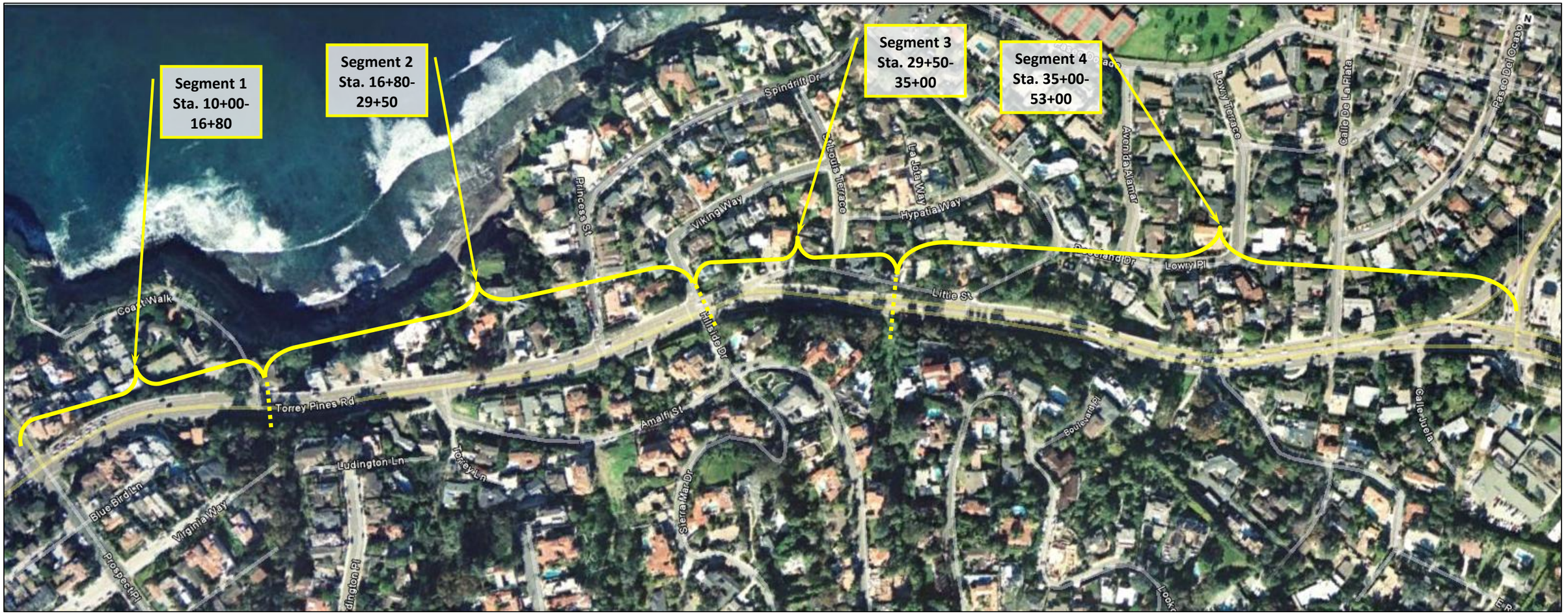


FIGURE 1

Aerial View of Project Showing Conceptual Locations of Segments

(Yellow lines represent locations of proposed segments; Line locations are approximate)

APPENDIX

A. TORREY PINES ROAD CONCEPTUAL COST ESTIMATE

TORREY PINES ROAD CONCEPTUAL COST ESTIMATE

DESCRIPTION	QTY	UNIT	$/UNIT	TOTAL	Approximate Cost Breakdown per Segment: Segment 1 Sta. 10+00-16+80	Segment 2 Sta. 16+80-29+50	Segment 3 Sta. 29+50-35+00	Segment 4 Sta. 35+00-53+00
Mobilization/ Demobilization	1	LS	$600,000	$600,000	$ 150,000	$ 150,000	$ 150,000	$ 150,000
Bond and Field Orders	1	LS	$1,000,000	$1,000,000	$ 152,809	$ 285,393	$ 123,596	$ 438,202
Stormwater Control Measures	1	LS	$1,154,000	$1,154,000	$ 176,342	$ 329,344	$ 142,629	$ 505,685
Remove & Dispose AC Pavement	17,500	SF	$4	$70,000	$ 10,697	$ 19,978	$ 8,652	$ 30,674
Cold Mill Pavement	9,100	LF	$3	$23,660	$ 3,615	$ 6,752	$ 2,924	$ 10,368
Asphalt Concrete Pavement Overlay	294,000	SF	$3	$882,000	$ 134,778	$ 251,717	$ 109,011	$ 386,494
Remove & Dispose of Sidewalk	17,200	SF	$2	$36,120	$ 5,519	$ 10,308	$ 4,464	$ 15,828
Sidewalk per G-7	35,500	SF	$6	$227,200	$ 34,718	$ 64,841	$ 28,081	$ 99,560
Remove and Dispose of Curb and Gutter	7,700	LF	$3	$25,410	$ 3,883	$ 7,252	$ 3,141	$ 11,135
Curb and Gutter Type G	8,400	LF	$24	$203,280	$ 31,063	$ 58,015	$ 25,124	$ 89,078
Remove and Dispose of Retaining Walls (shotcrete)	11,675	SF	$10	$116,750	$ 63,000	$ 7,500	$ -	$ 46,250
Remove and Dispose of Retaining Walls (Cement Block)	1,300	SF	$10	$13,000	$ -	$ 13,000	$ -	$ -
Retaining Wall Sta. 12+80-16+00 Soil Nail w/concrete façade	6,800	SF	$350	$2,380,000	$ 2,380,000	$ -	$ -	$ -
Retaining Wall Sta. 15+50-16+60 Soil Nail w/concrete façade	1,500	SF	$350	$525,000	$ 525,000	$ -	$ -	$ -
Retaining Wall Sta. 17+80-20+80 Soil Nail w/concrete façade	5,100	SF	$350	$1,785,000	$ -	$ 1,785,000	$ -	$ -
Retaining Wall Sta. 22+70-25+50 SDRSD C-11 Wall	2,100	SF	$150	$315,000	$ -	$ 315,000	$ -	$ -
Retaining Wall Sta. 27+80-29+10 SDRSD C-11 Wall	1,000	SF	$150	$150,000	$ -	$ -	$ 150,000	$ -
Soil Nail Wall Sta. 30+00-34+90	10,600	SF	$200	$2,120,000	$ -	$ -	$ 2,120,000	$ -
Retaining Wall Sta. 30+00-34+90 SDRSD C-11 w/façade	6,560	SF	$150	$984,000	$ -	$ -	$ 984,000	$ -
Soil Nail Sta. 35+80-37+50	3,830	SF	$200	$766,000	$ -	$ -	$ -	$ 766,000
Retaining Wall Sta. 35+80-37+50 SDRSD C-11 w/façade	2,640	SF	$150	$396,000	$ -	$ -	$ -	$ 396,000
Station 41+50-43+50 SDRSD C-2 block retaining wall	900	SF	$40	$36,000	$ -	$ -	$ -	$ 36,000
Station 45+00-45+80 SDRSD C-2 block retaining wall	600	SF	$40	$24,000	$ -	$ -	$ -	$ 24,000
Pavement Striping Removed	26,500	LF	$3.75	$99,375	$ 15,185	$ 28,361	$ 12,282	$ 43,546
Pavement Striping and Grooving Pavement	27,000	LF	$1.20	$32,400	$ 4,951	$ 9,247	$ 4,004	$ 14,198
Excavation	1,000	CY	$50	$50,000	$ 7,640	$ 14,270	$ 6,180	$ 21,910
Pedestrian Ramps	28	EA	$2,000	$56,000	$ 12,000	$ 14,000	$ 8,000	$ 22,000
Traffic Control	1	LS	$900,000	$900,000	$ 200,000	$ 200,000	$ 200,000	$ 300,000
Guardrail	650	LF	$300	$195,000	$ 132,000	$ 63,000	$ -	$ -
Trees	175	EA	$2,000	$350,000	$ 53,483	$ 99,888	$ 43,258	$ 153,371
Relocate Street Lights	6	EA	$10,000	$60,000	$ 20,000	$ 20,000	$ 10,000	$ 10,000
Relocate Water line AVAR valves & blowoff assemblies	5	EA	$10,000	$50,000	$ -	$ 20,000	$ -	$ 30,000
Fence: Parapet and Plexiglas type	650	LF	$230	$149,500	$ 92,000	$ 57,500	$ -	$ -
Fence: Wood and Metal fence	900	LF	$30	$27,000	$ -	$ -	$ 9,000	$ 18,000
Privacy Fence	60	LF	$50	$3,000	$ -	$ -	$ -	$ 3,000
	Subtotal All Items			$15,804,695	$ 4,208,684	$ 3,830,365	$ 4,144,347	$ 3,621,299
	Contingency		30%	$4,741,409	$1,262,605	$1,149,110	$1,243,304	$1,086,390
	Total			$20,546,104	$5,471,289	$4,979,475	$5,387,651	$4,707,689
Construction Cost Grand Total (rounded to nearest $100,000)				**$20,500,000**	**$5,500,000**	**$5,000,000**	**$5,400,000**	**$4,700,000**
Additional Project Costs:			Planning	$500,000	$125,000	$125,000	$125,000	$125,000
			Design, Construction Management & Administration	$3,800,000	$1,000,000	$900,000	$1,000,000	$900,000
			Land Acquisition Administration	$200,000	$100,000	$100,000	$0	$0
			Land Acquisition @ $120/Square Foot and 11600 sq. ft.	$1,400,000	$700,000	$400,000	$300,000	$0
			TOTAL	$26,446,104				
TOTAL PROJECT COSTS (rounded to nearest $100,000)				**$26,500,000**	$7,400,000	$6,500,000	$6,800,000	$5,700,000

Notes:

1 Trees include retaining wall plantings and irrigation systems, root barriers, and 1 year maintenance contract. Assumes corrosion proof attachments insect/decay resistant trellis. Trellis will be from 4' to 15' height however cost is an average.
2 Retaining wall height from Coastal Comission and City Department of Planning and Land Use
3 Estimate excludes retaining wall constructed by others at approx. stations 37+40 - 40+70
4 Soil Nail wall costs are based on the difference between the $350/sf wall with soil nails and the $150/SF SDRSD C-11 retaining wall without soil nails
5 4-foot wide sidewalk is assumed for the project. Remaining available width to be utilized for parkway strip behind sidewalk.
6 Land Acquisition assumes 2000 sq ft Segment 1, 7220 sq ft Segment 2, and 2300 sq ft Segment 3.
7 Land acquisition administration or effort to acquire land is based on the estimated no. of properties affected.
8 Design and Administration includes costs for detailed design, bidding and awarding contract, and City construction management and office management during design
9 Land acquisition costs were based on actual real estate prices averages of $100 per foot. A 20% contingency was added.

APPENDIX A

APPENDIX J

Cost Estimate

(Cost Estimate is presented at the back of Appendix I)

APPENDIX K

CEQA CHECKLIST AT A CONCEPTUAL LEVEL

Preliminary Notes on
CEQA Environmental Checklist

PROJECT DESCRIPTION AND BACKGROUND

Project Title:	**Torrey Pines Road Improvements between Prospect Street and La Jolla Shores Road**
Lead agency name and address:	**City of San Diego**
Contact person and phone number:	
Project Location:	**Torrey Pines Road between Prospect St & La Jolla Shores Dr.**
Project sponsor's name and address:	**City of San Diego**
General plan description:	
Zoning:	**Includes City right of way. If right of way is acquired zoning will is LJSPD-SF and RS1-5**
Description of project: (Describe the whole action involved, including but not limited to later phases of the project, and any secondary, support, or off-site features necessary for its implementation.)	**Minor realignment of roadway, installation of sidewalks on south side of road, installation of enhanced fencing to meet La Jolla Community plan, Install guardrail in two specific locations, install retaining walls as required and minor grading to accommodate walls for sidewalk installation. Additional easements for construction required and potential additional right of way.**
Surrounding land uses and setting; briefly describe the project's surroundings:	**A 4 lane modified collector road with cliffs on the south side and embankments in locations along north side of the roadway, striking views of ocean from road adjacent residential properties throughout.**
Other public agencies whose approval is required (e.g. permits, financial approval, or participation agreements):	**The project is in the City of San Diego Coastal Zone, appealable to the Coastal Commission**

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project. Please see the checklist beginning on page 3 for additional information.

☐	Aesthetics	☐	Agriculture and Forestry	☐	Air Quality
☐	Biological Resources	☐	Cultural Resources	☐	Geology/Soils
☐	Greenhouse Gas Emissions	☐	Hazards and Hazardous Materials	☐	Hydrology/Water Quality
☐	Land Use/Planning	☐	Mineral Resources	☐	Noise
☐	Population/Housing	☐	Public Services	☐	Recreation
☐	Transportation/Traffic	☐	Utilities/Service Systems	☐	Mandatory Findings of Significance

DETERMINATION:

On the basis of this initial evaluation:

☐	I find that the proposed project COULD NOT have a significant effect on the environment, and A NEGATIVE DECLARATION will be prepared.
☐	I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.
☐	I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.
☐	I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.
☐	I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required

Signature:	**Date:**
Printed Name:	**For:**

CEQA Environmental Checklist

This checklist identifies physical, biological, social and economic factors that might be affected by the proposed project. In many cases, background studies performed in connection with the projects indicate no impacts. A NO IMPACT answer in the last column reflects this determination. Where there is a need for clarifying discussion, the discussion is included either following the applicable section of the checklist or is within the body of the environmental document itself. The words "significant" and "significance" used throughout the following checklist are related to CEQA, not NEPA, impacts. The questions in this form are intended to encourage the thoughtful assessment of impacts and do not represent thresholds of significance.

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
I. AESTHETICS: Would the project:				
a) Have a substantial adverse effect on a scenic vista	☐	☐	☐	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway	☐	☐	☐	☐
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☐	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	☐

Prepare Visual Analysis and report that addresses effects to view sheds and aesthetics utilizing 30%-60% design details. This should particularly include project retaining walls and fences

II. AGRICULTURE AND FOREST RESOURCES: In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment Project; and the forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☐	☒
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☒

There are no Agricultural resources known to be affected by this project. This section should be "Not Applicable"

III. AIR QUALITY: Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☐	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non- attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☐	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☐

Prepare Air Quality Report; base report on traffic control plans and 2007 Corridor study (has traffic loads, may require traffic study update) use findings to address questions in this section.

Comment: Potential for sensitive receptors at nearby residences affected by construction. City of San Diego contract requirements will be followed. Reduced right turn lane at Torrey Pines Road and Prospect St. may affect long term impact

IV. BIOLOGICAL RESOURCES: Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	☐	☐	☐	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☐
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☐

Perform Biological survey and prepare Biological Letter Report to verify biology in the affected areas.

Comment: Conduct survey of impacted vegetated areas of the project. Include staging areas.

