13.7 Project Report

PROJECT REPORT

BROOKHURST STREET AND ADAMS AVENUE INTERSECTION IMPROVEMENTS, CC-1377

PREPARED FOR:

THE CITY OF HUNTINGTON BEACH
PUBLIC WORKS DEPARTMENT

PREPARED BY:

Harris & Associates

34 EXECUTIVE PARK, SUITE 150
IRVINE, CA 92614-4705
(949) 655 - 3900

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Prepared By:

Randall Berry, PE
RCE # 44642

Reviewed By:

William F. Janusz, PE, PTOE
Principal Civil Engineer

Approved By:

Robert Stachelski, PE
Transportation Manager

TABLE OF CONTENTS PAGE

LIST OF ATTACHMENTS

TABLE OF FIGURES PAGE

TABLE OF PHOTOS PAGE

TABLE OF TABLES PAGE

1.0 EXECUTIVE SUMMARY

1.1 Introduction

Harris & Associates was retained by the City of Huntington Beach (herein referred to as City) to provide a comprehensive Project Report (PR) that provides a framework for the City's intent to improve the intersection of Brookhurst Street and Adams Avenue. In addition, this PR partially addresses the City's responsibilities for roadway capacity improvements as specified in **"Attachment A"**, **"***Memorandum of Understanding C-6-0834 Among Cities of Costa Mesa, Fountain Valley and Huntington Beach and the Orange County Transportation Authority Regarding Agency Responsibilities for Implementing the Consensus Recommendation for the Garfield-Gisler Bridge Crossing over the Santa Ana River"*, (herein referred to as MOU C-6-0834), approved by the City Council of the City of Huntington Beach on November 6, 2006. Specifically, four (4) out of the eight (8) City responsibilities outlined in MOU C-6-0834 are achieved, which involve constructing new bus turnouts, consolidating driveways, and constructing additional thru lanes and dedicated right turn lanes. The proposed project improvements will ultimately widen all four legs of the intersection, thus accommodating the increased traffic demand, satisfy environmental constraints, and achieve the City-acceptable level of service based on projected Year 2030 travel demand data.

The purpose of this PR is to briefly summarize the evaluation of alternative roadway alignments, related environmental considerations, traffic engineering, right-of-way procurement and other construction related elements. Cost-related information presented in this PR include soft costs (consisting of engineering design, construction management, right-of-way and easement acquisition, and utility improvement costs), which help in developing the required budget for the selected design alternative, and "planning-level" construction estimates. Furthermore, this PR aids in determining the appropriate procedures related to programming (see Section 7.0 hereon) and engineering design decisions.

Per MOU C-6-0834, funding for this project, including the development of Final Plans, Specifications, and Estimates (PS&E), is anticipated from the Orange County Transportation Authority's (OCTA) Combined Transportation Funding Programs (CTFP) and OCTA's renewed Measure M (i.e. M2) Signal Synchronization Program.

This PR is intended to be a planning level tool and has been prepared based on current available information. Modifications may be made as issues are further identified, resolved and refined.

1.2 Proposed Alternatives

The terms of the PR assignment required Harris to investigate at least three design alternatives and assess each on a number of criteria including compliance with MOU C-6-0834, effectiveness of the design concept, constructability, safety, schedule, cost, traffic impacts, environmental impacts, and others. Two viable "build" alternatives considered for this project include Alternative 1: "10-foot wide thru lanes", and Alternative 2: "12-foot wide lanes". The third alternative, Alternative 3: "No Build", proposes no improvements be constructed at this intersection. Details of each alternative are outlined in Section 4.0. Upon conducting a thorough analysis of each alternative, and utilizing Harris objective "Risk Chart (see page 18) we conclude that Alternative 1 is the preferred alternative (see **"Attachment B"** for geometric plan and typical cross sections of Alternative 1).

Recommended Alternative 1: 10-foot wide thru lanes

Alternative 1 consists of widening all four legs of the intersection of Brookhurst Street and Adams Avenue with proposed 10-foot wide thru lanes. The key components of the roadway for Alternative 1 consist of two left turn lanes, three thru lanes, and an additional right turn lane in both the northbound and southbound direction along Brookhurst Street and addition of two left turn lanes, four thru lanes including one additional through lane, and one right turn lane in both the westbound and eastbound direction along Adams Avenue. Additional improvements include, but are not limited to, construction of an 8-foot City parkway / sidewalk, reconstruction of curb ramps, utility relocations and adjustments, traffic signal modifications, and street light modifications / relocations.

Based on traffic analysis performed for the Brookhurst Street and Adams Avenue intersection, operating projections for Future Year 2030 conditions conclude that Alternative 1 will provide the necessary street capacity to operate the intersection at Level of Service (LOS) "D", which is an acceptable LOS per the City's current policy at traffic signal controlled intersections. Further details of the traffic analysis conducted for this Alternative can be found in Section 3.3.

The opinion of probable costs (construction plus soft costs) of this preferred alternative is estimated to be $6.8 million.

1.3 Conclusion / Recommendations:

The recommended alternative for the Brookhurst Street and Adams Avenue intersection improvements is **Alternative 1**. The advantages of this 10' wide thru lanes design, consisting of competitive construction costs, requiring the least amount of right-of-way and/or easement acquisition and reduced impacts to existing private property improvements make this the recommended project solution.

Alternative 1 is also rated number 1 in Harris' objective "Risk Chart" (see page 18) while Alternative 3 "No Build" is rated last. Although Alternative 3 would cost nothing today, it doesn't comply with the City's obligations outlined in MOU C-6-0834, nor will it operate at an acceptable LOS based on future traffic projections.

2.0 BACKGROUND

2.1 Project History

On November 30, 2006, the City entered into MOU C-6-0834 (see **"Attachment A"**) with OCTA, requiring the City to amend the City's General Plan Circulation Elements to support the designation of the Garfield-Gisler Bridge as a "Right-of-Way Reserve" corridor on the Orange County Master Plan of Arterial Highways (MPAH), implement the Smart Street and Bridge Widening Strategy A improvements[1], and ensure that buildout of the Garfield-Gisler Bridge is not assumed for land use planning or traffic analysis purposes. Specifically, this PR addresses the following City responsibilities outlined in MOU C-6-0834 for the proposed intersection improvements at Brookhurst Street and Adams Avenue:

- HB-4: Install a bus turnout at the existing bus stop at northbound Brookhurst Street at Adams Avenue
- HB-5: Install a bus turnout at the existing bus stop at southbound Brookhurst Street at Adams Avenue
- HB-6: Consolidate driveways on the northbound and southbound sides of Brookhurst Street at Adams Avenue
- HB-7: Add a fourth through lane in the north, south, east, and westbound approaches at Brookhurst Street / Adams Avenue. Add dedicated right-turn lanes in the north and southbound approaches

The remaining requirements HB-1 thru HB-3 and HB-8 of MOU C-6-0834 are anticipated to be addressed in separate projects by City staff.

Subsequently, the City began preparation of a local area traffic model as part of an effort to update the General Plan Circulation Element. Concurrent to that effort, the City was also undertaking an effort to prepare the Beach and Edinger Corridor Specific Plan. The traffic model provided a more refined tool for predicting traffic volumes on local roadways based on anticipated land use changes within the City. The results of these efforts confirmed that the City will likely need additional traffic capacity at the intersection of Brookhurst Street and Adams Avenue to maintain long-term operational standards. The traffic volume projections varied slightly from those presented in the Garfield/Gisler study, potentially affecting the actual improvements needed.

The City retained the professional engineering services of Harris & Associates (civil design), Albert Grover & Associates (traffic engineering), and KDM Meridian (topographic survey) to address the items above through preparation of traffic studies, this PR, and 50% project design plans and cost estimates, which will act as a precursor to the eventual preparation of the Final PS&E of the project.

[1] *Circulation Feasibility Study and Cost Estimate for the Garfield-Gisler Crossing Over the Santa Ana River* (LSA, June 2006)

2.2 Existing Facility

The intersection of Brookhurst Street and Adams Avenue is located in the City of Huntington Beach, Orange County, California, specifically 0.45± miles west of the Santa Ana River Channel, and 2.2± miles south of Interstate 405 Freeway. Along Brookhurst Street, the project area extends approximately 0.15± miles north and 0.18± miles south of the intersection. Along Adams Avenue, the project area extends approximately 0.20± miles west, and 0.20± miles east of the intersection. See **Figures 1 and 2** of the project vicinity map and aerial view of project location, respectively.

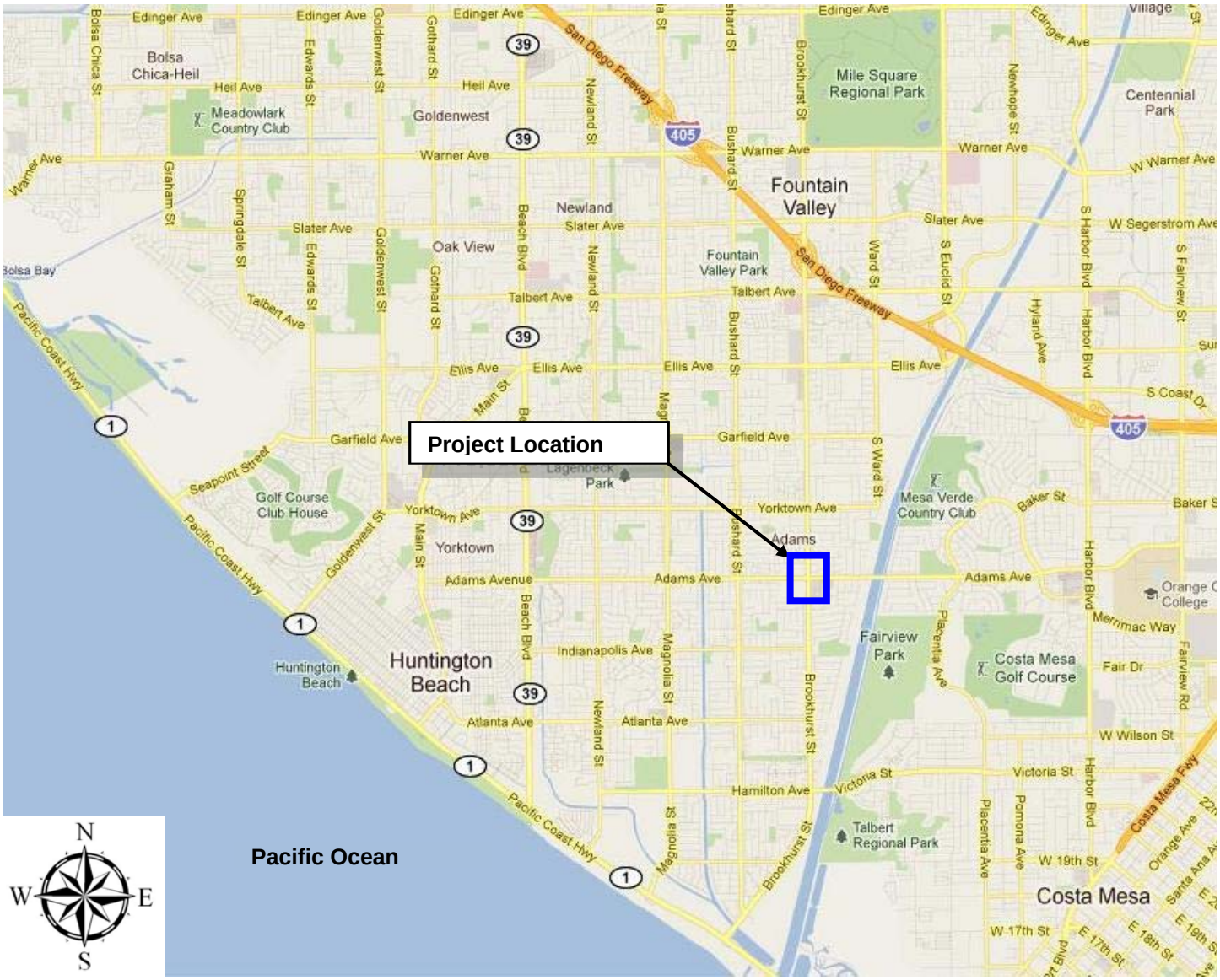

Figure 1: Project Vicinity Map

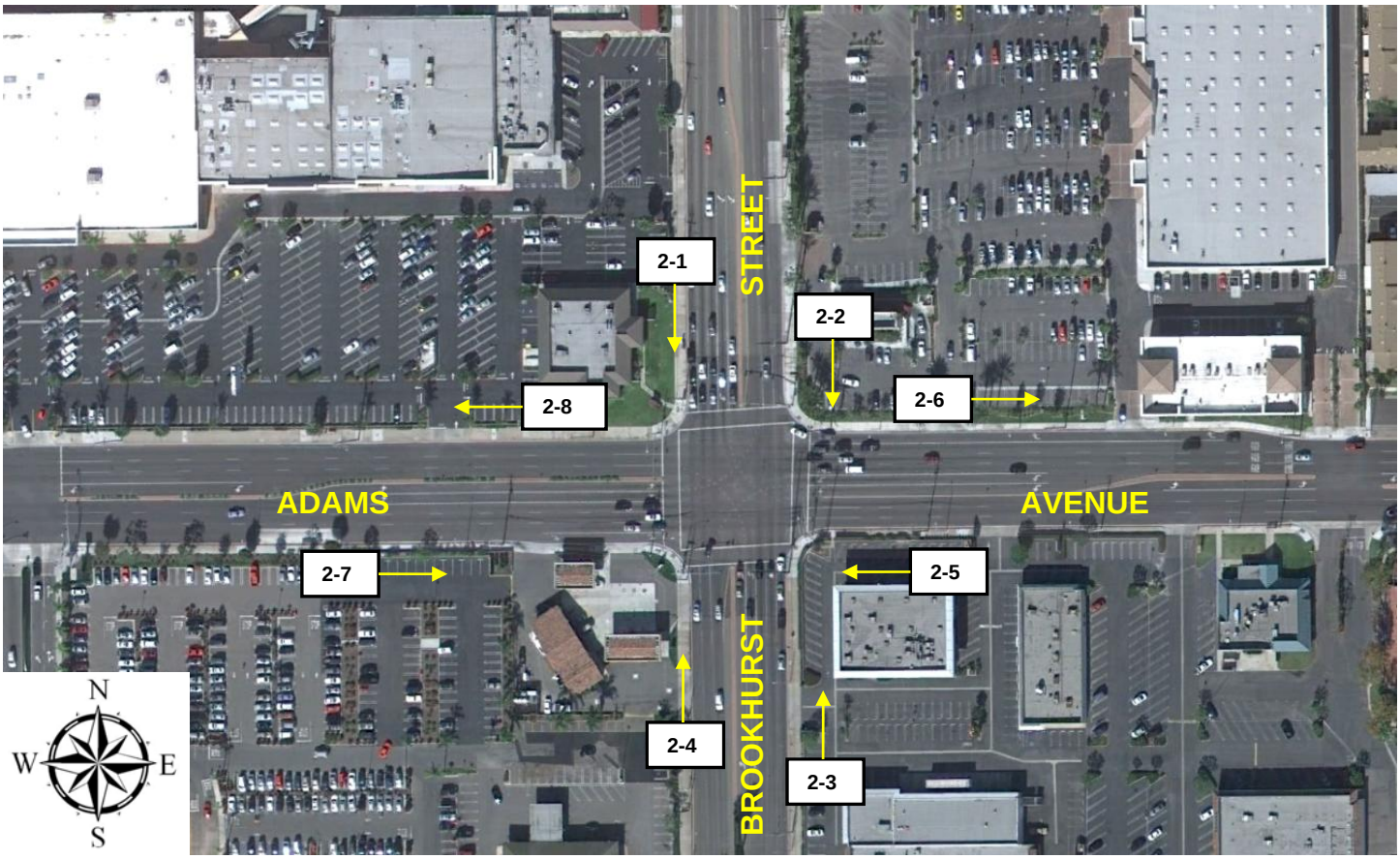

Figure 2: Aerial View of Project Location

LEGEND

x-x → Approximate location of photos taken, which correspond to the photos shown on pages 7 & 8

N

Brookhurst Street

Brookhurst Street currently consists of three thru lanes in both directions (north and southbound) and dual left turn lanes (onto east and westbound Adams Avenue). Existing street width is approximately 96 feet, from westerly to easterly curb. Existing right-of-way width is 120 feet north and south of the intersection. See **Photos 2-1 thru 2-4** of Brookhurst Street, north and south of the Adams Avenue intersection, which correspond to their approximate location on Figure 2-2 Aerial Map.

Photo 2-1: Brookhurst Street, standing north of intersection (looking S'ly from NW'ly side)

Photo 2-2: Brookhurst Street, standing north of intersection (looking S'ly from NE'ly corner)

Photo 2-3: Brookhurst Street, standing south of intersection (looking N'ly from SE'ly side)

Photo 2-4: Brookhurst Street, standing south of intersection (looking N'ly from SW'ly side)

Adams Avenue

Adams Avenue currently consists of three thru lanes in both directions (east and westbound), dual left turn lanes and designated right turn only lanes (onto northbound and southbound Brookhurst Street). Existing street width from northerly curb to southerly curb varies approximately 100' to 103' west of the intersection and approximately 84' to 95' east of the intersection. Existing right-of-way width varies 120' to 123' west of the intersection, and 100' to 111' east of the intersection. See **Photos 2-5 thru 2-8** of Adams Avenue, east and west of the Brookhurst Street intersection, which correspond to their approximate location on Figure 2-2 Aerial Map.

Photo 2-5: Adams Avenue, standing east of intersection (looking W'ly from SE'ly corner)

Photo 2-6: Adams Avenue, standing east of intersection (looking E'ly from N'ly side)

Photo 2-7: Adams Avenue, standing west of intersection (looking E'ly from S'ly side)

Photo 2-8: Adams Avenue, standing west of intersection (looking W'ly from N'ly side)

As indicated in the City's General Plan Circulation Elements (see **Attachment "J"** for applicable excerpts), Brookhurst Street and Adams Avenue are designated as Major Arterial Streets, with a vehicle capacity of approximately 45,000 Average Daily Traffic (ADT). The signalized intersection of Brookhurst Street and Adams Avenue currently operates at Level of Service (LOS) D during peak evening hours, which is an acceptable LOS at traffic-signal controlled intersections within the City. The City's General Plan land use designations within the project vicinity consist of commercial general, residential medium high density and low density.