V. CULTURAL RESOURCES: Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☐	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☐	☐	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☐
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☐

Prepare a Cultural Resources Studies and sensitive archeological sites by the project. Known paleontological sensitive area that requires monitoring for possible marine fossils, etc. during excavation work in construction

VI. GEOLOGY AND SOILS: Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☐	☐	☐
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42? The active Rose Canyon fault has been mapped crossing the eastern portions of the project alignment. The fault also crosses residential properties on opposite sides of the project alignment. There is a high potential for ground rupture at the alignment in the event of a nearby seismic event. The proposed project will not exacerbate the potential for fault rupture.	☐	☐	☒	☐
ii) Strong seismic ground shaking? The site is subject to potentially strong seismic ground shaking on a regional or local active fault. The proposed project will not exacerbate the potential for ground shaking.	☐	☐	☐	☒

iii) Seismic-related ground failure, including liquefaction? The eastern end of the alignment is underlain by alluvium which could be subject to liquefaction on a regional or local active fault in the region. The proposed project will not exacerbate the potential for seismic-related ground failure or liquefaction.	☐	☐	☐	☒
iv) Landslides? No landslides are mapped within or adjacent to the subject alignment. In the City of San Diego Seismic Safety Study (2008), the central portion of the alignment is mapped as being underlain by slide prone formations. Since no landslides are mapped on the site, the alignment is not expected to expose people or structures to potential adverse effects due to landslides.	☐	☐	☐	☒
b) Result in substantial soil erosion or the loss of topsoil? The project alignment is currently paved, vegetated and urbanized. Construction of the project is not anticipated to result in substantial soil erosion if graded in accordance with the City of San Diego grading ordinance and if Best Management Practices are utilized to prevent surface water from running over slopes. Due to the relative shallow grading, substantial loss of topsoil is not anticipated, if topsoil is present.	☐	☐	☐	☒
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse? In the City of San Diego Seismic Safety Study (2008), the central portion of the alignment is mapped as being underlain by slide prone formations. The eastern end of the alignment is underlain by alluvium which could be subject to liquefaction on a regional or local active fault in the region. No landslides are mapped on the site. It is not expected that the site could become unstable due to an off-site landslide, lateral spreading, subsidence or collapse, if the project is constructed in accordance with the City of San Diego ordinances and current practices of a reputable geotechnical engineer and engineering geologist.	☐	☐	☒	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property? Expansive soils may be present on the site. The proposed project will not exacerbate potentially expansive soil if constructed in accordance with City of San Diego ordinances.	☐	☐	☐	☒

e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒

Septic tanks or other waste water disposal systems are not anticipated to be a part of the proposed alignment.

A Geotechnical Reconnaissance study (June 4, 2010, Ninyo and Moore) was prepared for the preliminary project design.

VII. GREENHOUSE GAS EMISSIONS: Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☐	☐
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☐	☐

Prepare <u>Greenhouse Gas Analysis</u> to describe impacts of greenhouse gases to the project. Include considerations for excavation operations and traffic impacts that affect temporary and permanent project features. Permanent feature may include reduced length of right turn lane at Prospect St.

VIII. HAZARDS AND HAZARDOUS MATERIALS: Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	☒
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	☒
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☒	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☒

An Initial Site Assessment June 4, 2010, Ninyo & Moore) was prepared for the preliminary design. The unauthorized release case at the gas station located at the east end of the alignment is closed and is presumed an unlikely possibility that contamination will be encountered. Project design specifications must include verbiage in event contamination is encountered and bid items to identify unit rates.

IX. HYDROLOGY AND WATER QUALITY: Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☐	☐
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	☐	☐	☐	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☐	☐	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☐
f) Otherwise substantially degrade water quality?	☐	☐	☐	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☐	☒
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒
j) Inundation by seiche, tsunami, or mudflow	☐	☐	☐	☒

Prepare Water Quality Technical Report and Drainage Study for the project and use to address the items of this section.

Comment: Project is not in 100-yr flood zone. A SWPPP prepared in accordance with City of San Diego requirements is required for construction.

X. LAND USE AND PLANNING: Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Physically divide an established community?	☐	☐	☐	☒
b)Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

Discuss in the CEQA document text. Additional sidewalk from project would bring community together and make alignment more useable. No land use change in right of way; possible acquisition of private property would change property land use. Project consistent with La Jolla Community Plan and Torrey Pines Corridor Study (October 2007). Project is over 100 feet from beach therefore Coastal Bluff Requirements not applicable. Bio report to review if habitat or community conservation plan affects project

XI. MINERAL RESOURCES: Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒

This section "Not Applicable" to the project.

XII. NOISE: Would the project result in:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☐	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☐
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☐
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☐
) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☐

Prepare Noise Report to identify whether mitigation for impacts is required.

Comment: construction equipment generates significant noise; determine construction work hours and other mitigation to meet City of San Diego requirements. Possible permanent impact from reduction of right turn length at Prospect St intersection.

XIII. POPULATION AND HOUSING: Would the project:

a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

No impact to housing by project

XIV. PUBLIC SERVICES:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:	☐	☐	☐	☐
Fire protection?	☐	☐	☐	☐
Police protection?	☐	☐	☐	☐
Schools?	☐	☐	☐	☐
Parks?	☐	☐	☐	☐
Other public facilities?	☐	☐	☐	☐

Discuss in CEQA document. Temporary impact during construction.

Comment: Fire stations 9 and 13 are located on either side of the project. Construction may delay response by obstructing access; however project phasing would influence these temporary impacts. This applies to police, school and park access. Emergency lane in middle of alignment is proposed to remain after construction.

XV. RECREATION:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒

No impacts or additional parks in current project.

XVI. TRANSPORTATION/TRAFFIC: Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	☐	☐	☐	☐
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	☐	☐	☐	☐
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that result in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
e) Result in inadequate emergency access?	☐	☒	☐	☐
f) Conflict with adopted policies, plans or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	☐	☐	☐	☒

Prepare <u>Updated Traffic Study</u>. Traffic impacts are temporary impacts to be mitigated with detours and other traffic control features during construction, designed in accordance with City of San Diego traffic control guidelines, with exception of shortening right turn lane on Torrey Pines Road at Prospect St. Existing and new bicycle lanes are consistent with the 2010 Draft Bicycle Master Plan update.

XVII. UTILITIES AND SERVICE SYSTEMS: Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☒	☐
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☒
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	☒
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☒

Improved stormwater facilities will be designed at intersection with Hillside Drive because of revised road profile. Design will be in accordance with City of San Diego Drainage Guidelines,

XVIII. MANDATORY FINDINGS OF SIGNIFICANCE

a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☐	☐	☐
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☐	☐

Too soon to determine

APPENDIX L

PICTURE PACKAGE

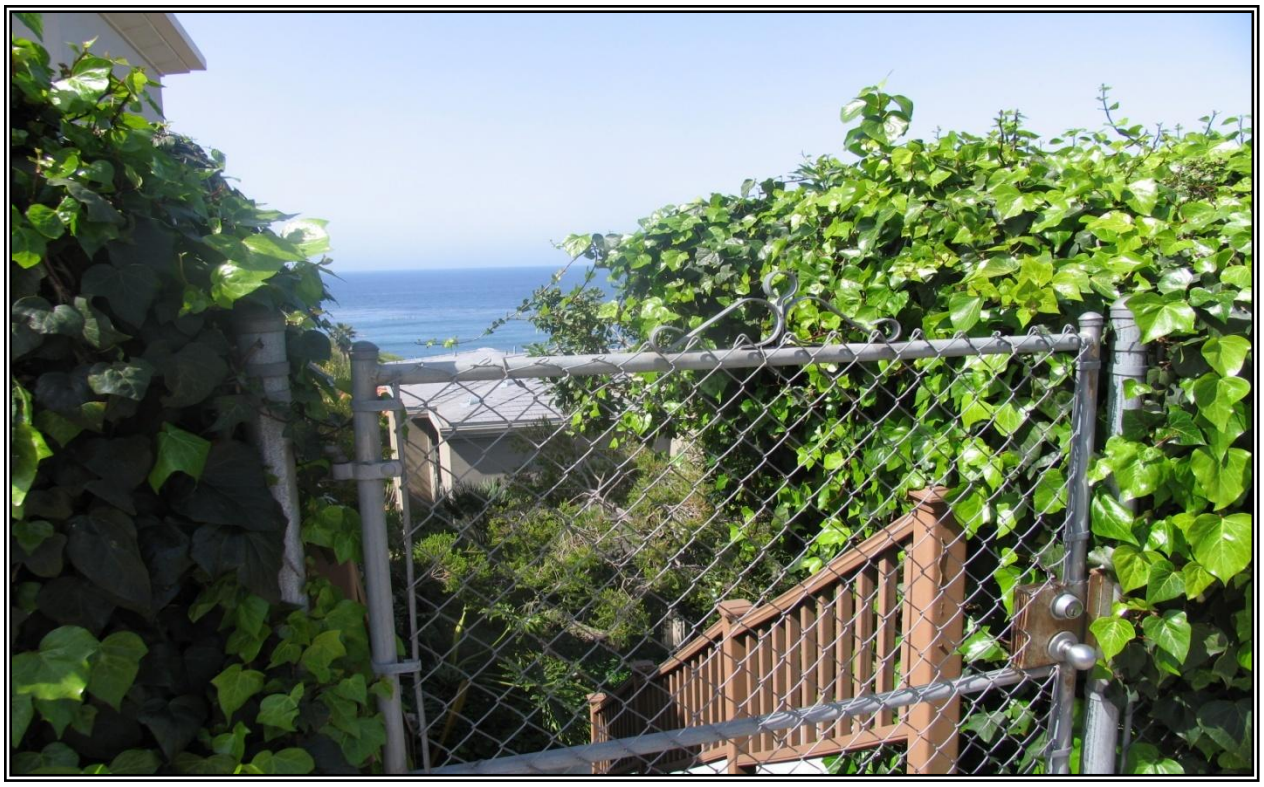
TORREY PINES PRELIMINARY ENGINEERING

PICTURE PACKAGE

By

TRAN CONSULTING ENGINEERS

JANUARY 2011



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Picture 1333

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Picture 1339

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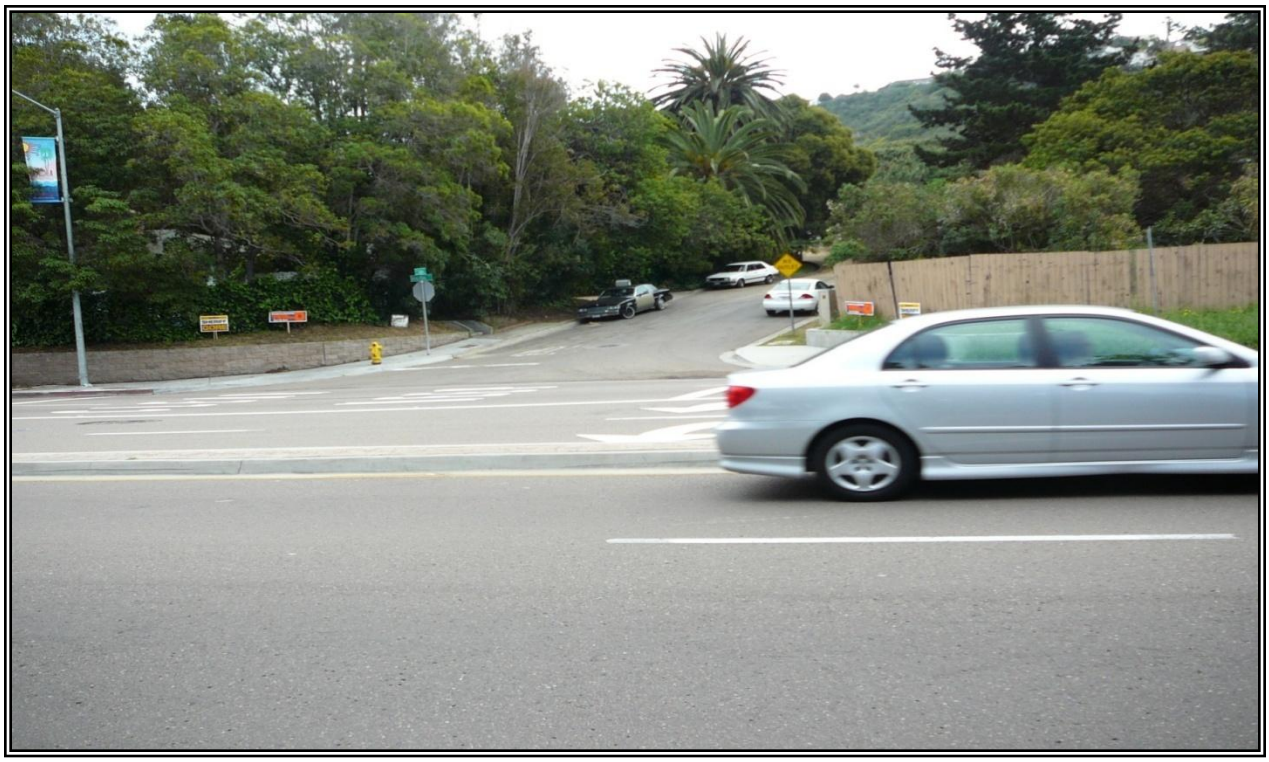

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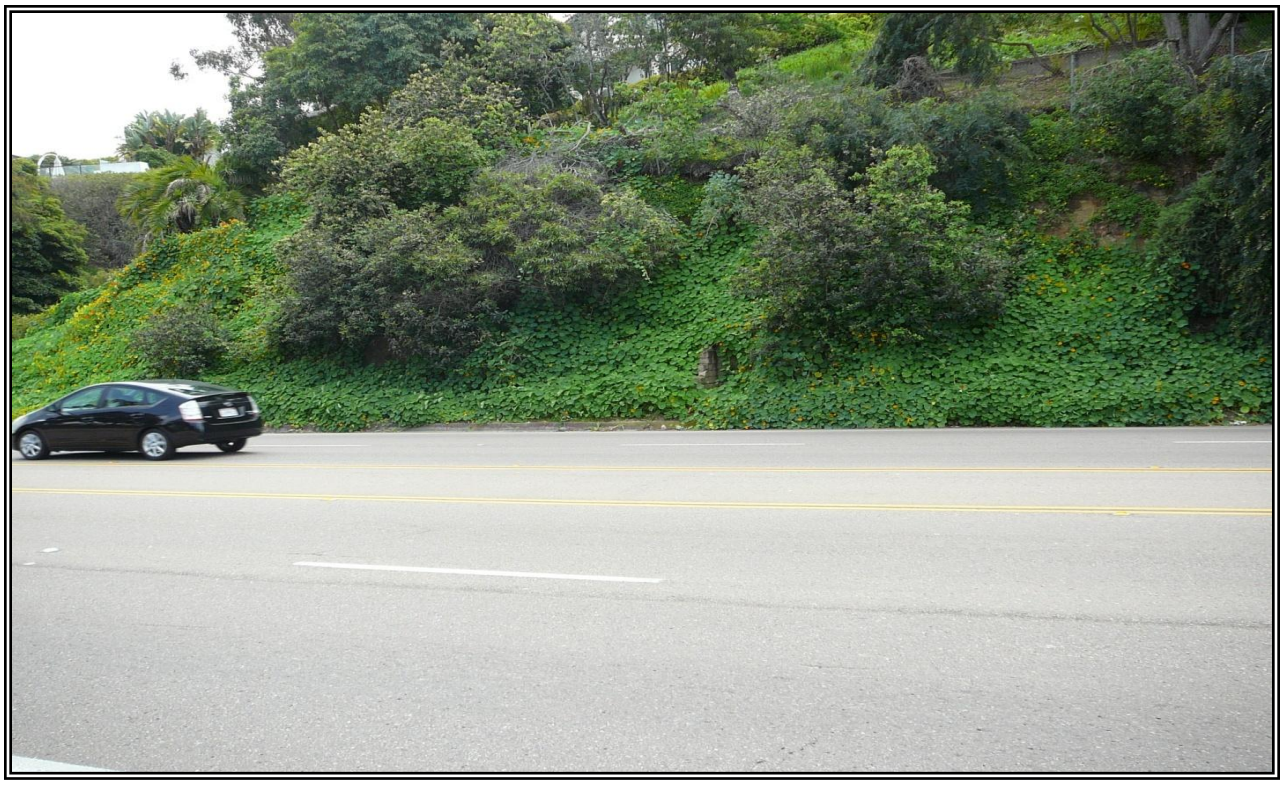