2.3 Utilities

The data gathering efforts for this PR included identification of existing utilities within the project area, sending out preliminary utility notification letters requesting facility maps to affected utility companies (including coordination with City staff for all existing City facilities), review of utility maps, and plotting existing utilities on project base maps utilizing a combination of all sources. This was completed prior to the completion of this PR to facilitate the design. The list of contacted utility companies is provided in **Table 1** below:

Table 1
List of Utility Companies in Project Area

Utility	Company	Contact Person	Phone Number
Cable	Time Warner Cable	Dave Dolney	(714) 903-8446
Electric	Southern California Edison	Cindy Verrengia	(714) 973-5681
Fiber Optic	NextG Networks	Ron Herrera	(909) 593-9700
Gas	Southern California Gas – Distribution	Stefan Faber	(714) 634-3217
Sewer	Orange County Sanitation District	Quynh Nguyen	(714) 593-7326
Storm Drain	City of Huntington Beach	Eric Powell	(714) 536-5524
Telephone	Verizon	Ray Roundtree	(714) 375-6760
Water	Orange County Water District	Chuck Steinbergs	(714) 378-3229

Significant utility impacts, specifically relocation of existing power poles or undergrounding of overhead utilities, are anticipated with the proposed "build" alternatives. Relocation or undergrounding of utilities will continue to be coordinated with the affected utility agencies during the design phase of the project, in compliance with the City's General Plan - Utilities Element and per the City's franchise agreement to determine financial responsibility. Other minor utility impacts involve adjustment of water valves, and sewer and storm drain manhole frame and covers, affected by the widening, to new finished grades.

Upon completion of the 50% design plans, it is recommended that second utility notification letters indicating the specific details of the proposed improvements, including the 50% design plans, be prepared and submitted to all affected utility agencies listed in Table 1 above, for review and determination of potential conflicts of existing facilities with the proposed roadway improvements.

3.0 PROJECT NEED AND PURPOSE

3.1 Problem, Deficiencies, Justification

The traffic analyses for this report are based on current traffic counts and projections from the City's current subarea traffic model. Current traffic counts show operating conditions on the existing intersection as LOS D during peak periods. Per MOU C-6-0834, initial forecasts for Year 2030 travel demand data for the project area was generated using the regional model Orange County Transportation Analysis Model (OCTAM), developed by OCTA, using the Southern California Association of Governments (SCAG) model as a basis for the OCTAM model. Those projections were further refined using the City's certified subarea traffic model, specifically the "City of Huntington Beach – Beach Boulevard and Edinger Avenue Specific Plan". The latest results predict the intersection to operate below LOS D in the Year 2030 if no improvements are made. Service levels exceeding D are unacceptable per the City's current policy. Without improvements to the intersection, traffic congestion is expected to increase to an adverse level (Level of Service F), compromising the safety and operational efficiency of the intersection (see Section 3.3 below for further discussion regarding traffic-related impacts).

The proposed alternatives to mitigate projected traffic capacity and operational deficiencies at the intersection of Brookhurst Street and Adams Avenue include widening all four legs and installing new bus turnouts to address the effects of increased traffic demand generated by the growth and developments in the area.

3.2 Regional and System Planning

Per the City's General Plan Circulation Elements, Brookhurst Street and Adams Avenue are considered major arterial streets. These two roadway segments also serve as primary truck routes that sustain effective transport of commodities. The proposed intersection improvements will sustain the currently operating Orange County Transportation Authority bus routes.

Future Year 2010 projections are presented in the City's General Plan Circulation Elements (see **Attachment "J"** for applicable excerpts), which proposes that ultimate Build-Out Year 2010 Conditions for Brookhurst Street is to be an 8 lane principal (divided) arterial and Adams Street is to be a 6 lane major (divided) arterial. The information in the Circulation Elements is fairly dated and is currently being updated through a General Plan update process.

3.3 Traffic

Level of Service (LOS) analyses were conducted for Existing conditions and Future Year 2030 conditions utilizing the Highway Capacity Manual (HCM) operations methodology and the Intersection Capacity Utilization (ICU) methodology. The HCM methodology for LOS analysis is based on the overall intersection delay. The WEBSTER program was used for the HCM analysis. A brief overview of WEBSTER is provided in **"Attachment E"**. The ICU methodology is based on overall intersection volume-to-capacity ratio. The Level of Service (LOS) criteria for both methodologies is provided in **Table 2**.

Table 2
LOS Criteria for HCM Operations and ICU Methodologies

HCM Operations Methodology		ICU Methodology	
LOS	**Delay (seconds)**	**LOS**	**ICU (volume/ capacity ratio)**
A	< 10.1	A	< 0.61
B	10.1 - 20.0	B	0.61 - 0.70
C	20.1 - 35.0	C	0.71 - 0.80
D	35.1 - 55.0	D	0.81 - 0.90
E	55.1 - 80.0	E	0.91 - 1.00
F	> 80.0	F	> 1.00

Existing conditions were based on AM and PM peak hour turning movement counts collected in 2007. The total volumes per approach, which help identify areas where potential improvements will be necessary, are summarized in **Table 3**.

Table 3
Brookhurst Street / Adams Avenue
Total Approach Volumes (Peak Hourly)

Scenario		Total Approach Volume (vehicles per hour)				Total
		Eastbound	Westbound	Northbound	Southbound	
Existing Conditions	AM	2,292	1,022	1,408	1,198	5,920
	PM	1,044	2,356	1,586	1,362	6,348
Future Year 2030 Conditions	AM	2,800	1,230	1,630	1,560	7,220
	PM	1,710	3,140	1,880	1,980	8,710

The heaviest traffic occurs during the PM peak hour for both existing and future conditions with a total of 6,348 and 8,710 vehicles per hour respectively. The AM peak hour has a higher proportion of eastbound traffic, whereas the PM peak hour has a higher proportion of westbound traffic. Existing LOS analyses is summarized below in **Table 4**.

Table 4
Brookhurst Street / Adams Avenue
Existing Intersection LOS Analysis

Scenario		HCM (WEBSTER) Analysis		ICU Analysis	
		DELAY	LOS	ICU	LOS
Peak Hour	AM	42	D	0.89	D
	PM	40	D	0.76	D

The Future Year 2030 conditions volumes were based on the "City of Huntington Beach – Beach Boulevard and Edinger Avenue Specific Plan"[2] for the Brookhurst Street at Adams Avenue intersection. For Future Year 2030 conditions with existing geometrics, it is expected that the intersection will operate at an unacceptable Level of Service "E" in the PM peak hour. The current acceptable LOS for the City is Level of Service "D". Future Year 2030 LOS with existing geometrics using HCM and ICU analyses is summarized below in **Table 5**.

Table 5
Brookhurst Street / Adams Avenue
Future Year 2030 Intersection LOS Analysis
(No Improvements)

Scenario		HCM (WEBSTER) Analysis		ICU Analysis	
		DELAY	LOS	ICU	LOS
Peak Hour	AM	52	D	1.03	F
	PM	56	E	1.05	F

Based on the WEBSTER analyses for Future Year 2030, two viable "build" alternatives were prepared for the intersection of Brookhurst Street and Adams Avenue (see Section 5.0 "Alternatives" for further discussion). Each alternative will provide the necessary street improvements to operate the intersection at an acceptable Level of Service "D" per the City's policy. For both viable "build" alternatives, a cycle length of 130 seconds was used in the LOS analyses as a result of the increased pedestrian timing required due to the proposed widening. Future Year 2030 LOS using HCM and ICU analyses for both alternatives is summarized below in **Table 6**.

[2] *Beach and Edinger Corridors Specific Plan, Approved by City Council, March 1, 2010*

Table 6
Brookhurst Street / Adams Avenue
Future Year 2030 Intersection LOS Analysis

Scenario		HCM (WEBSTER) Analysis[1]		ICU Analysis[2]	
		DELAY	LOS	ICU	LOS
Peak Hour	**Alternative 1**				
	AM	38	D	0.79	C
	PM	44	D	0.88	D
	Alternative 2				
	AM	40	D	Same as Alternative 1	
	PM	44	D		

1. Level of service differs for each alternative since HCM takes into account lane widths which affect minimum pedestrian timings. 2. Level of service is the same for both alternatives since ICU does not take into account lane widths.

WEBSTER analysis worksheets for each scenario are provided in **"Attachment E"**, and ICU analysis worksheets are provided in **"Attachment F"**

4.0 ALTERNATIVES

The aerial topographic survey specifically obtained for this project was used to layout and analyze several design alternative roadway design alignments. This PR considered three total alternatives, specifically, two viable "build" alternatives for further engineering and environmental studies, and a "no-build" alternative.

Alternatives:

1. **"10-foot wide thru lanes".** Widen all four legs of the intersection with proposed 10' wide thru lanes.

2. **"12-foot wide thru lanes".** Widen all four legs of the intersection with proposed 12' wide thru lanes.

3. **"No build".**

Considerations regarding design, safety, environmental impacts, traffic demand, right-of-way, and cost were thoroughly reviewed in forming the two viable "build" alternatives. The "build" alternatives were developed primarily to address the requirements of MOU C-6-0834 (as summarized in **Table 7** below) and based on further input from City staff. Regarding item HB-7 from MOU C-6-0834, supplementary traffic operational analyses of the intersection were performed to determine the necessity of a 4th thru lane in the north, south, east, and westbound approaches. Using Future Year 2030 volumes from the "City of Huntington Beach - Beach Boulevard and Edinger Avenue Specific Plan"[3], three thru lanes in the northbound and southbound direction along Brookhurst Street were determined to be sufficient. The analysis was presented to City staff, and concurred that a 4th thru lane was not required to meet the LOS target.