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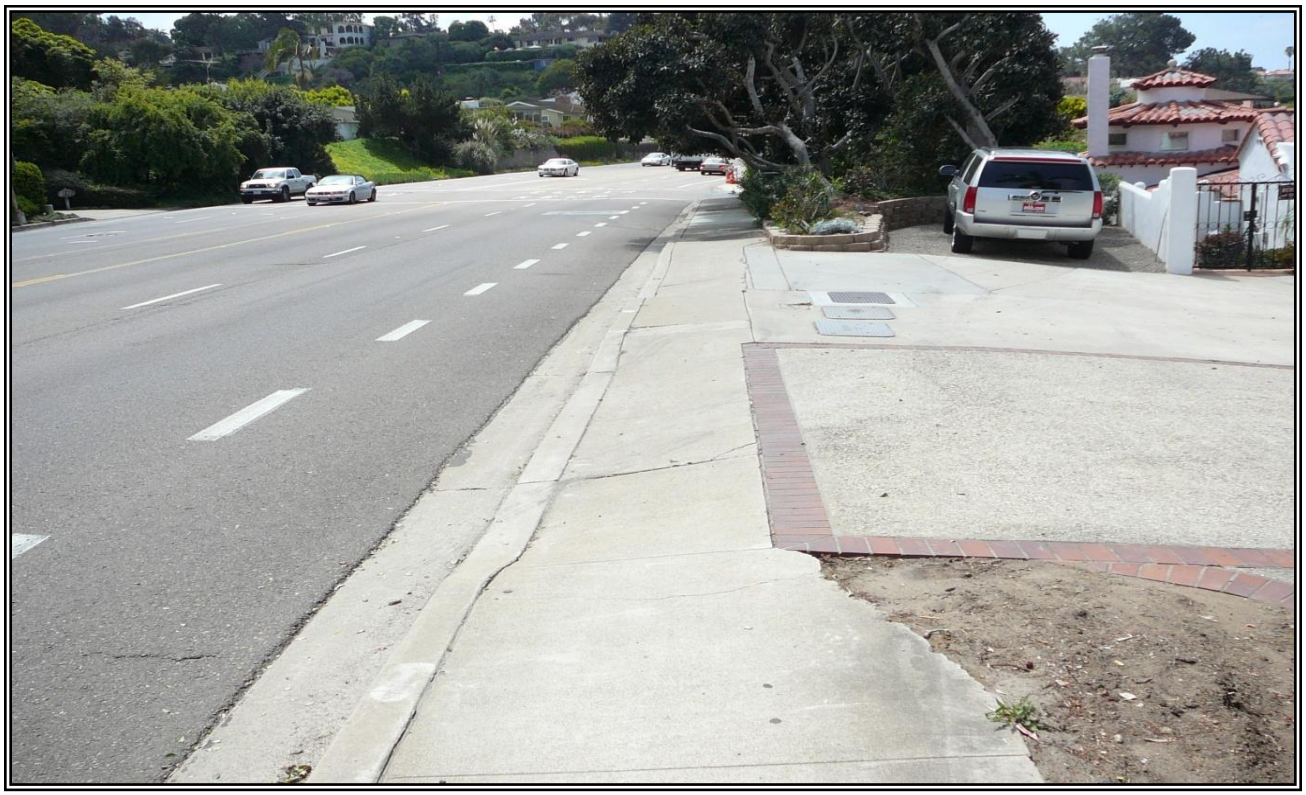

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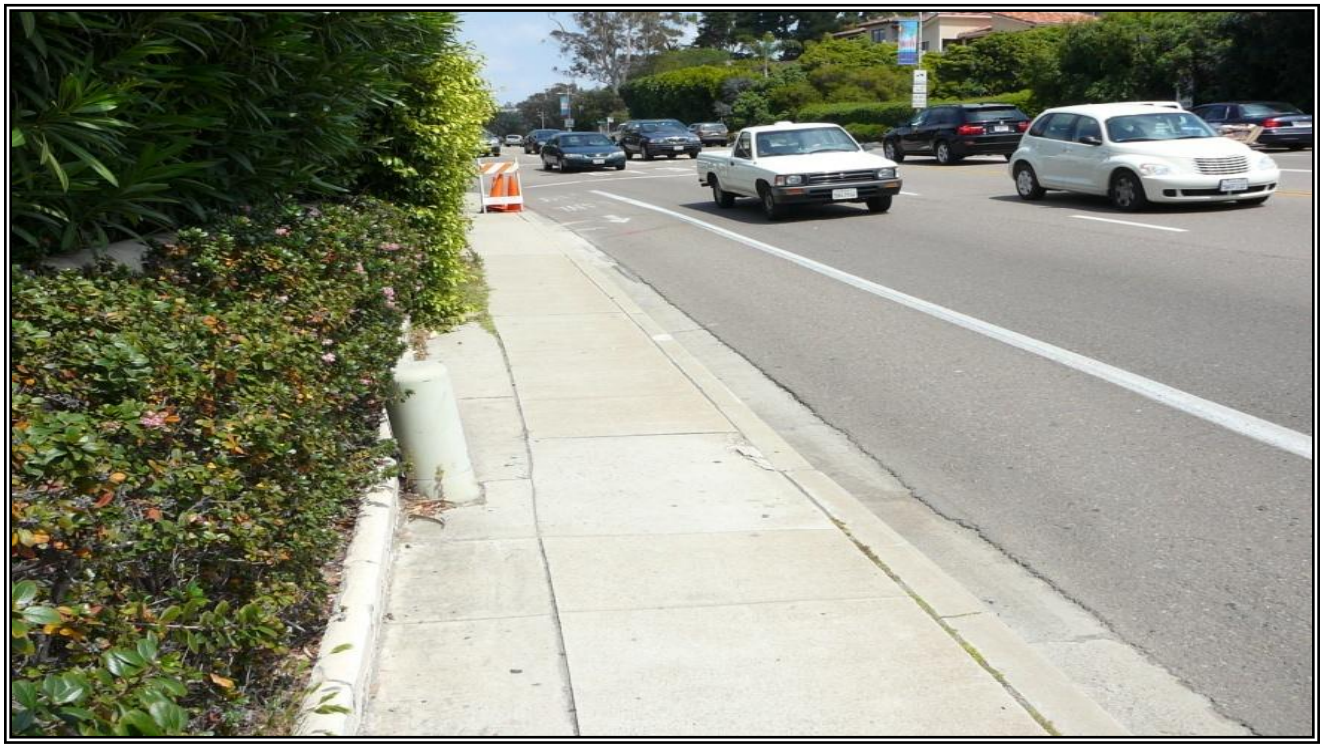

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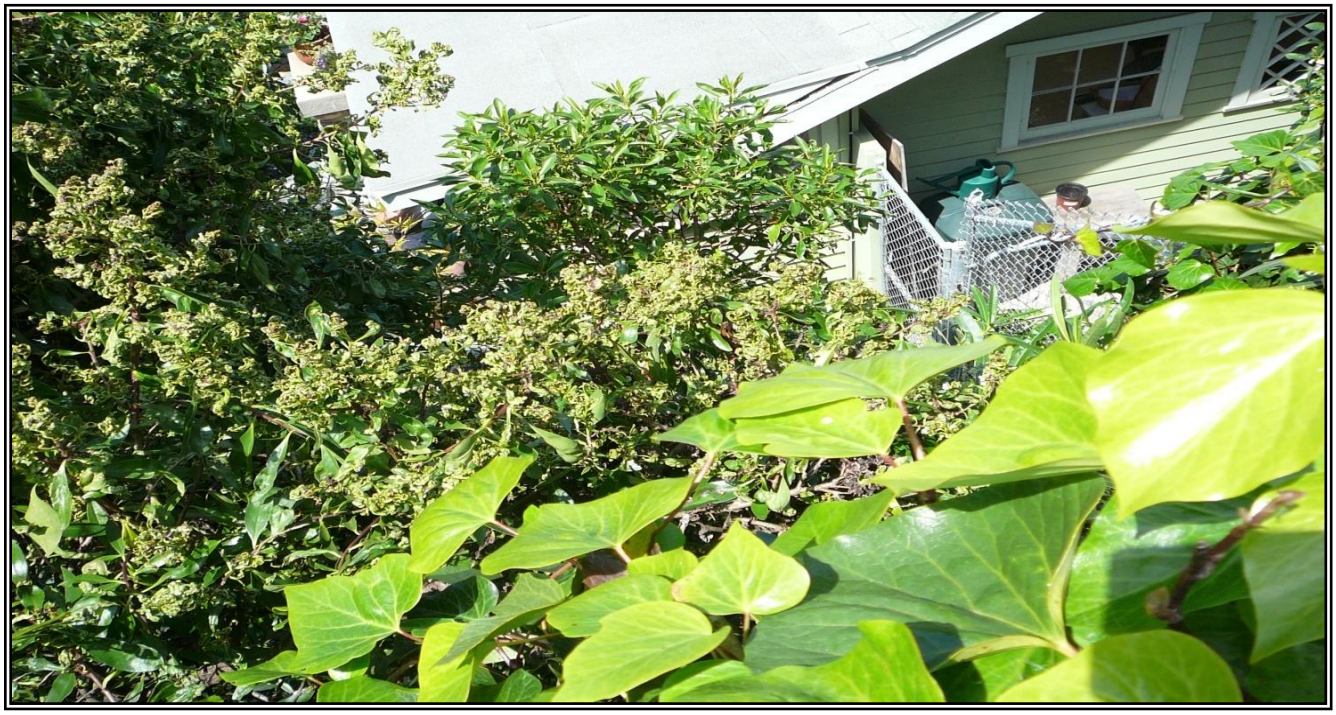

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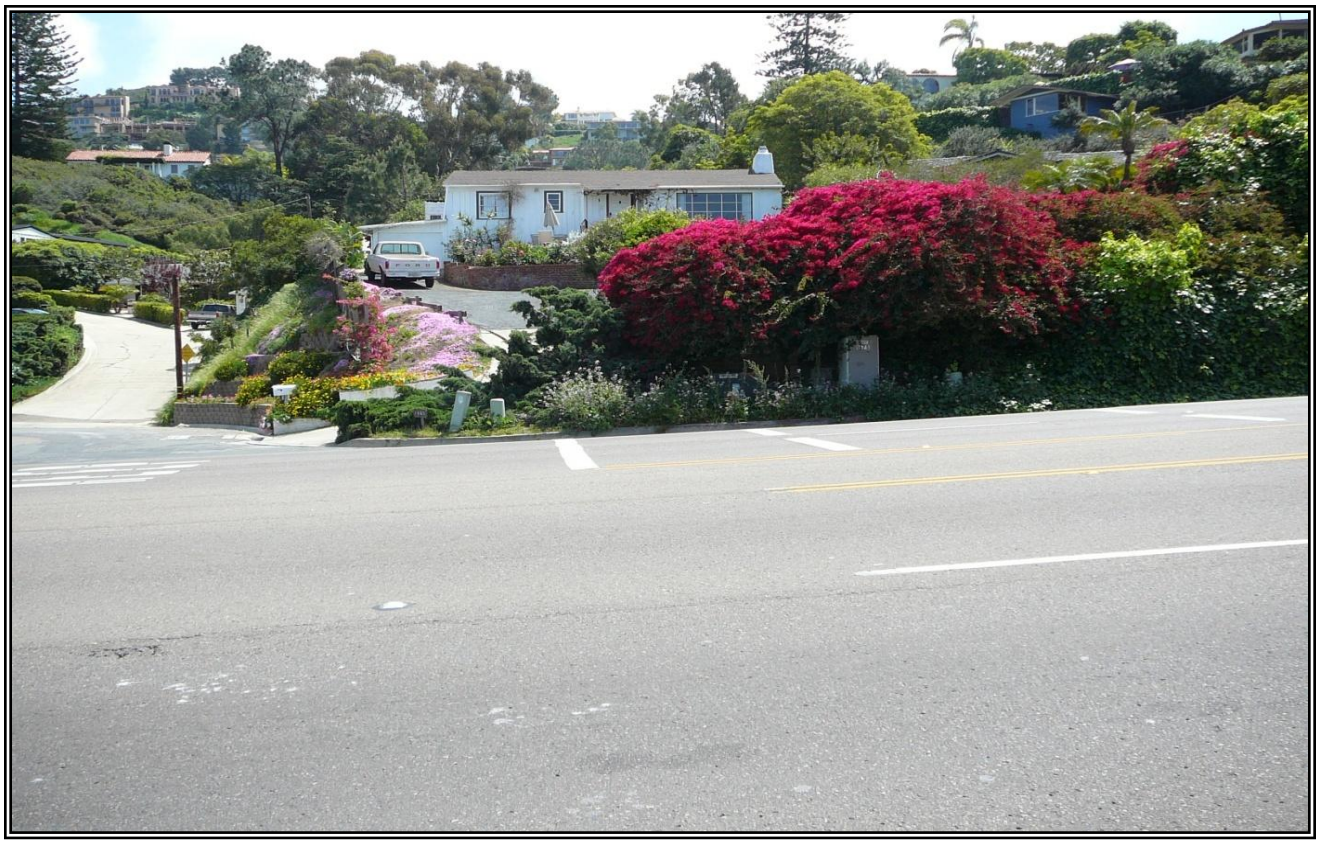