Table 7
Summary of MOU C-6-0834 Obligations

ITEM	Meets requirements of MOU?			COMMENTS
	ALT. 1	ALT. 2	ALT. 3	
HB-4	√	√	X	
HB-5	√	√	X	
HB-6	√	√	X	
HB-7	√	√	X	4th thru lane not required to meet LOS target

The results of the proposed Brookhurst Street and Adams Avenue intersection geometry for the "build" alternatives are summarized in **Table 8** and **Figures 3 & 4** below:

[3] *Beach and Edinger Corridors Specific Plan, Approved by City Council, March 1, 2010*

Table 8

Proposed Intersection Geometry for "Build" Alternatives 1 & 2

Brookhurst Street						Adams Avenue					
NB			SB			EB			WB		
L	T	R	L	T	R	L	T	R	L	T	R
2	3	2	2	3	1	2	4	1	2	4	1

LEGEND

L = Left turn lane
T = Thru lane
R = Right turn lane

NB = Northbound
SB = Southbound
EB = Eastbound
WB = Westbound

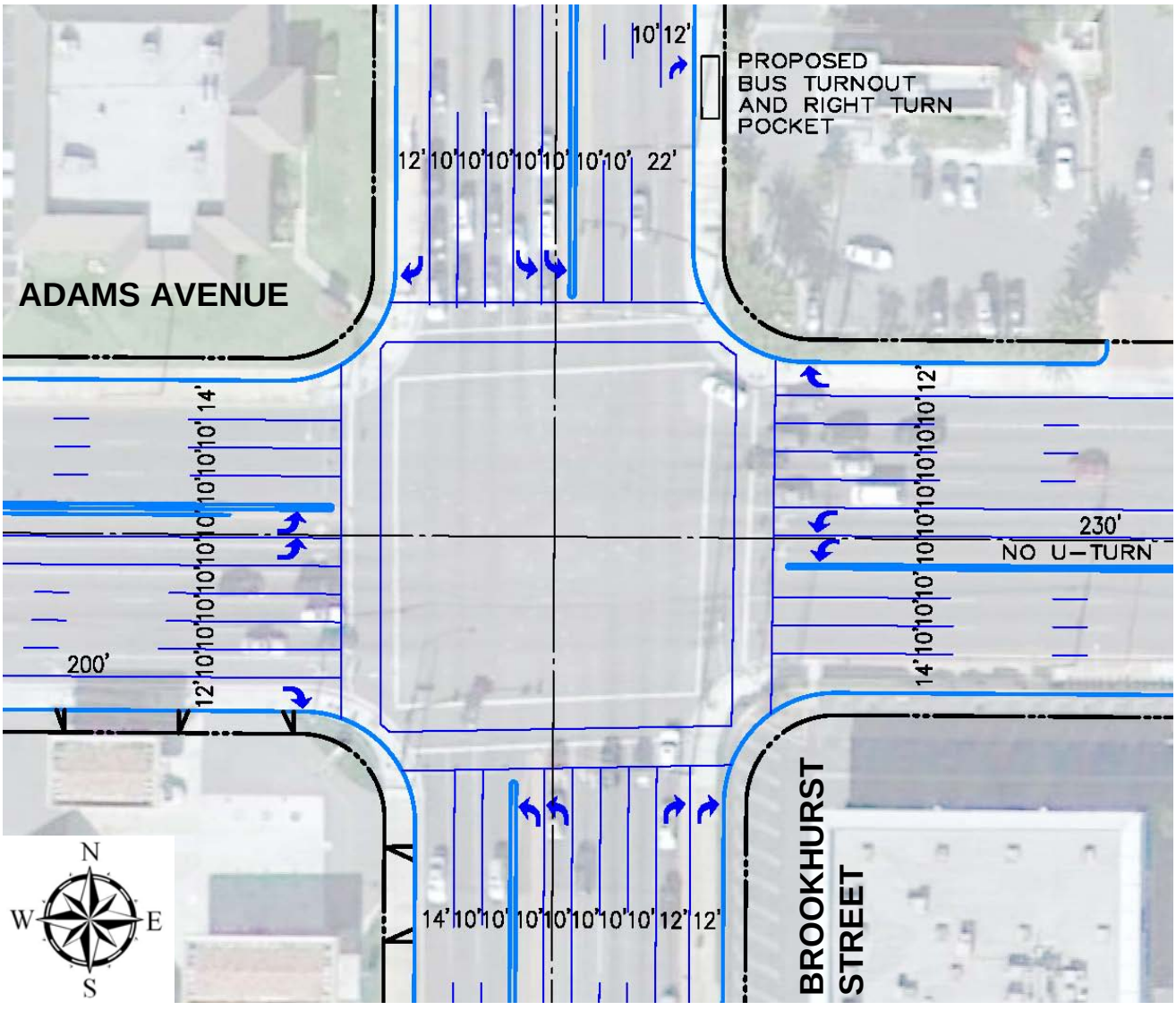

Figure 3: Proposed Alternative 1 Intersection Layout (10' wide thru lanes)

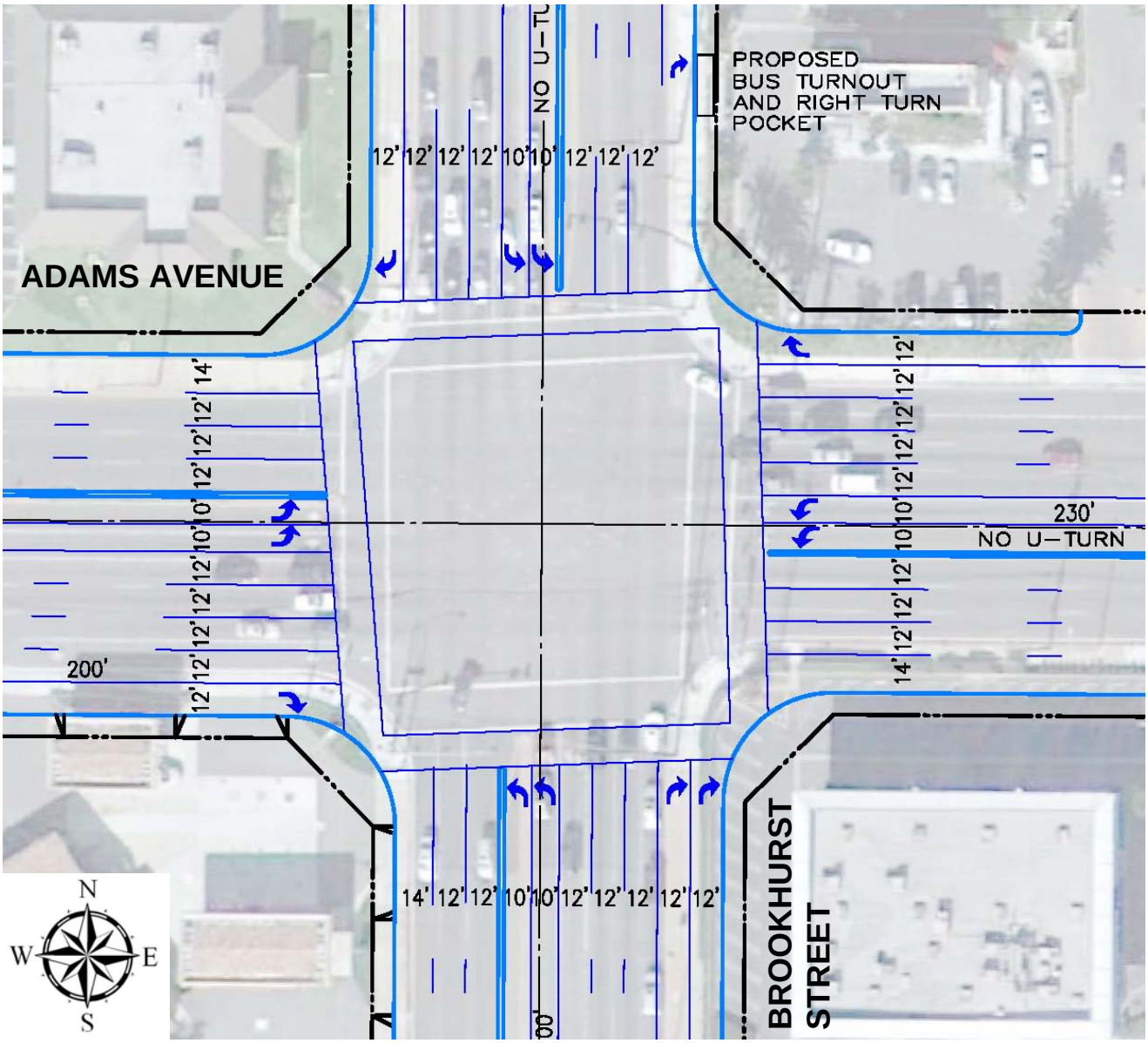

Figure 4: Proposed Alternative 2 Intersection Layout (12' wide thru lanes)

As determined by the traffic analysis in **"Attachment E"** and Section 3.3, the "build" alternatives will achieve and/or maintain LOS D operations, which is an acceptable level of service at traffic signal controlled intersections per the City's current policy.

Additional improvements of both "build" alternatives include:

- Reconstruction of asphalt concrete pavement
- Installation of an 8-foot wide City parkway / sidewalk
- Reconstruction of curb ramps (conforming to the latest ADA requirements)
- Relocation of existing catch basins, as applicable
- Construction of short retaining walls and decorative perimeter walls at specific locations

- Utility relocations and adjustments, including power poles
- Street light system modifications / relocations
- Traffic signal modifications
- Landscaping and irrigation improvements
- Traffic signing and striping improvements

Summary of Opinion of Probable Costs

The preliminary opinion of probable construction costs of the intersection improvements for Alternatives 1 and 2 are summarized in **Table 9** below, and the detailed breakdown can be found in the **"Attachment D".**

Table 9
Summary of Probable Costs for Viable "Build" Alternatives

	Build Alternative 1	Build Alternative 2
Total Estimated Project Cost =	**$6,822,813**	**$8,294,531**

Summary of Right of Way Acquisition Required

The results of the estimated right of way required for Alternatives 1 and 2 are summarized in **Table 10** below, and the detailed breakdown can be found in the **"Attachments G & H".**

Table 10
Right of Way Acquisition Required for Alternatives 1 & 2

	Alternative 1	Alternative 2
Estimated Right of Way Acquisition =	**31,230 sq. ft.**	**57,899 sq. ft.**

Conclusion / Recommendations

Through a detailed assessment of the all three alternatives, **Harris' recommends Alternative 1 as the preferred design layout** based on requiring the least amount of right-of-way, potentially the shortest design time and construction schedule, assumed to be the least environmentally impacting, least impacts to private improvements, and lower overall project costs. See Harris' objective "Decision / Risk Analysis Chart" shown on the next page for overall breakdown of the preferred alternative selection analysis.

DECISION/RISK ANALYSIS

CC-1377 Brookhurst St & Adams Ave Intersection Improvements				Project Cost	Project Schedule	Constructability Issues	R/W and Easement Acquisition	Environmental Impacts	Geotechnical Issues	Safety	Meets requirements of MOU C-6-0834	Impacts to the City of Huntington Beach	Impacts to Businesses	Impacts to Private Residents	Resulting Level of Service (LOS) for Future Year 2030 Conditions	Impacts to Traffic
Weighting Factor				5	3	3	5	5	2	5	5	3	4	4	5	5
Alternative No.	Rank	Raw Score	Weighted Score													
10-foot wide thru lanes																
1	**1**	23	94.5	1	2	2	2	2	1.5	1.5	2	2	2	2	1.5	1.5
12-foot wide thru lanes																
2	**2**	20	84	0.5	1.5	1.5	1.5	1.5	1.5	2	2	1.5	1.5	1	2	2
No build; Leave Conditions "as-is"																
3	**3**	8.5	34.5	1.5	1	1	1	1	1	1	0	0	0.5	0.5	0	0

LEGEND

Raw Score = Sum of all Raw Scores
Weighted Score = Sum of Weighting factor x Raw Score

RAW SCORE LEGEND		
2	=	Alt. Is best solution among alternatives
1.5	=	Alt. Is a very good solution
1	=	Alt. is an acceptable solution
0.5	=	Alt. Is a marginal solution
0	=	Not Acceptable
-1	=	Alt. Is an inferior solution with problems

WEIGHTING FACTOR LEGEND		
5	=	Most Important / Sensitive Issue
4	=	More Important / Sensitive Issue
3	=	Average Importance / Sensitive Issue
2	=	Less Important / Sensitive Issue
1	=	Least Important / Sensitive Issue

4.1 Viable Build Alternatives

4.1.1 Alternative 1

Alternative 1 requires the least change to the intersection configuration among the viable build alternatives. This alternative addresses the intent of MOU C-6-0834, maintaining acceptable long-term traffic operations for the intersection of Brookhurst Street and Adams Avenue. Brookhurst Street would be widened to provide three thru lanes, consisting of **10' wide thru lanes,** in each northbound and southbound directions, dual left turns lanes onto eastbound and westbound Adams Avenue, dual right turn lanes onto eastbound Adams Avenue, and one right turn lane onto westbound Adams Avenue (see **"Attachment B"** for the proposed geometric plan, typical sections and striping plan of Alternative 1).

The primary advantages of Alternative 1 are requiring the least amount right of way and easement acquisition needed for its construction, potentially the shortest design time and construction schedule, thus providing potential relief per an expedited schedule possible of any alternative, least amount of walking distance and time along the crosswalks for pedestrians, least environmentally impacting due to minimized roadway widening, reduced impacts to adjacent businesses and residential properties and is arguably the least expensive alternative.

Right-of-Way Data

For Alternative 1, approximately 31,230 sq. feet of right-of-way acquisition is required to accommodate the proposed roadway widening of all four legs of the intersection. A detailed summary of the required right of way acquisition is provided in **Table 11** below and the comprehensive Right-of-Way Exhibits of each intersection quadrant for Alternative 1 can be found in **"Attachment G".**

Table 11
Right of Way Acquisition Required for Alternative 1

Intersection Quadrant	Estimated Right of Way Acquisition Required (sq. ft.)	Total # of Parcels Impacted	Comments
Northwest	5,856±	2	Several utility easements impacted
Southwest	2,632.±	2	Additional R/W required impacts newly developed Chase Bank
Northeast	6,548±	4	Several utility easements impacted
Southeast	16,194±	3	Several utility easements impacted
TOTALS	**31,230± sq. ft.**	**11**	

No residential dwellings are anticipated to be displaced by this alternative. As the project proceeds towards the PS&E stage, City staff will be the lead agency in coordinating all right of way appraisals and conducting all property acquisitions required.

Opinion of Probable Costs

The detailed breakdown opinion of probable costs for Alternative 1 can be found in **"Attachment D".** A brief summary of the project costs are provided in **Table 12** below:

Table 12

Summary of Probable Costs for Alternative 1

	Total Construction Cost (in 2011 dollars)	*Total Soft Costs (in 2011 dollars)	Total Estimated Project Costs (in 2011 dollars)
Build Alternative 1	$4,248,250	$2,574,563	**$6,822,813**

* Soft Costs consist of Engineering Design, Construction Management, R/W and Easement Acquisition, and Utility Relocations and/or Undergrounding

4.1.2 Alternative 2

Alternative 2 consists of widening all four legs of the intersection of Brookhurst Street and Adams Avenue. Brookhurst Street would be widened to provide three thru lanes, comprising of **12' wide thru lanes,** in each northbound and southbound directions, dual left turns lanes onto eastbound and westbound Adams Avenue, dual right turn lanes onto eastbound Adams Avenue, and one right turn lane onto westbound Adams Avenue (see **"Attachment C"** for the proposed geometric plan, typical sections and striping plan of Alternative 2).

The primary advantages of Alternative 2 are increased safety and vehicular driving comfort due to wider thru lanes. Per AASHTO Geometric Design of Highways and Streets, 12' lane widths are most desirable on higher speed, free-flowing, principal arterials, and with substantial truck traffic. However, since Alternative 2 requires additional right of way acquisition, a lengthier schedule, greater impacts to adjacent businesses and residents, and higher costs, it is considered the least favorable "build" alternative.

Right-of-Way Data

For this alternative, approximately 57,899 sq. feet of right-of-way acquisition is required to accommodate the proposed roadway widening of all four legs of the intersection. A detailed summary of the required right of way acquisition required is provided in **Table 13** below and the comprehensive Right-of-Way Exhibits of each intersection quadrant for Alternative 2 can be found in **"Attachment H".**

Table 13
Right of Way Acquisition Required for Alternative 2

Intersection Quadrant	Estimated Right of Way Acquisition Required (sq. ft.)	Total # of Parcels Impacted	Comments
Northwest	13,959±	2	Several utility easements impacted
Southwest	6,776±	3	Additional R/W required impacts newly developed Chase Bank
Northeast	10,805±	4	Several utility easements impacted
Southeast	26,359±	6	Several utility easements impacted. Residential dwellings at 20011 and 20012 Lawson Lane are anticipated to be displaced by this alternative
TOTALS	**57,899± sq. ft.**	**15**	

As the project proceeds towards the PS&E stage, City staff will be the lead agency in coordinating all right of way appraisals and conducting all property acquisitions required.

Opinion of Probable Costs

The detailed breakdown opinion of probable costs for Alternative 2 can be found in **"Attachment D".** A brief summary of the project costs are provided in **Table 14** below:

Table 14
Summary of Probable Costs for Alternative 2

	Total Construction Cost (in 2011 dollars)	*Total Soft Costs (in 2011 dollars)	Total Estimated Project Costs (in 2011 dollars)
Build Alternative 2	$5,425, 625	$2,868,906	**$8,294,351**

* Soft Costs consist of Engineering Design, Construction Management, R/W and Easement Acquisition, and Utility Relocations and/or Undergrounding

4.1.3 Impacts to Private Improvements for Viable "Build" Alternatives

Parking Space Elimination

On December 29, 2010, a parking lot evaluation was conducted to determine the usage and number of marked parking spaces requiring elimination to accomplish the proposed widening. **Table 15** below provides a summary of the number of stalls that would be eliminated per intersection quadrant and per alternative:

Table 15
Summary of Eliminated Parking Stalls

Quadrant	Eliminated Stalls	
	Alternative 1	Alternative 2
Northwest	32	76
Northeast	0	25
Southwest	18	18
Southeast	62	62

A field review of all four intersection quadrants, and a detailed survey of parking utilization in the northwest and southeast quadrants were conducted during the afternoon (after 1:00 PM) on three separate days: Friday, November 19th; Friday, November 26th (the day after Thanksgiving, typically referred to as "Black Friday" and recognized as the busiest shopping day of the year); and Tuesday, December 28, 2010. These two quadrants will have the greatest potential reduction in stalls. The other quadrants were reviewed but not surveyed in detail as observations indicated that they have a sufficient number of stalls to handle demand even after widening under both scenarios.