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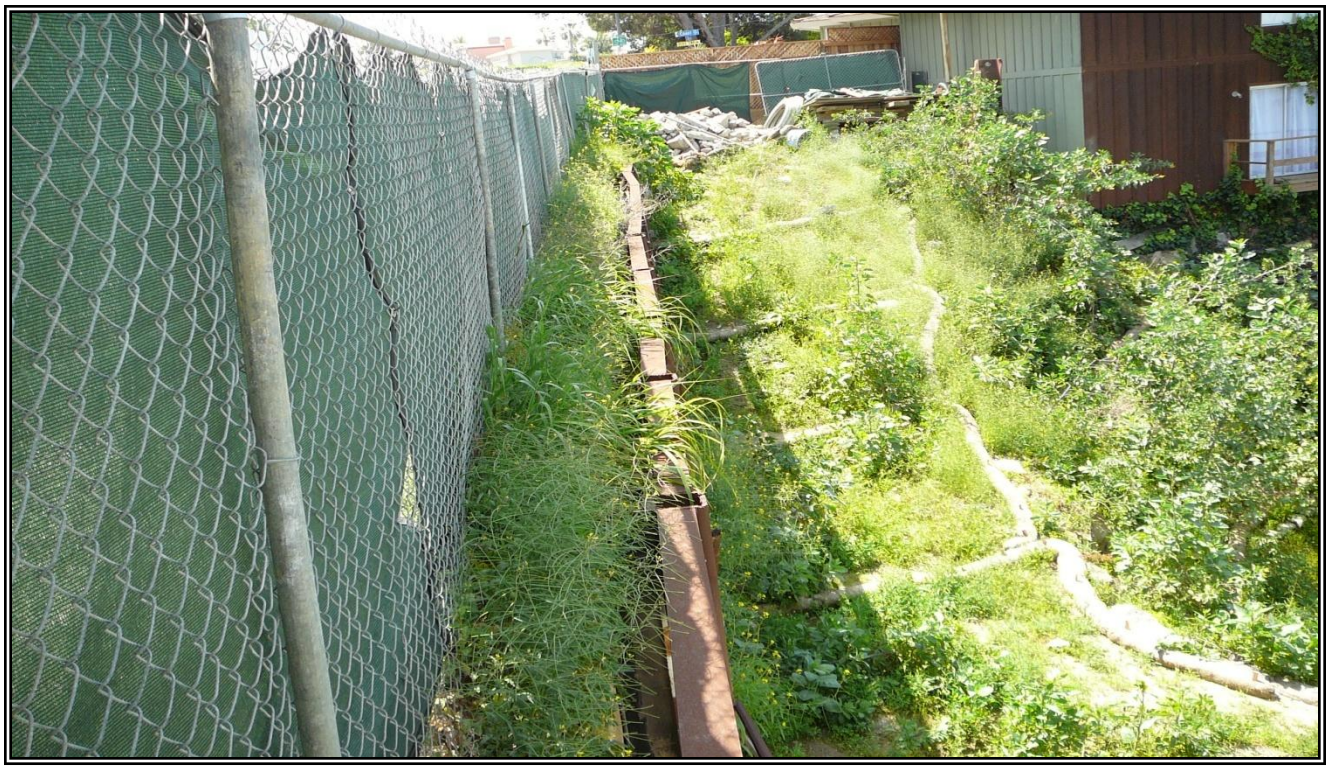

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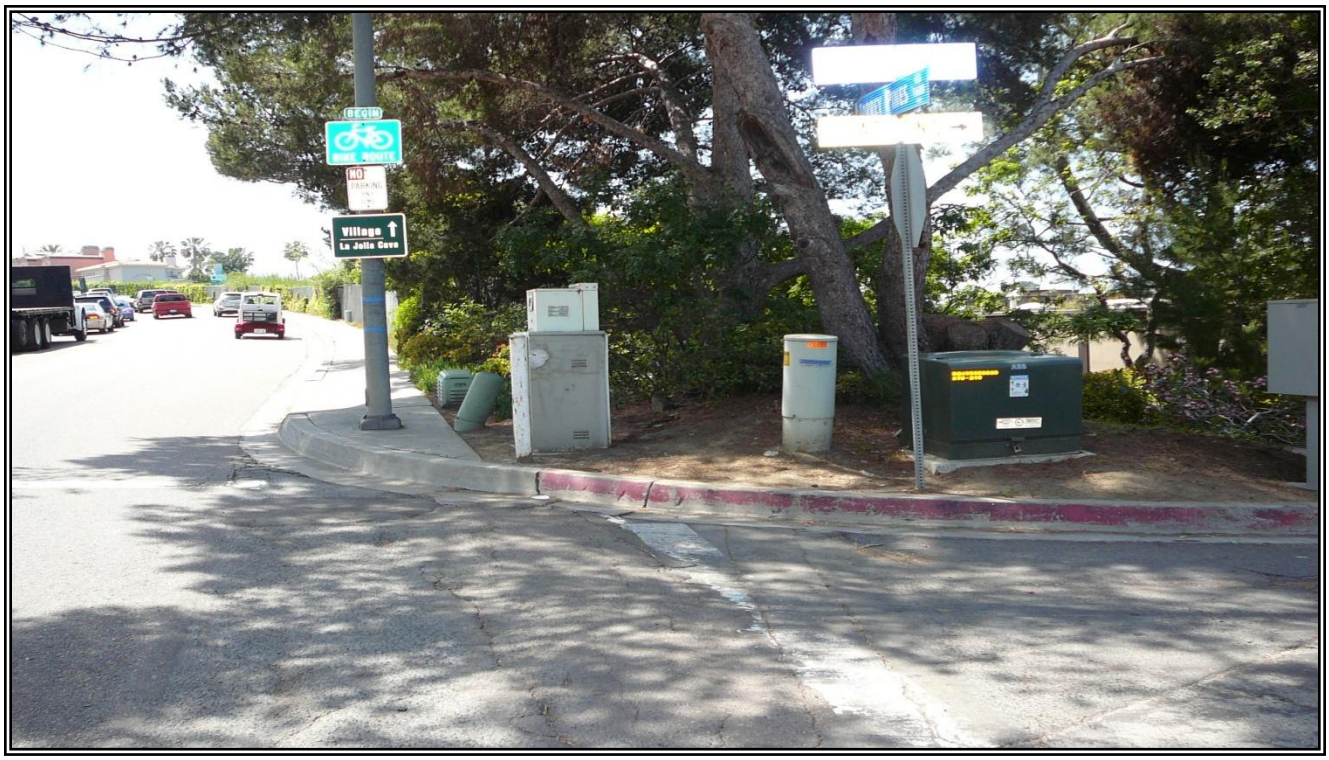

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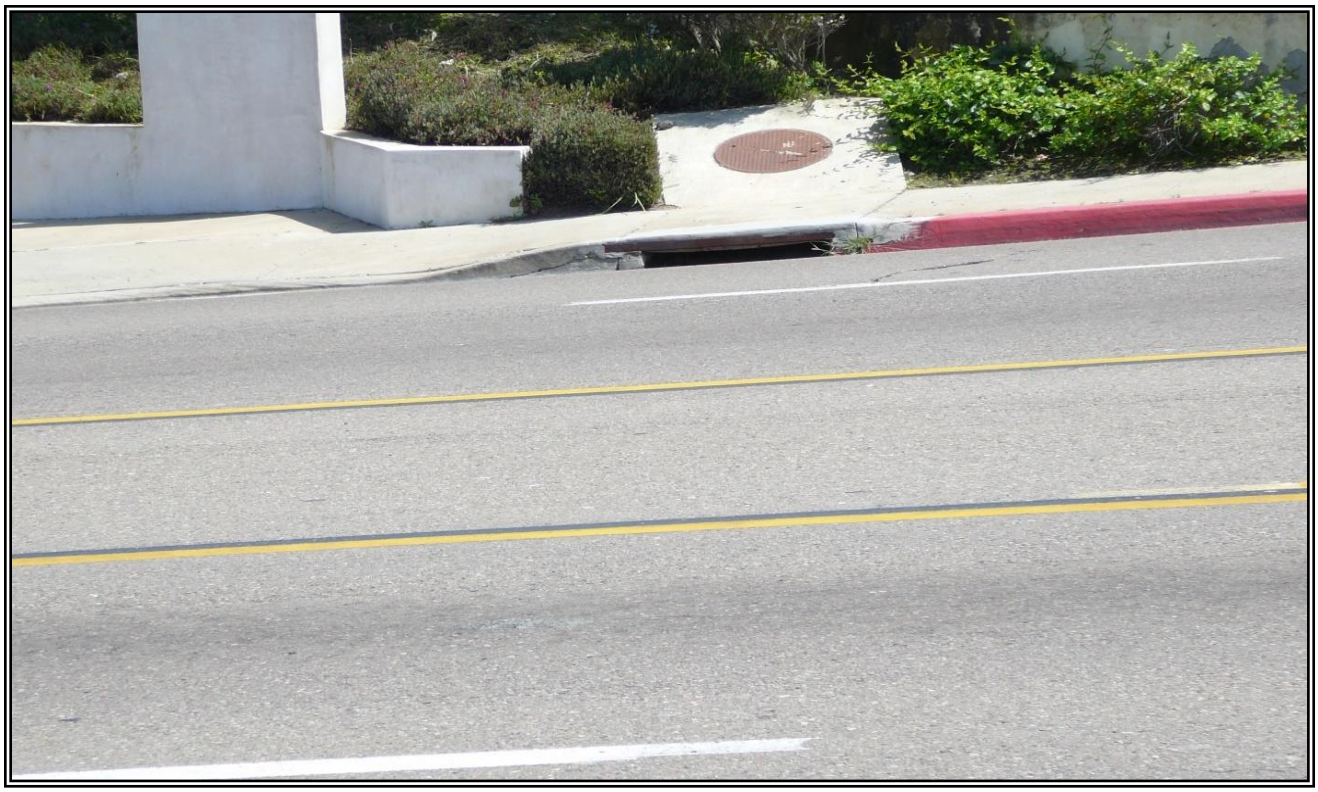

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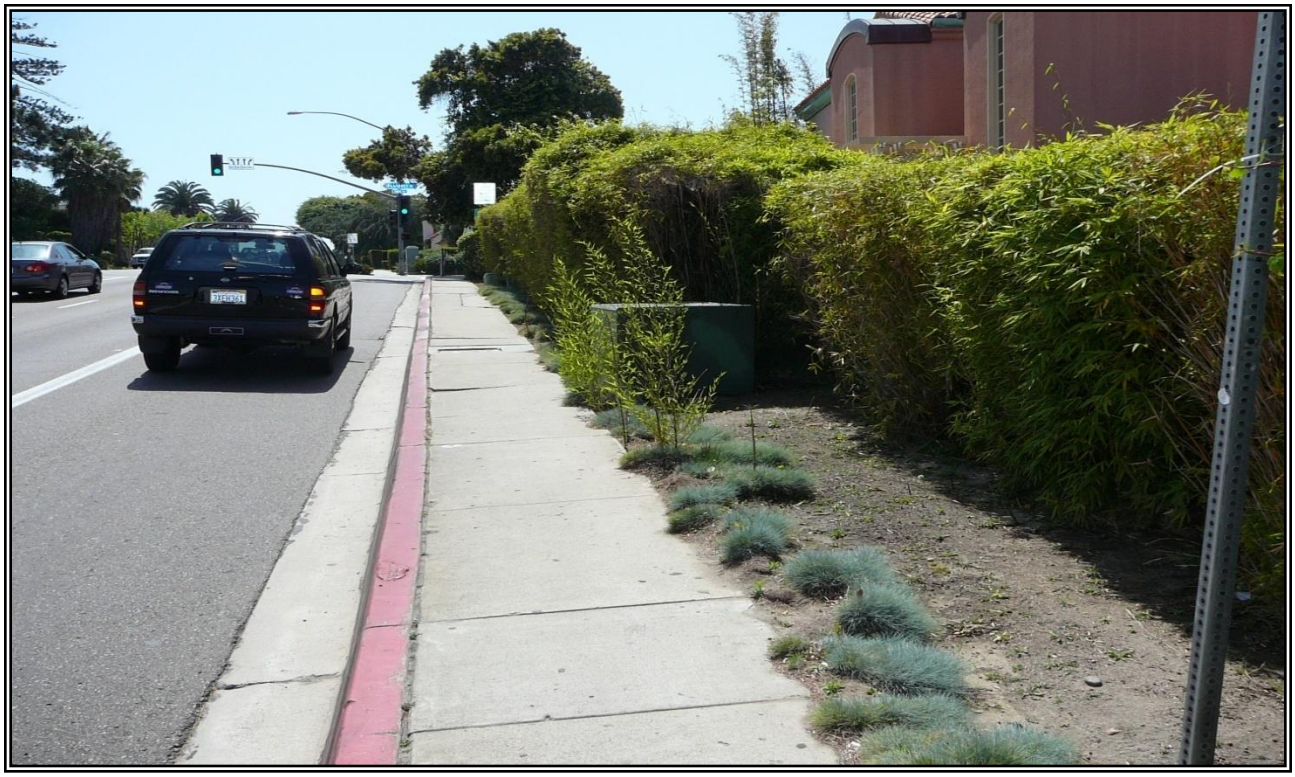

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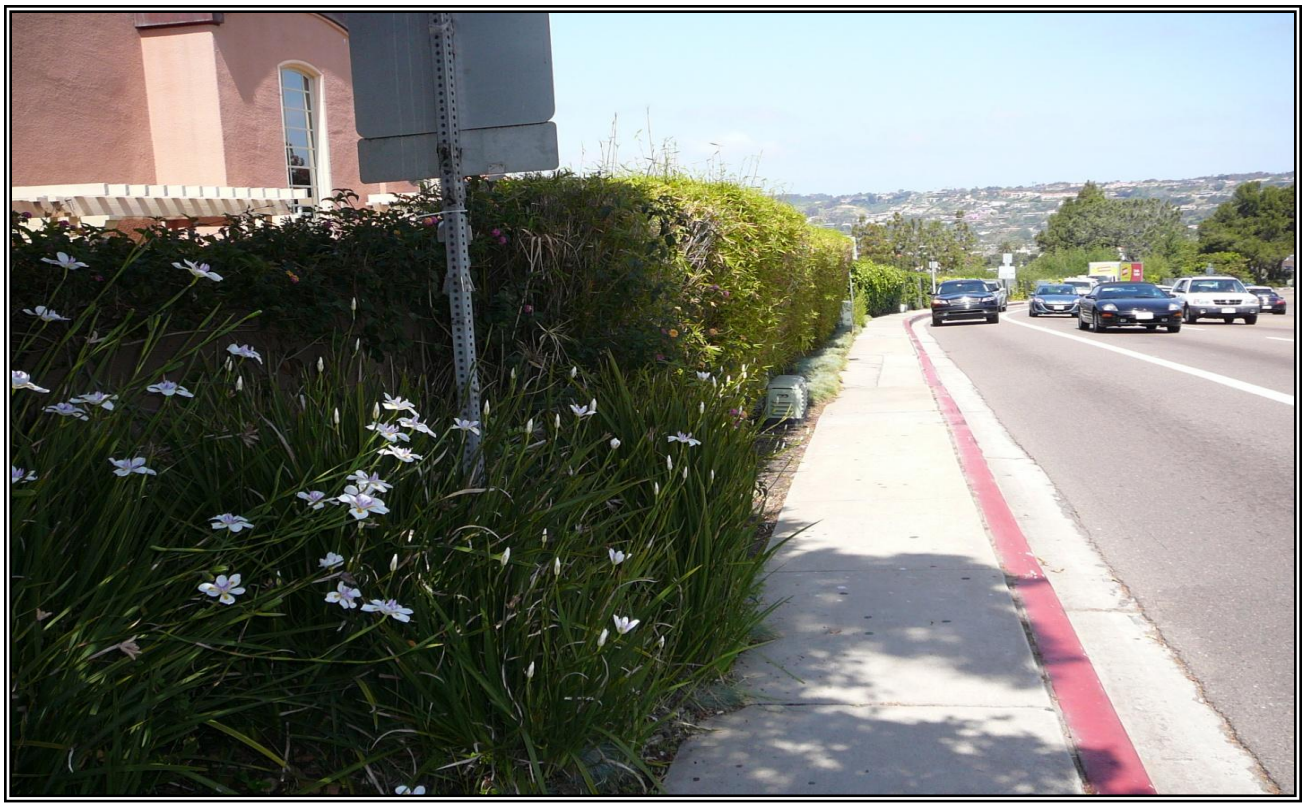