Table 16 below shows the counts and percentages of empty parking stalls as determined via the field review/survey:

Table 16
Summary of Empty Parking Stalls via Field Review / Survey

Date of Review:	11/29/2010	11/26/2010	12/28/2010
Northwest Quadrant			
Total # of Stalls	191	191	191
Total # of Empty	83	0	95
Percentage Empty	44%	0%	50%
Southeast Quadrant			
Total # of Stalls	108	1080	108
Total # of Empty	89	87	86
Percentage Empty	82%	81%	80%

Based on the observations and/or counts conducted, there are a sufficient number of stalls to allow elimination of stalls in all four quadrants without an anticipated deficiency to the existing businesses for both "build" alternatives. However, based on an observed 2010 "Black Friday" deficiency, it is reasonable to expect a deficiency during holiday shopping, where the elimination of stalls in the northwest quadrant could negatively affect the existing businesses. Such occasional occurrences are common and, in fact, anticipated at most shopping areas, where to provide parking sufficient to handle the one or two day "worst case" demand would not be practical.

Existing Landscaped Areas

Harris conducted a comprehensive field review to identify existing landscaped areas, beyond the public right-of-way, affected by the proposed widening improvements. **Table 17** below provides a summary of the landscaped areas affected per intersection quadrant per alternative:

Table 17
Summary of Landscaped Areas Affected

Quadrant	Estimated Landscape Area Lost	
	Alternative 1 (sq. ft.)	Alternative 2: (sq. ft.)
Northwest	3,445±	5,840±
Northeast	4,156±	6,098±
Southwest	2,212±	3,375±
Southeast	7,143±	11,360±
TOTALS	**16,956± sq. ft.**	**26,673± sq. ft.**

4.2 "No Build" Alternative 3

This "no build" alternative proposes no improvements be constructed at this intersection, leaving the intersection in an "as-is" condition. This alternative does not satisfy the requirements of MOU C-6-0834. Further, it does not address future traffic operational deficiencies resulting from continued growth and increasing traffic levels, nor does it improve air quality, traffic operations and safety. As indicated in MOU C-6-0834, the intersection is predicted to operate below LOS D for future year 2030 "no build alternative". Based on this analysis, Alternative 3 is considered the least favorable alternative.

5.0 CONSIDERATIONS REQUIRING DISCUSSION

5.1 Hydrology and Hydraulics Study

A brief hydrology and hydraulics (H&H) study was prepared for the existing and anticipated relocation of storm drain catch basins within the PR's study area, (see **"Attachment I"**). The H&H study analyzed existing catch basins within the tributary drainage area to determine the adequacy of their length, local depression, and approaching grades to intercept the design flows for a 25-year frequency for a sump condition catch basin and 10-year frequency for a flow by condition catch basin, based on the requirements of the Orange County Local Drainage Manual. The primary goal is to better protect the affected commercial businesses within the tributary area of the Brookhurst Street and Adams Avenue Intersection Improvements from flooding by potentially upsizing the catch basins to accept the same tributary drainage areas currently conveyed via the existing catch basins.

The analyses determined that most of the catch basins are adequate to handle the 25-year storm frequency at the existing length, local depression and approach grade. Only the catch basin at the south east leg of Adams Avenue requires upsizing to intercept the 25-year storm frequency flows.

5.2 Environmental Clearances

The City will be the lead agency for the preparation of the environmental documentation. Staff anticipates the appropriate environmental documents for this project are most likely an Initial Study / Environmental Assessment (IS/EA), leading to a Mitigated Negative Declaration / Finding of No Significant Impact (MND/FONSI), or a Categorical Exemption / Exclusion Determination. City staff is currently preparing a separate scope of work, to address the necessary environmental requirements, concurrently with this PR.

5.3 Resource Conservation

The proposed project is anticipated to improve traffic operations and facilitate traffic movements through the project area, thereby resulting in decreased energy consumption. Reducing congestion and related traffic delays will result in faster average travel speeds, thus providing fuel efficiency. Although the construction phase of the project may experience a temporary increase of energy consumption, long-term substantial wasteful use of energy is not anticipated.

Effort will be made to possibly salvage existing material for re-use on-site. Determination of what items to salvage and the respective quantity of salvaged material will be made during the design phase of the project.

5.4 Pedestrian Accessibility

The proposed roadway widening improvements will impact existing pedestrian travel ways, thus new pedestrian facilities, including sidewalks and curb access ramps shall be installed in compliance with current Title II regulations of the American Disabilities Act (ADA) and 2007 California Building Code (CBC) Title 24, Part 2, Volumes 1 and 2.

5.5 Transportation Management Plan

Preparation of a Transportation Management Plan (TMP) is recommended during the PS&E and final design phase of this project. The TMP shall provide a framework of coordinated transportation management strategies to implement during construction in order to minimize project related traffic impacts and delays associated with construction. The proposed construction and improvements will include widening the roadway, which may require lane closures, sidewalk closures, driveway closures, and detours.

The TMP shall be supported by the detailed traffic studies outlined in this report to evaluate traffic operations, including input from local business owners and City staff. It is recommended that specific details (such as any necessary lane closures during off-peak hours or at night, short term detour routes, and addressing continuous access to business driveways, etc.) should be identified in the TMP to establish the final construction traffic control and phasing required for both vehicles and pedestrians. The TMP typically includes public information and outreach to notify motorists, bicyclists, pedestrians, businesses, community groups, local entities, delivery services vehicles, bus services, emergency services, and other project stakeholders of upcoming closures and detours, possibly thru various media such as flyers, radio, television, and newspapers. Various TMP elements, such as construction area signs, detour signs and portable changeable message signs, may be utilized to alleviate and minimize delay to the traveling public.

5.6 Project Phasing

The implementation of Alternative 1 improvements could be phased over several years depending on the availability of funding and acquisition of required right-of-way. While it is proposed that Environmental Clearance be completed for all the identified improvements, specific improvements may be completed in a phased manner. However, if funding is available for the construction phase of the project, it is recommended that the intersection improvements be completed in one (1) phase to mitigate impacts to traffic and potential cost savings (i.e. economy of scale). The actual work should be built in a predetermined sequence so that the entire roadway is not simultaneously affected. Development of a detailed stage construction and traffic handling plan will be considered during the PS&E stage to minimize traffic impacts.

6.0 OTHER CONSIDERATIONS AS APPROPRIATE

6.1 Public Hearing Process

A public meeting is recommended to be scheduled to present the developed viable alternatives for public comment.

6.2 Agreements, Permits, Approvals

Cooperative agreements with OCTA will be required to identify funding sources and the implementing agency for design, right-of-way, construction activities, and environmental mitigation.

No outside permitting agency approvals are anticipated for the project.

Encroachment permits shall be coordinated with City staff for surveys, geotechnical borings, construction activities and any other activities requiring work within the intersection limits.

7.0 PROGRAMMING

7.1 Funding

The City is the sponsor for this PR. Funding for this project is anticipated from OCTA's CTFP program.

7.2 Schedule and Staffing

Per MOU C-6-0834, the City agreed to construct the intersection improvements by year 2020. The following is a tentative milestone schedule:

Project Approval / Environmental Clearance ..... Mid to Late 2013

Final PS&E completed ..... Late 2013 +/- *

Right-of-Way Acquisition ..... 2013 thru 2015

Ready to List ..... 2016 +/- *

Begin Construction ..... 2017 +/- *

End Construction ..... 2018 +/- *

*Note: Dates are assumed and requires additional City staff feedback to provide more accuracy

8.0 PROJECT PERSONNEL

City of Huntington Beach

William Janusz, Project Manager	(714) 536-5431
Jonathan Claudio, Senior Civil Engineer	(714) 374-5380

Harris & Associates

Randall Berry, Project Manager	(949) 655-3900, ext. 2314
Randall Bliss, Senior Project Engineer	(949) 655-3900, ext. 2356
Gary Solsona, Project Engineer	(949) 655-3900, ext. 2355

Albert Grover and Associates

Mark Miller, Traffic Engineer	(714) 992-2990
Ruben Perales, Transportation Engineering Assistant	(714) 992-2990

9.0 ATTACHMENTS

A. Memorandum of Understanding C-6-0834

B. Alternative 1: 10' thru lanes
Geometric Plan, Typical Cross Sections, and Proposed Striping Plan

C. Alternative 2: 12' thru lanes
Geometric Plan, Typical Cross Sections, and Proposed Striping Plan

D. Opinion of Probable Costs – Alternatives 1 and 2

E. Highway Capacity Manual (HCM) Operations (WEBSTER) Analysis Worksheets

E.1 WEBSTER Overview

E.2 Existing Conditions

E.3 Future Year 2030 Conditions (no improvements)

E.4 Future Year 2030 Conditions

F. Intersection Capacity Utilization (ICU) Analysis Worksheets

F.1 Existing Conditions

F.2 Future Year 2030 Conditions (no improvements)

F.3 Future Year 2030 Conditions

G. Right-of-Way Exhibits – Alternative 1

H. Right-of-Way Exhibits – Alternative 2

I. Hydrology and Hydraulics Study Report

J. Applicable Excerpts of the City of Huntington Beach General Plan Circulation Elements

ATTACHMENT A

Memorandum of Understanding C-6-0834

MEMORANDUM OF UNDERSTANDING C-6-0834

AMONG

CITIES OF COSTA MESA, FOUNTAIN VALLEY AND HUNTINGTON BEACH

AND

THE ORANGE COUNTY TRANSPORTATION AUTHORITY

REGARDING

AGENCY RESPONSIBILITIES FOR IMPLEMENTING THE CONSENSUS RECOMMENDATION

FOR THE

GARFIELD-GISLER BRIDGE CROSSING OVER THE SANTA ANA RIVER

This Memorandum of Understanding (MOU) is entered into among the Orange County Transportation Authority, hereinafter referred to as the OCTA, and the Cities of Fountain Valley, Costa Mesa and Huntington Beach, hereinafter referred to as Cities.