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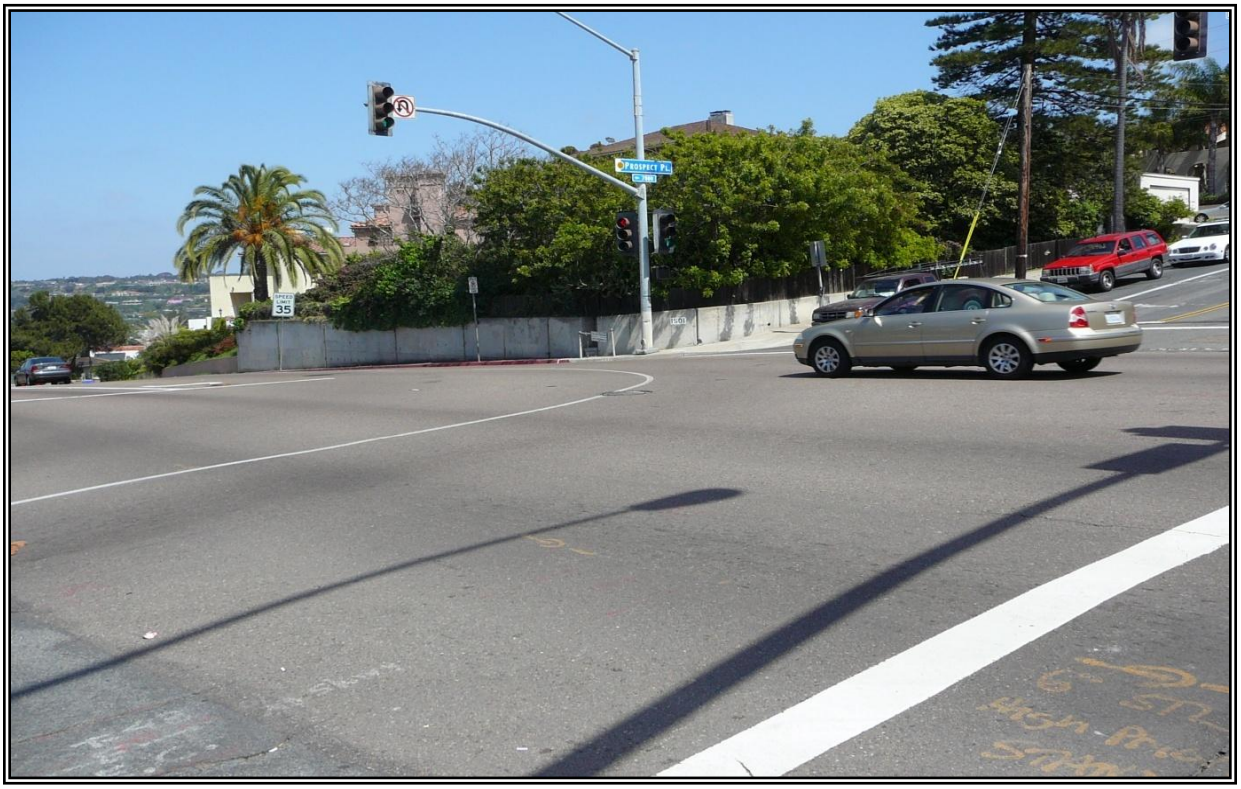

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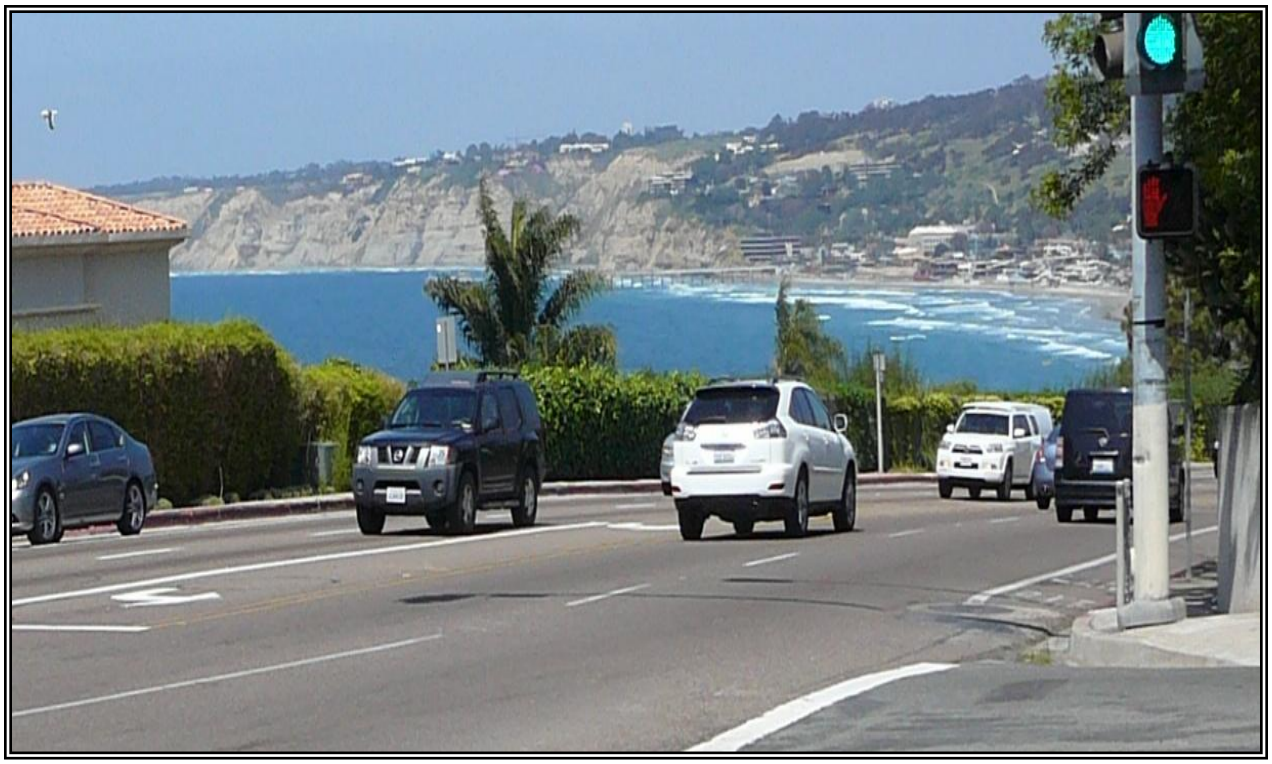

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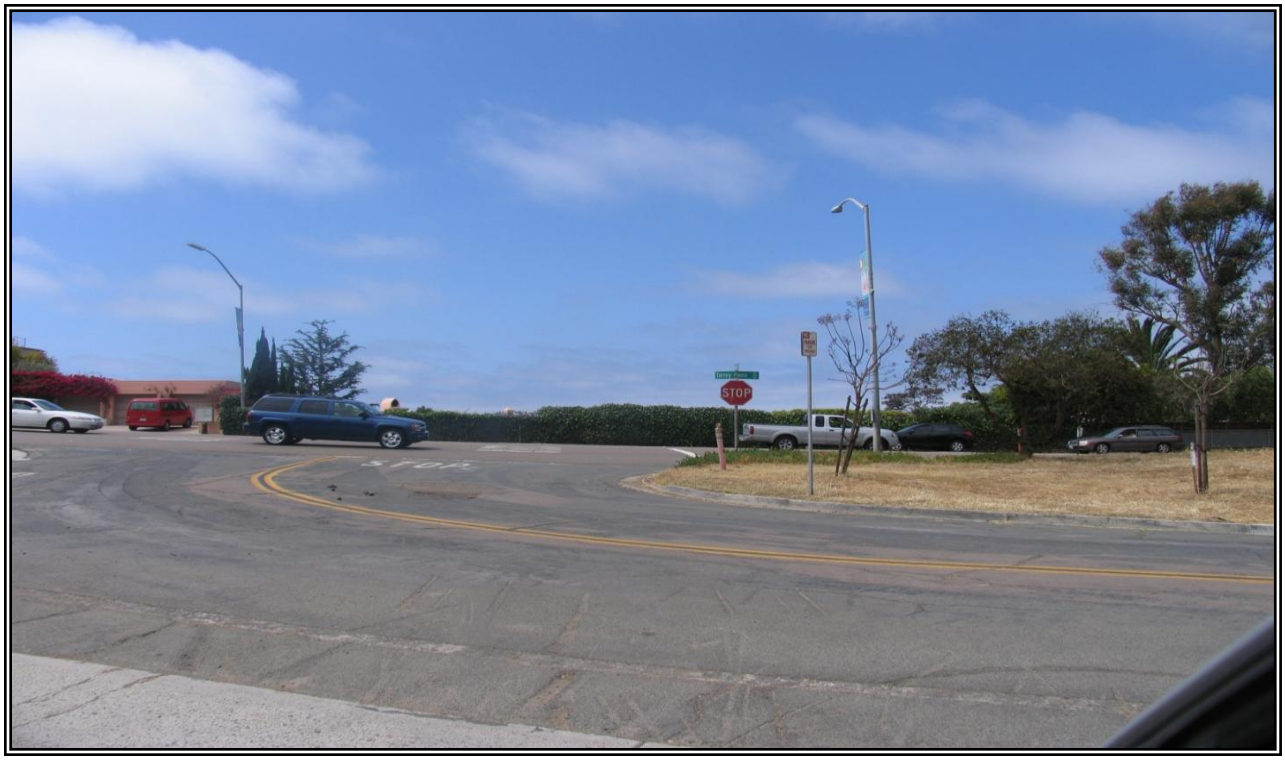

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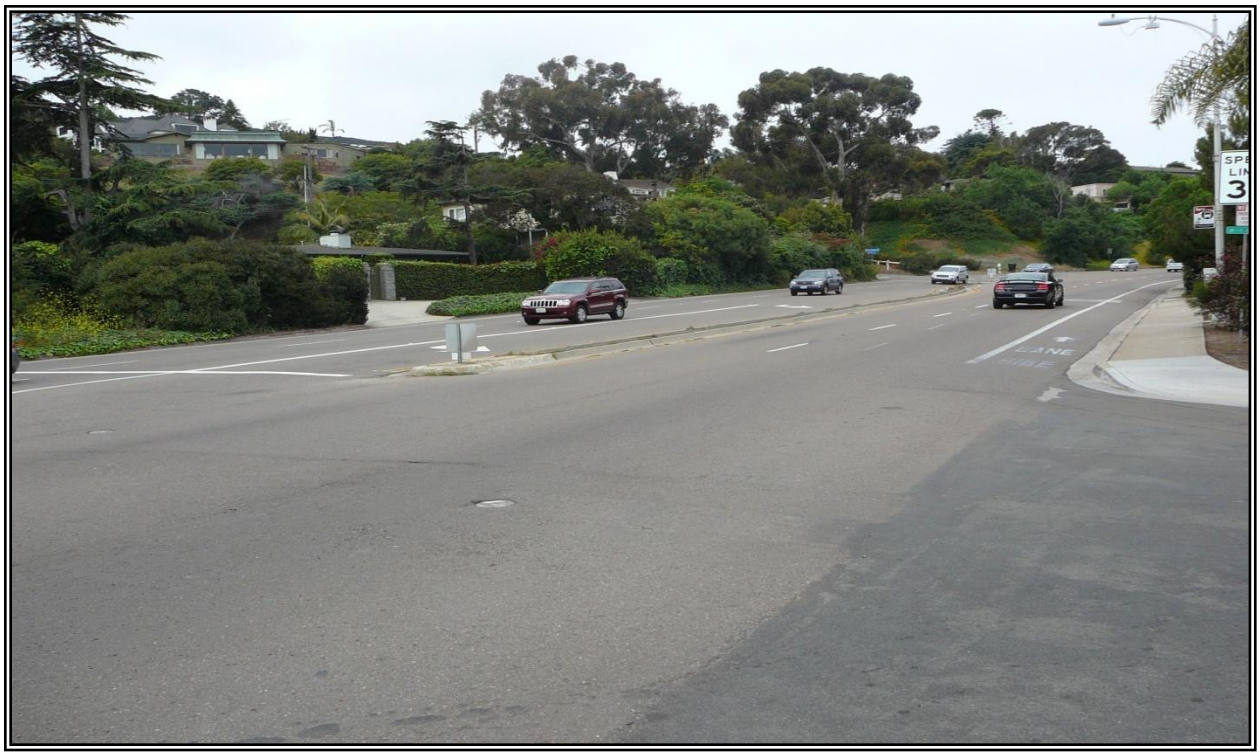

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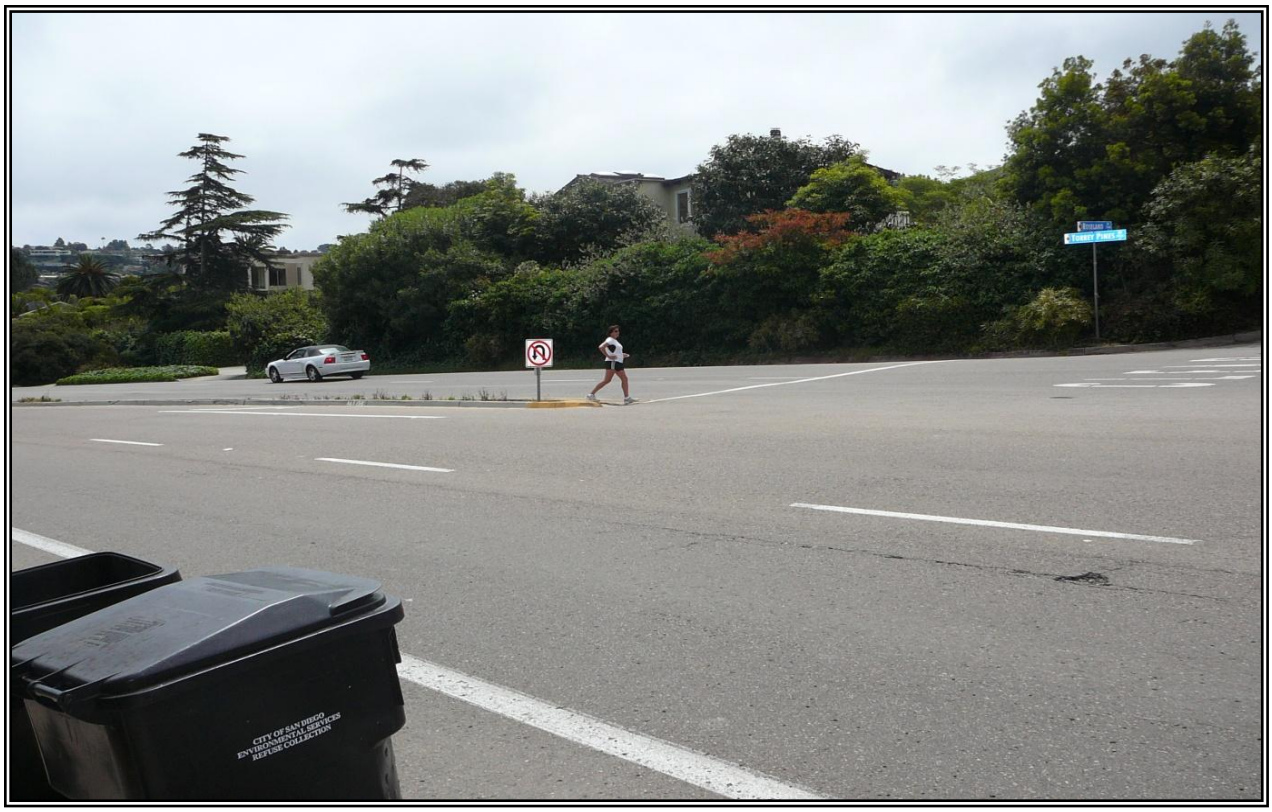

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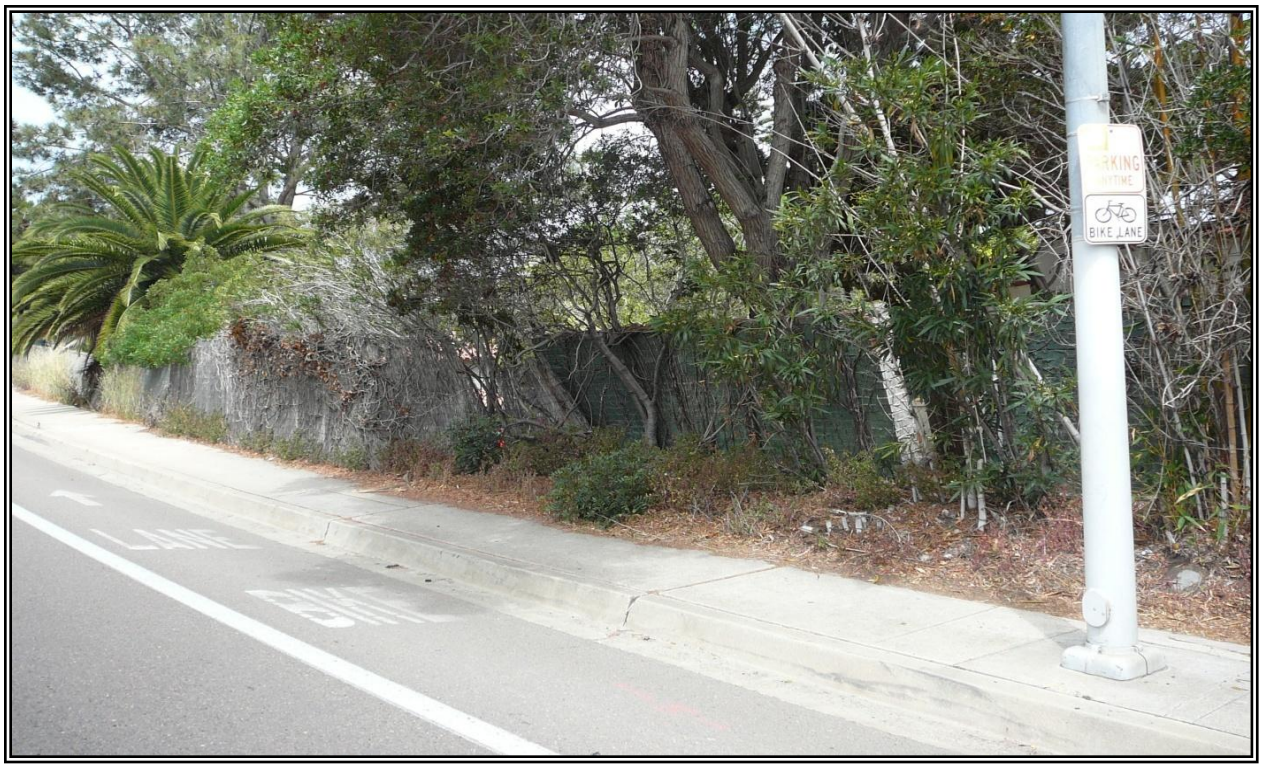

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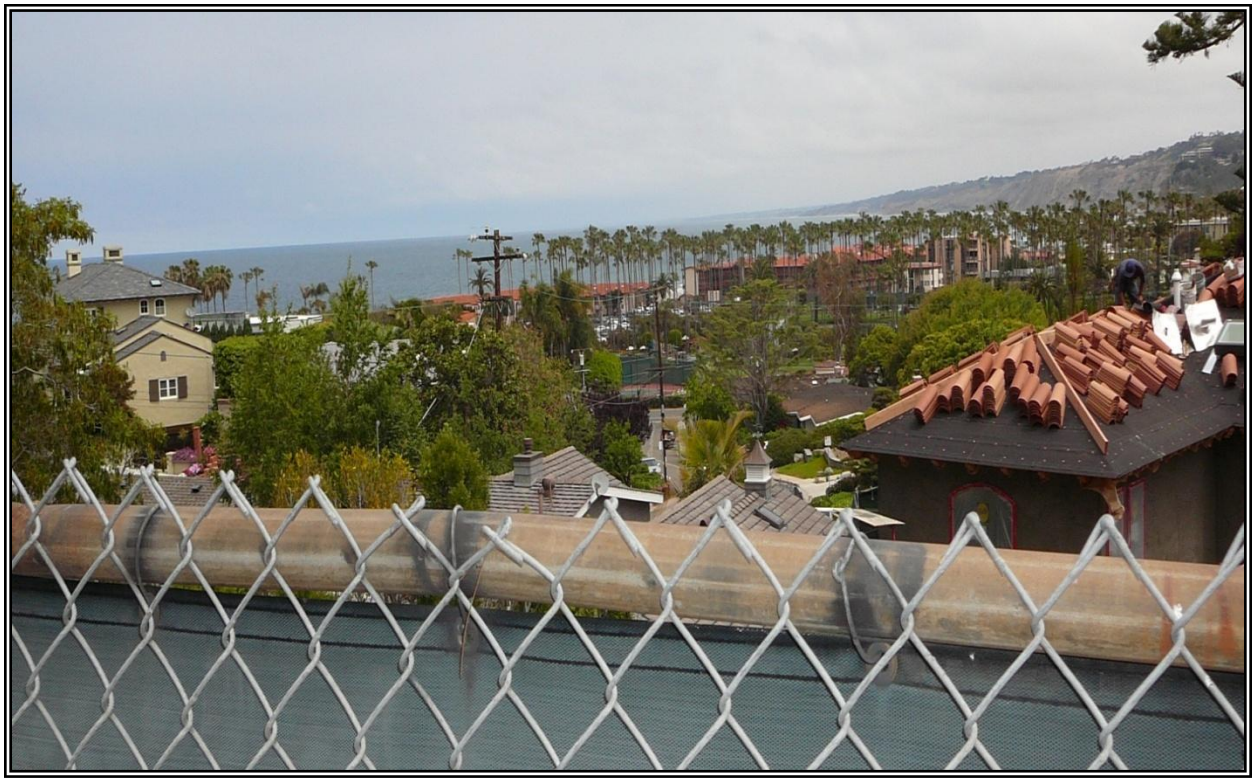

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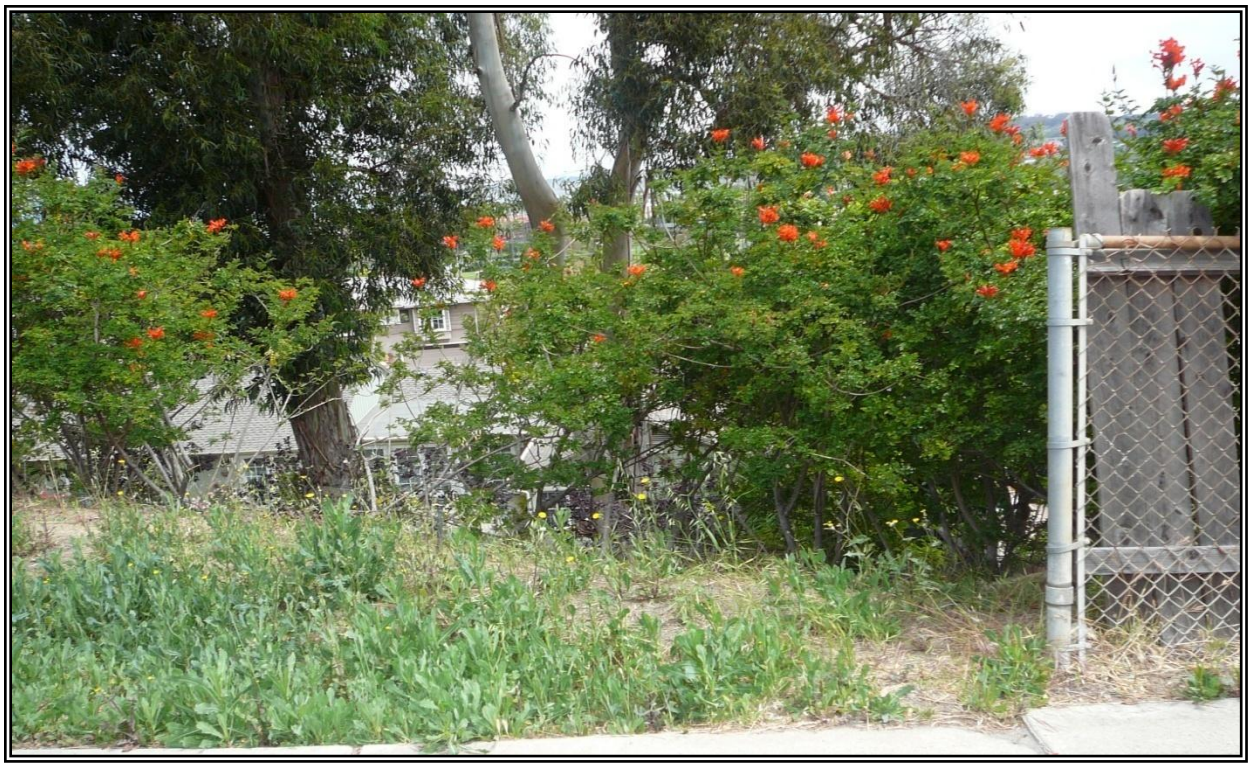

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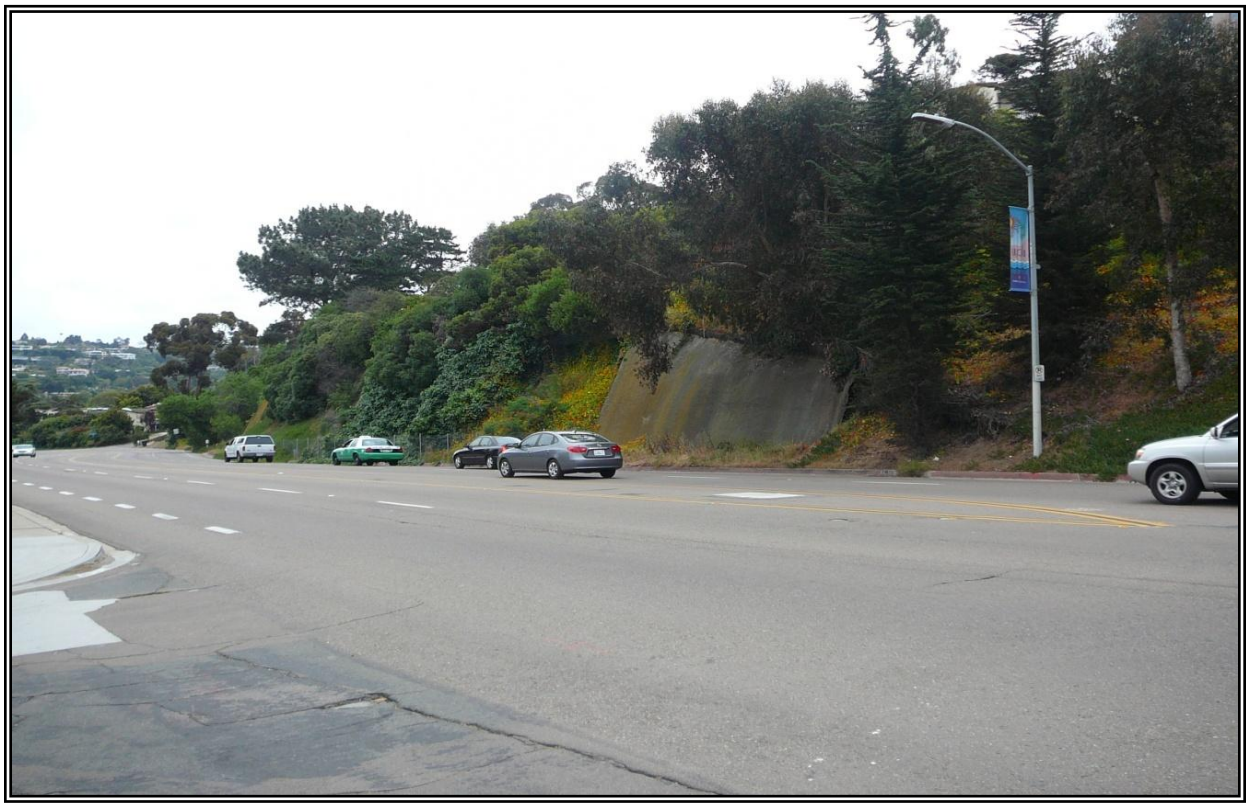

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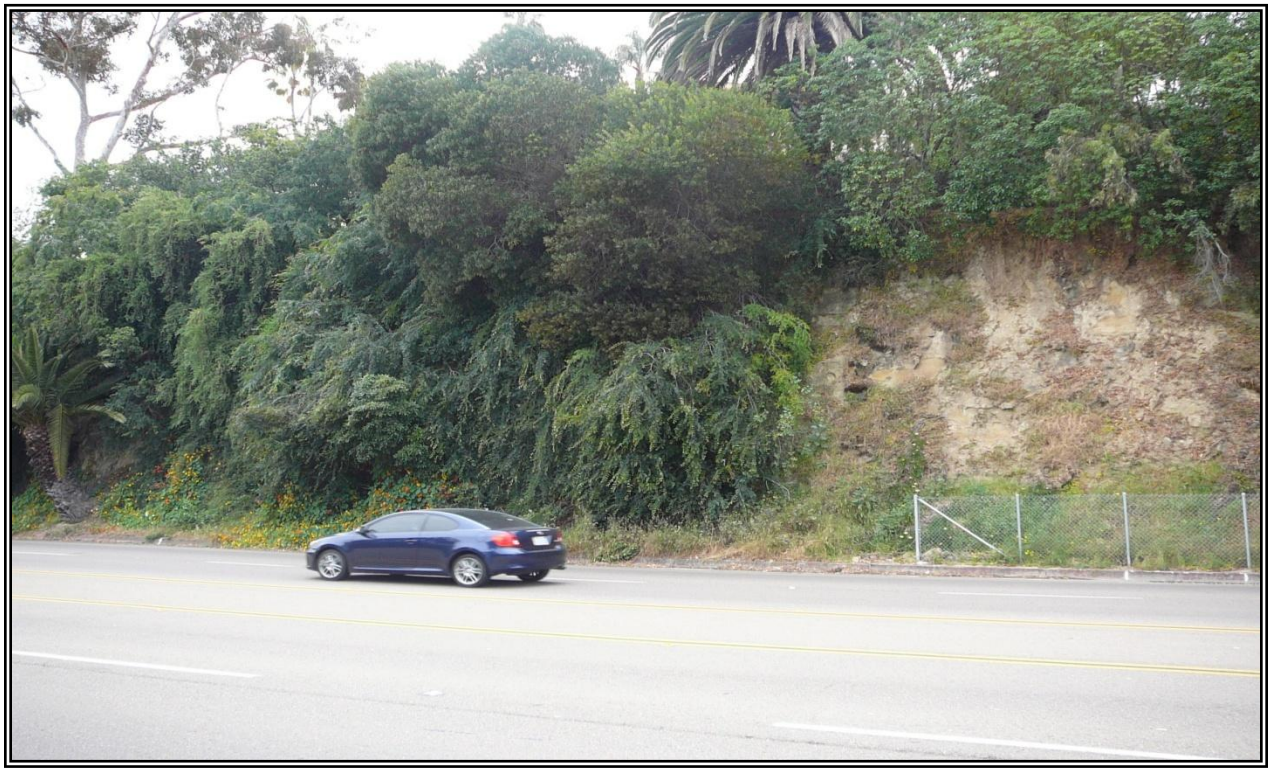