Consistent with the Garfield-Gisler ad-hoc Policy Advisory Committee's consensus recommendation on June 15, 2006, each of the parties to this MOU agrees to support the designation of the Garfield-Gisler Bridge as a "Right-of-Way Reserve[1]" corridor on the Orange County Master Plan of Arterial Highways (MPAH) and, within their respective General Plans/Long Range Plans, implement the Smart Street and Bridge Widening Strategy A (Strategy A) improvements within their jurisdictions and ensure that buildout of the Garfield-Gisler Bridge is not assumed for land use planning or traffic analysis purposes. This MOU describes the specific duties and responsibilities of each party with respect to supporting these actions.

This document establishes obligations on all parties and constitutes an exchange of promises.

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[1] The Right-of-Way Reserve classification allows local jurisdictions considering deletion of a planned MPAH facility to request OCTA to re-designate the adopted facility as a "Right of Way Reserve" corridor for a specific length of time in order to assess the actual need for it. If OCTA agrees to re-designate the subject facility as a "Right-of-Way Reserve" corridor on the MPAH, then all appropriate City General Plan Circulation Elements shall be revised to reflect such re-designation. During the "reserve" period, the right-of-way shall be preserved however, the planned street shall not be considered as mitigation for development planning purposes. At the end of the designated period, a final decision shall be made regarding reinstatement or deletion of the street on the MPAH.

Recital

The parties acknowledge that this MOU requires that certain actions be taken with regard to amending the general plans and capital improvement programs of the parties hereto and that the parties hereto cannot predetermine those actions that are the subject of public hearings. Nevertheless, the parties agree that the benefits of this MOU are dependent on such actions and therefore commit to conducting said hearings within 6 months of the effective date of this agreement. If such action is not taken within said time line, the benefits of this agreement shall not be available to the parties unless all parties consent to an extension or other arrangement.

Section 1. MPAH and General Plan/Long Range Plan Designations

1.1 OCTA Responsibilities

1.1.1 Amend Master Plan of Arterial Highways

After the cities have amended their General Plans, OCTA shall amend the MPAH to re-designate the Garfield-Gisler Bridge, and the eastbound and westbound approaches thereto, as a "Right-of-Way Reserve" corridor. Consistent with the MPAH's original concept for the Garfield-Gisler Bridge, the right-of-way reservation shall be for a secondary arterial highway in Costa Mesa and a primary arterial in Fountain Valley and Huntington Beach.

1.1.2 Amend Orange County Long Range Transportation Plan

After the MPAH has been amended and during the next update to the Orange County Long Range Transportation Plan (LRTP), OCTA shall ensure that the Garfield-Gisler Bridge, and the eastbound and westbound approaches thereto, are reflected as a "Right-of-Way Reserve" corridor in the LRTP.

1.2 Cities' Responsibilities

1.2.1 Amend General Plans

The Cities shall pursue amendment of their General Plan Circulation Elements to reflect that the Garfield- Gisler Bridge and the eastbound and westbound approaches thereto have been designated as a "Right-of-Way Reserve" corridor in the MPAH. Consistent with the MPAH's original concept for the Garfield-Gisler Bridge, the City of Costa Mesa's General Plan shall reserve right-of-way for a secondary

arterial highway within the Garfield-Gisler corridor and the Fountain Valley and Huntington Beach General Plans shall reserve right-of-way for a primary arterial highway within the Garfield-Gisler corridor. Cities shall endeavor to complete the General Plan amendment process within 6 months of final adoption of this MOU.

Section 2. Reasonable Progress Toward Implementing Strategy A Improvements

2.1 OCTA Responsibilities

2.1.1 OCTA Responsibilities for Strategy A Improvements

To ensure reasonable progress toward implementation of Strategy A improvements, OCTA shall:

a. Make funding for implementation of the Strategy A improvements, as defined in the *Circulation Feasibility Study and Cost Estimate for the Garfield-Gisler Crossing Over the Santa Ana River* (LSA, June 2006), available to the Cities through the Combined Transportation Funding Programs (CTFP). A list of the improvements included in Strategy A is provided as Attachment A hereto.

b. Utilize the renewed Measure M Signal Synchronization Program and other CTFP programs as funding sources for implementation of the roadway improvements included in Strategy A.

2.2 Cities' Responsibilities

2.2.1 Cities' Responsibilities for Strategy A Improvements

To ensure reasonable progress toward implementation of Strategy A improvements, the Cities shall:

a. Include Strategy A improvements, as defined in the *Circulation Feasibility Study and Cost Estimate for the Garfield-Gisler Crossing Over the Santa Ana River* (LSA, June 2006), in their Capital Improvement Programs. All projects that emanate from Strategy A shall be considered multi-jurisdictional projects and shall, therefore, be eligible for additional points in OCTA's project prioritization process under the CTFP. A list of the improvements included in Strategy A is provided as Attachment A hereto.

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b. Make applications to OCTA for CTFP funding to implement Strategy A improvements. Such applications shall be supported by local match commitments consistent with the requirements of the CTFP programs from which funds are being requested.

1. Cities agree to make Strategy A projects a priority for available GMA or other interregional funding programs.

c. Implement Strategy A improvements as expeditiously as possible.

1. Cities agree to initiate Smart Street improvements on Harbor, Brookhurst, Adams and Fairview by the end of calendar year 2010. For purposes of this MOU, Smart Street improvements are defined as synchronization of traffic signals, removal of on-street parking and re-striping within existing right-of-way.

2. Cities agree to make reasonable progress on the Capital Projects by 2015, subject to funding availability. "Reasonable progress" shall be defined as inclusion of noted projects in Capital Improvement Programs (CIPs), preparation of preliminary plans, environmental studies, etc. For the purposes of this MOU, Capital Projects are defined as construction of bus turnouts, consolidation of driveways, construction of turn-pockets, street widening or bridge widening.

3. Cities agree that all Strategy A improvements shall be completed by 2020. If the Cities of Costa Mesa and Huntington Beach do not complete their portions of Strategy A improvements by end of calendar year 2020, then the Garfield-Gisler Bridge will automatically be re-instated on the MPAH as a planned facility. If the City of Fountain Valley has not completed the Strategy A improvements in their city, the Garfield-Gisler Bridge will remain designated "Right of Way Reserve" corridor until all improvements are completed.

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Section 3. Land Use and Transportation Planning and Traffic Analysis

3.1 OCTA Responsibilities

3.1.1 OCTA Responsibilities with Respect to Transportation Planning and Traffic Analysis

a. OCTA shall ensure that buildout of the Garfield-Gisler Bridge, and the eastbound and westbound approaches thereto, is not assumed in any of its transportation planning or traffic modeling activities.

b. OCTA shall ensure that implementation of the Strategy A program of projects is assumed in its transportation planning, modeling, and analysis activities.

3.2 Cities' Responsibilities

3.2.1 Land Use Planning

The Cities shall ensure that buildout of the Garfield-Gisler Bridge, and the eastbound and westbound approaches thereto, is not assumed in any of its land use planning activities.

3.2.2 Transportation Planning and Traffic Analysis

The Cities shall ensure that buildout of the Garfield-Gisler Bridge, and the eastbound and westbound approaches thereto, is not assumed in any of its transportation planning, traffic modeling, or traffic analysis activities.

Section 4. Compliance Monitoring and Reporting

4.1 OCTA Responsibilities

4.1.1 OCTA Responsibilities for Monitoring & Reporting City Compliance

a. OCTA shall monitor the Cities' compliance with the provisions of this MOU every two years through the MPAH Certification Review Process to ensure that the Cities are complying fully with the provisions of this agreement and making reasonable progress toward implementation of the Strategy A improvements. Progress reports shall be presented to the OCTA Board of Directors and the Cities every two years, at the conclusion of the review process.

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b. Upon completion of all the Strategy A improvements, and consistent with OCTA guidance for MPAH Right-of-Way Reserve corridors, OCTA in coordination with the cities shall re-evaluate traffic levels of service in the project study area to determine whether to delete, continue the reserve, or re-instate the Garfield-Gisler Bridge onto the MPAH as a planned facility.

4.2 Cities' Responsibilities

4.2.1 Cities Responsibilities for Reporting Compliance

The Cities shall provide progress reports to OCTA every two years through the MPAH Certification Review Process as a means of communicating that the provisions included herein are being implemented fully and expeditiously and that reasonable progress is being made toward implementation of the Strategy A improvements.

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Section 5. Amendment

5.1 Amendment

This MOU may be amended by the written consent of all four parties which are signatories hereto.

Richard Bagley for ATL — 12-12-06

THE ORANGE COUNTY TRANSPORTATION AUTHORITY — (Date)

12-9-06

MAYOR, CITY OF COSTA MESA — (Date)

12.5.2006 (

MAYOR, CITY OF FOUNTAIN VALLEY — Date)

11-30-06 (

MAYOR, CITY OF HUNTINGTON BEACH — Date)

Introduction

Through its General Plan Circulation Element, each of the cities within the Garfield/Gisler Bridge Crossing Study Area has established traffic level of service (LOS) D or better as representative of acceptable operating conditions on roadways within its jurisdiction. The Garfield/Gisler Study Area currently experiences significant traffic delay at several locations. In addition, the OCTAM model predicts that several intersections in the project study area will operate below LOS D in the Year 2030 if no improvements are made. To help the cities achieve and/or maintain LOS D operations, where feasible, throughout the project study area, Smart Street and Bridge Widening Strategy A includes a list of improvements to offset the traffic impacts associated with projected growth in traffic volumes. That program of projects is presented below.