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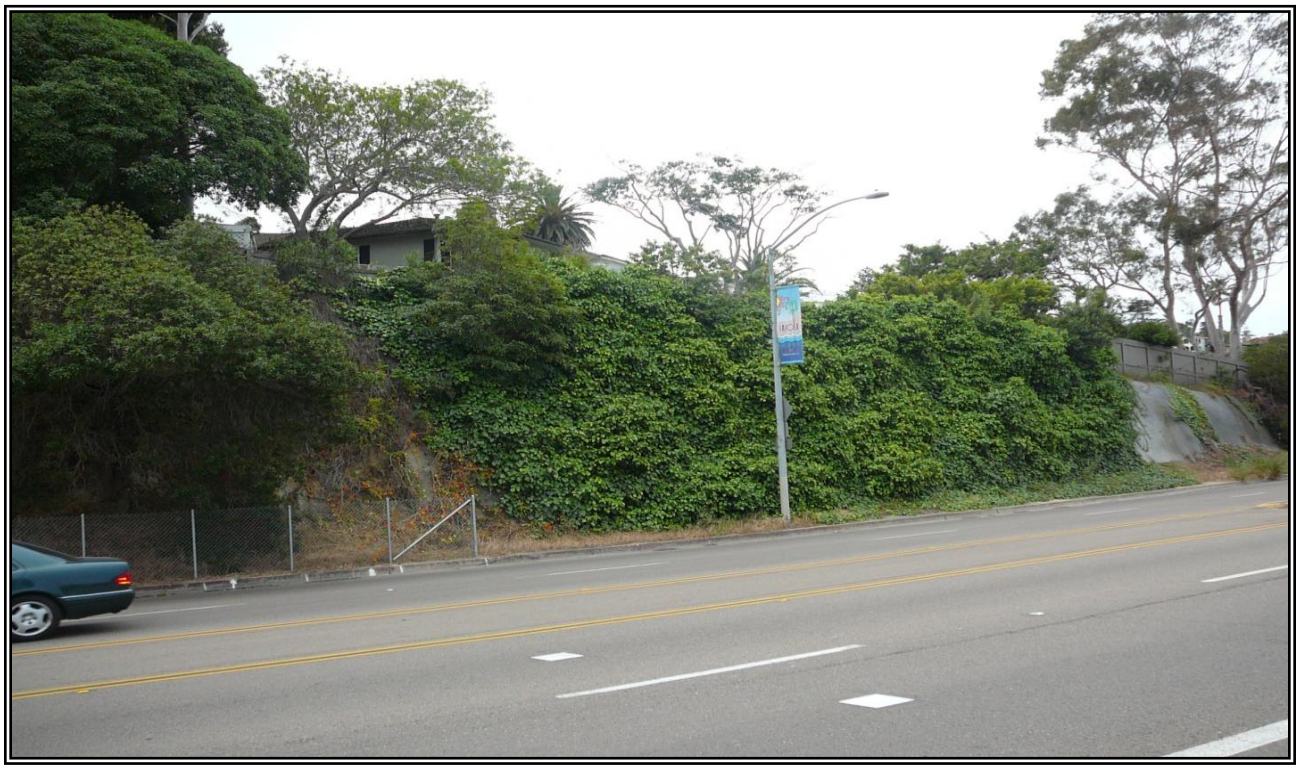

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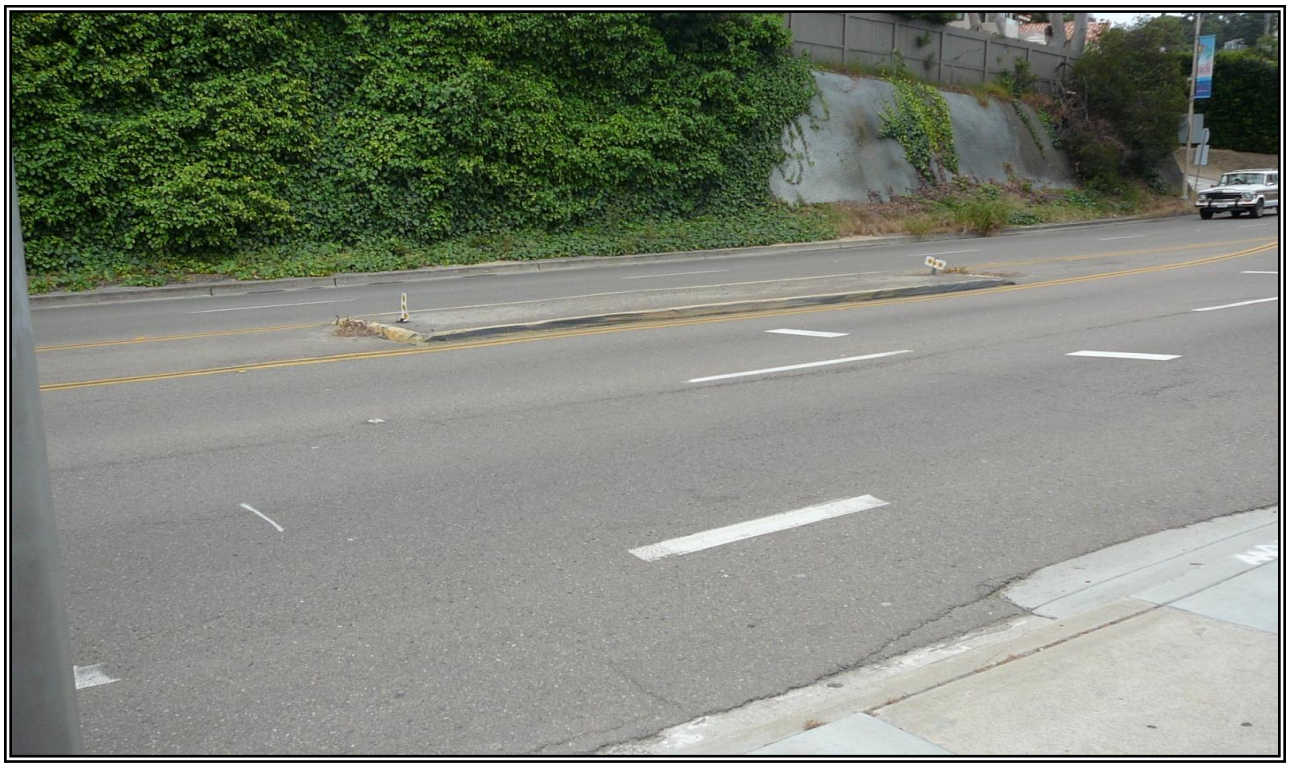

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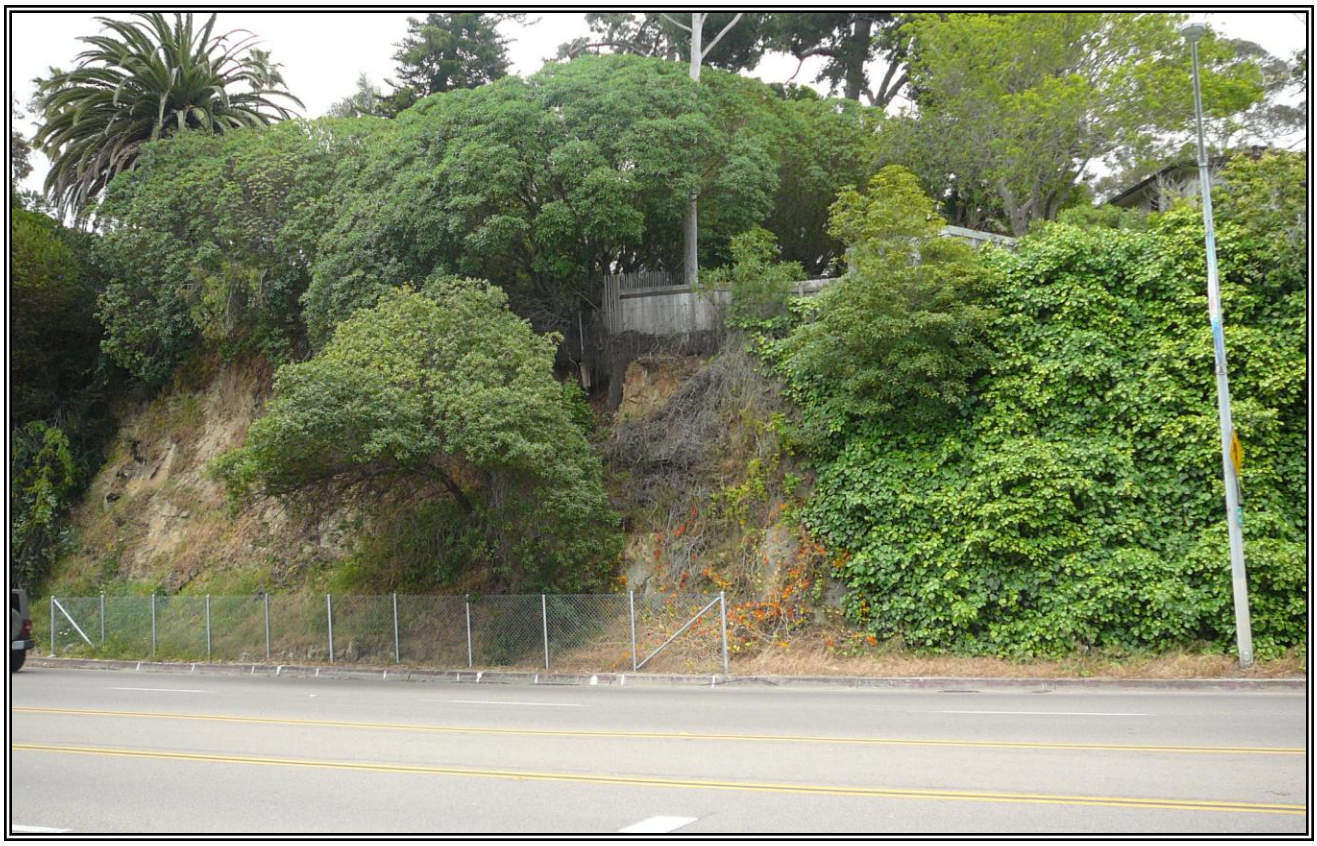

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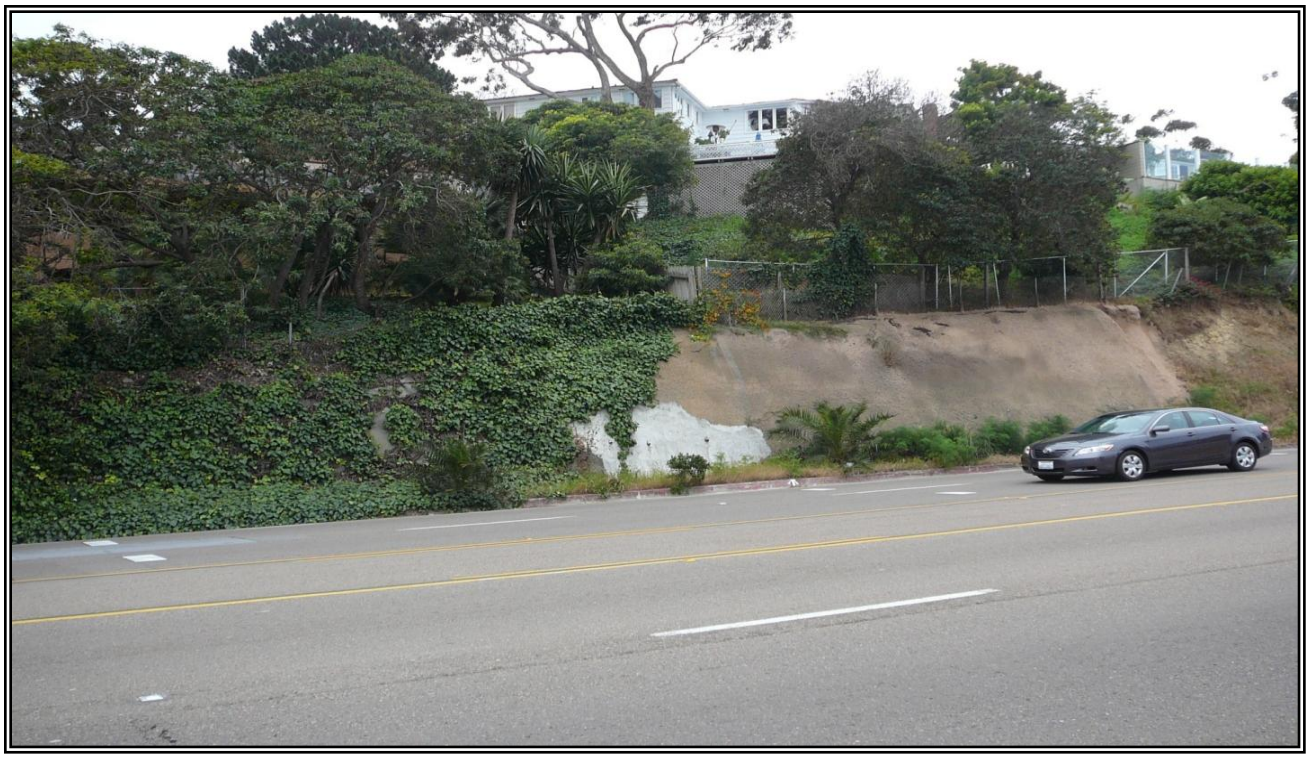

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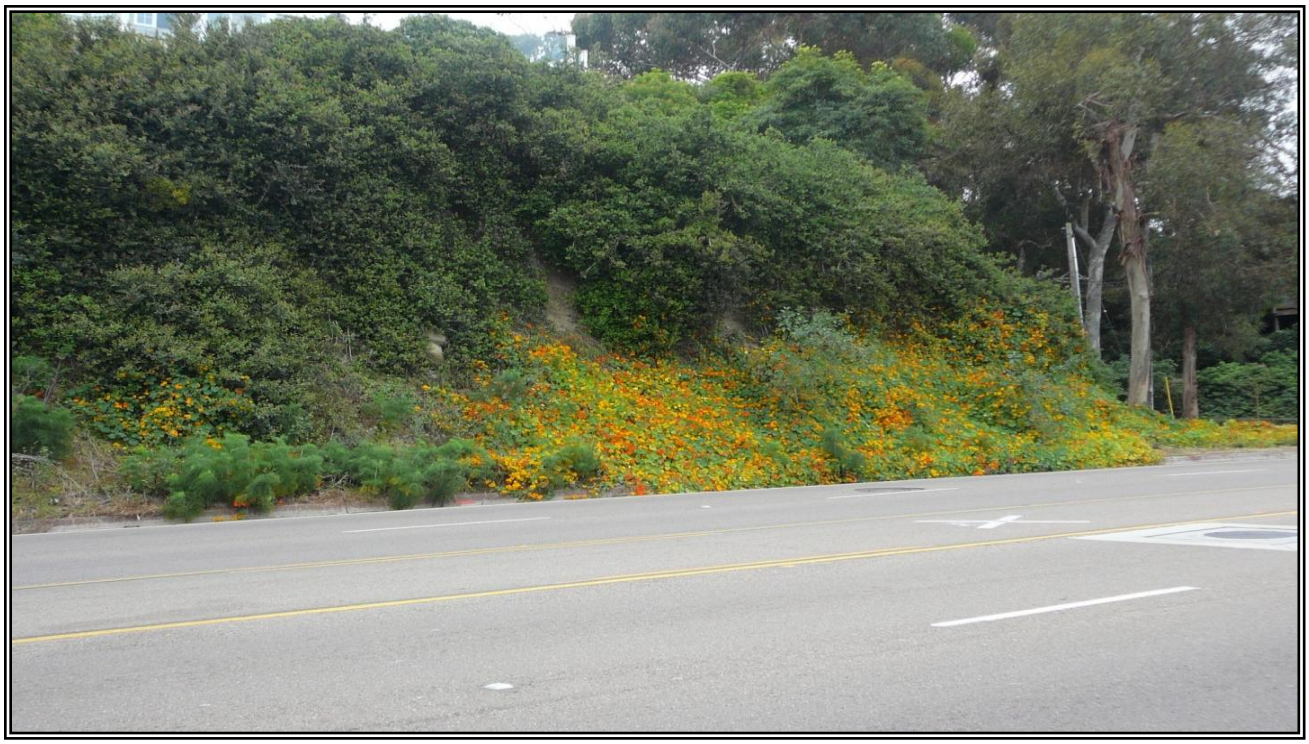

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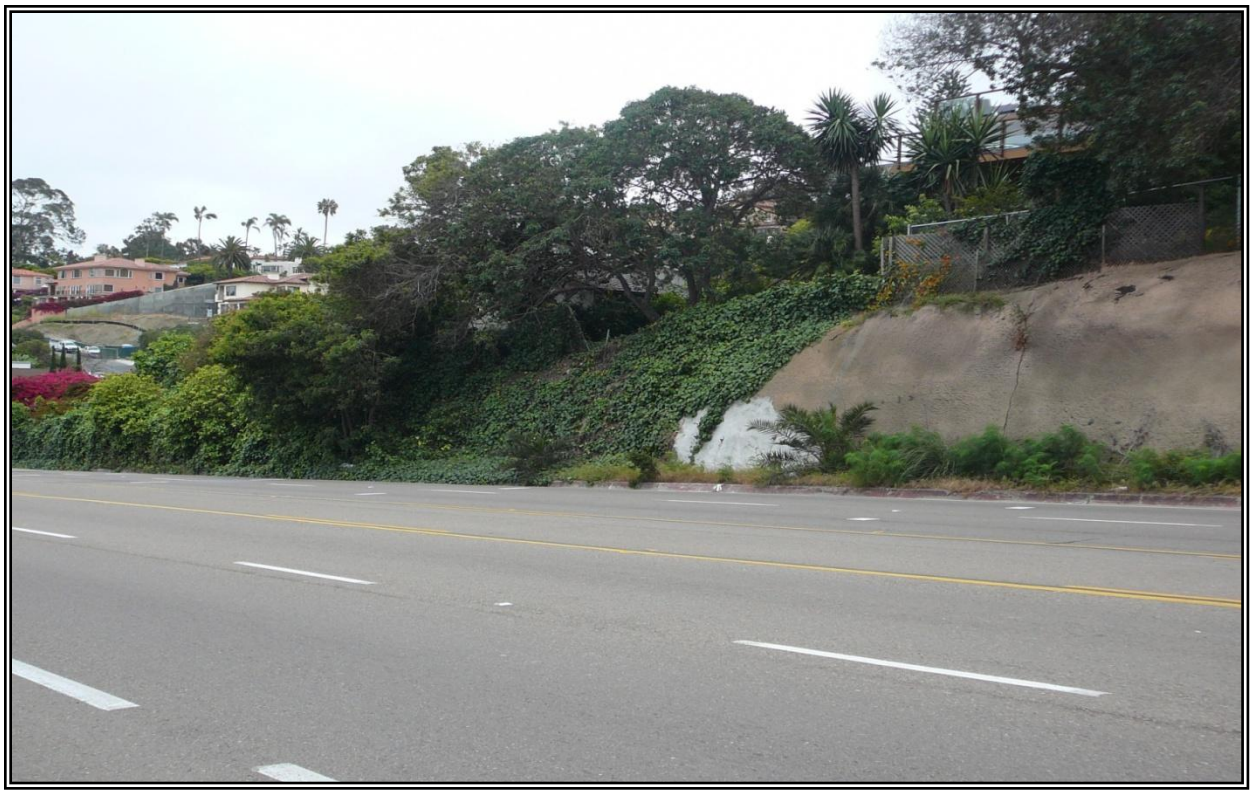

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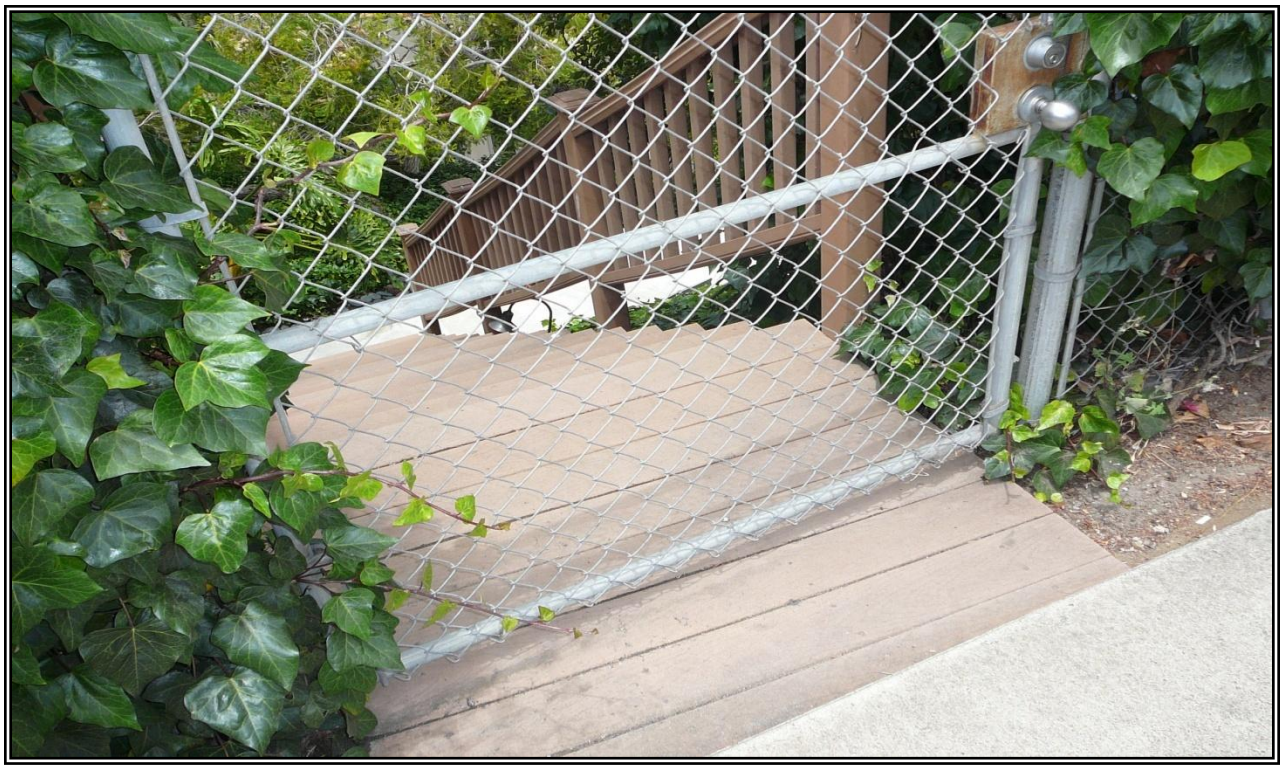

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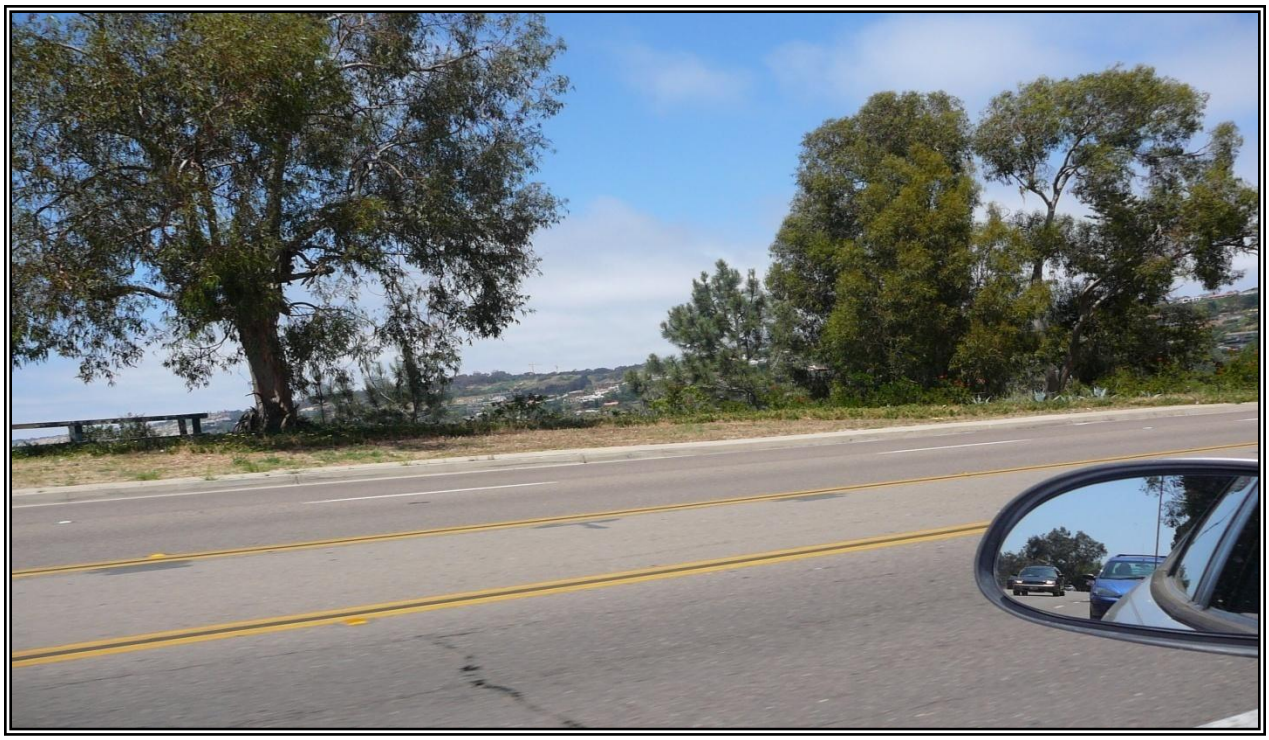

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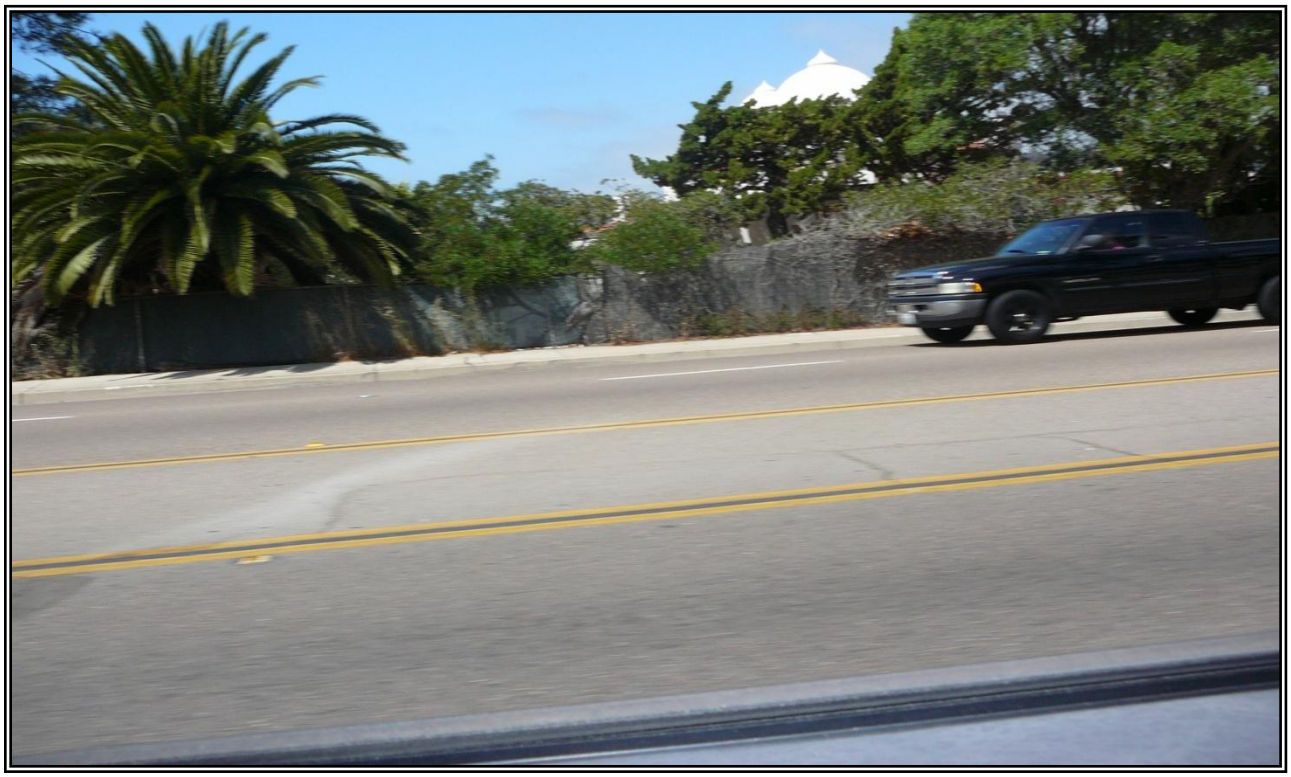

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