One of the key concepts included in the "Consensus MOU[2]" is that each of the cities within the Garfield/Gisler Bridge Crossing Study Area will make "reasonable progress" toward implementing the improvements included in Smart Street and Bridge Widening Strategy A. The intent of this concept is that the cities will, individually and collectively, make reasonable efforts to implement the proposed improvement(s) before traffic levels of service fall below the cities' LOS D standard at any of the locations included in the Smart Street and Bridge Widening Strategy A program of projects.

It should be noted that although the Smart Street and Bridge Widening Strategy A program of projects is specific, it is not meant to be prescriptive. If a city is able to identify an alternative traffic flow improvement which meets the overall objective of achieving and/or maintaining LOS D at any location within the study area, then that improvement shall be considered an acceptable alternative and shall be implemented as a substitute solution to the original recommendation.

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[2] *i.e.,* the "Memorandum of Understanding among Cities of Costa Mesa, Fountain Valley and Huntington Beach and the Orange County Transportation Authority Regarding Agency Responsibilities for Implementing the Consensus Recommendation for the Garfield/Gisler Bridge Crossing Over the Santa Ana River", October 27, 2006.

City of Costa Mesa

CM-1 Implement and maintain synchronized traffic signals along Harbor Boulevard between I-405 and Adams Ave.

CM-2 Implement and maintain synchronized traffic signals along Fairview Road between I-405 and Adams Avenue.

CM-3 Implement and maintain synchronized traffic signals along Adams Avenue between the Santa Ana River and Fairview Road; coordinate cross-jurisdictional traffic synchronization with the City of Huntington Beach.

CM-4 Install a bus turnout at the existing bus stop at northbound Harbor Boulevard at Adams Avenue.

CM-5 Install a bus turnout at the existing bus stop at northbound Harbor Boulevard at MacArthur Boulevard.

CM-6 Consolidate driveways on the northbound side of Harbor Boulevard at Adams Avenue.

CM-7 Modify the existing traffic signal at W. Mesa Verde Drive/Adams Avenue to provide a northbound right-turn overlap with the westbound left-turn phase.

CM-8 Maintain the existing northbound and southbound split phase at Hyland Avenue/ MacArthur Boulevard. Re-stripe the northbound approach to provide dual left-turn lanes, one shared left-through lane, and one right-turn lane.

CM-9 Add a fourth through lane in the northbound approach Harbor Boulevard/Gisler Avenue.[3]

CM-10 Add a third northbound left-turn lane at Harbor Boulevard/Adams Avenue, creating triple 200-foot northbound turn lanes with a 120-foot bay taper. Add a southbound right-turn lane for 150 feet with a 90-foot bay taper. Convert the fourth southbound through lane into a shared through-right lane. Add a third eastbound left-turn lane, creating triple 350-foot eastbound left-turn lanes with a 120-foot bay taper.

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CM-11 Modify the existing traffic signal at Fairview Road/Baker Avenue to provide a northbound right-turn overlap with the westbound left-turn phase.

City of Fountain Valley

FV-1 Implement and maintain synchronized traffic signals along Brookhurst Street between Ellis Avenue and Garfield Avenue; coordinate cross-jurisdictional traffic synchronization with the City of Huntington Beach.

FV-2 Under the lead of the County of Orange or the Orange County Transportation Authority and in coordination with the cities of Costa Mesa and Santa Ana, widen the Talbert Avenue/MacArthur Boulevard Bridge over the Santa Ana River from four to six lanes.

FV-3 Remove on-street parking on northbound Brookhurst Street between Ellis Avenue and Garfield Avenue.

FV-4 Modify the existing traffic signal at Ward Street/Talbert Avenue to provide a northbound right-turn overlap with the westbound left-turn phase.

FV-5 Under the lead of Caltrans or the Orange County Transportation Authority, reconstruct the westbound right-turn lane at I-405 Southbound Ramp/Ellis Avenue as a channelized free right-turn lane onto the I-405 southbound on-ramp. Eliminate the eastbound left-turn movements by constructing a dedicated eastbound through lane that becomes a slip on-ramp to southbound I-405.[4]

FV-6 Reconstruct the northbound right-turn lane on Newhope Street as a channelized free right-turn lane from to eastbound Talbert Avenue (or a City-defined alternative which would achieve LOS D or better in the year 2030).

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[3] Improvements to this intersection are already planned and funded.

[4] These improvements will be most effective with associated ramp and mainline improvements as part of a separate effort to improve traffic flow along I-405.

City of Huntington Beach

HB-1 Implement and maintain synchronized traffic signals along Brookhurst Street between Garfield Avenue and Adams Avenue; coordinate cross-jurisdictional traffic synchronization with the City of Fountain Valley.

HB-2 Implement and maintain synchronized traffic signals along Adams Avenue between Brookhurst Street and the Santa Ana River; coordinate cross-jurisdictional traffic synchronization with the City of Costa Mesa.

HB-3 Remove on-street parking on northbound Brookhurst Street between Garfield Avenue and Adams Avenue.

HB-4 Install a bus turnout at the existing bus stop at northbound Brookhurst Street at Adams Avenue.

HB-5 Install a bus turnout at the existing bus stop at southbound Brookhurst Street at Adams Avenue.

HB-6 Consolidate driveways on the northbound and southbound sides of Brookhurst Street at Adams Avenue.

HB-7 Add a fourth through lane in the north, south, east, and westbound approaches at Brookhurst Street/Adams Avenue. Add dedicated right-turn lanes in the north and southbound approaches.

HB-8 Add a second southbound left-turn lane at Bushard Street/Adams Avenue, creating dual 200-foot southbound left-turn lanes with a 120-bay taper.

ATTACHMENT B

Alternative 1: 10’ wide thru lanes

- Geometric Plan
- Typical Cross Sections
- Proposed Striping Plan

BROOKHURST ST

ADAMS AVE

CONTINENTAL DR

PVT DWY

PROPOSED C&G

PROPOSED R/W

PROPOSED MEDIAN CURB

PROPOSED BUS TURNOUT AND RIGHT TURN POCKET

EX BUS STOP

EXISTING TRAFFIC SIGNAL

NO U-TURN

STA 193+10± LIMITS OF PROPOSED IMPROVEMENTS

STA 204+94± LIMITS OF PROPOSED IMPROVEMENTS

STA 198+00

MATCH LINE SEE BELOW LEFT

SEE ABOVE RIGHT MATCH LINE

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

LEGEND

PROPOSED IMPROVEMENTS (CURB, GUTTER, SIDEWALK, DRIVEWAYS, ETC)

PROPOSED R/W

LIMITS OF PROPOSED IMPROVEMENTS

Underground Service Alert
Call: TOLL FREE
1-800-422-4133
TWO WORKING DAYS BEFORE YOU DIG

REVISIONS

REV.	DATE	BY	DESCRIPTION	APP'V'D	REV.	DATE	BY	DESCRIPTION	APP'V'D

PREPARED BY:
HARRIS & ASSOCIATES
34 Executive Park, Suite 150
Irvine, Ca. 92614-4705
(949) 655-3900 • FAX (949) 655-3995

UTIL DIV:		
DRAWN BY:		
DESIGNED BY:		
CHECKED BY:		

PREPARED UNDER THE SUPERVISION OF:
RANDALL G. BERRY, P.E.
RCE #C44642 DATE:

REVIEWED BY:
WILLIAM F. JANUSZ
R.C.E. NO.: #C44002 DATE:

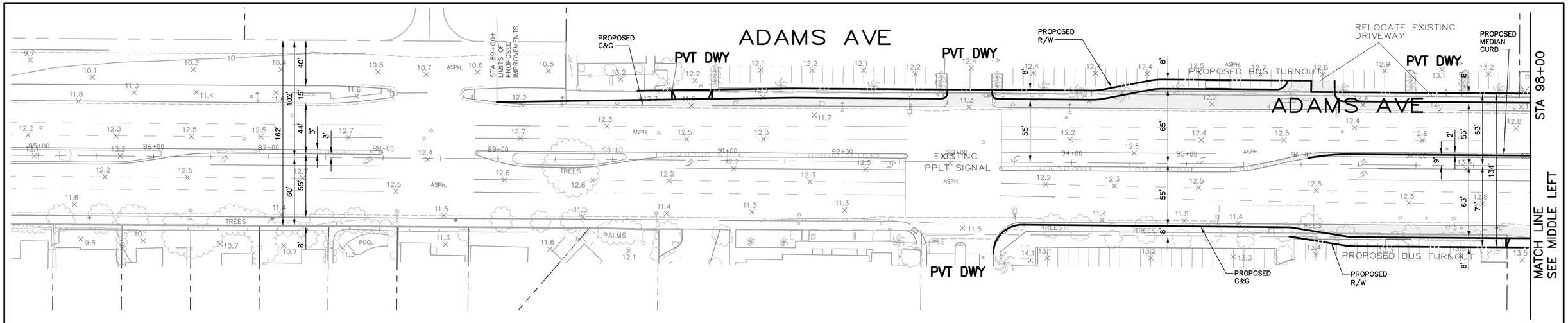
CITY OF HUNTINGTON BEACH
DEPARTMENT OF PUBLIC WORKS

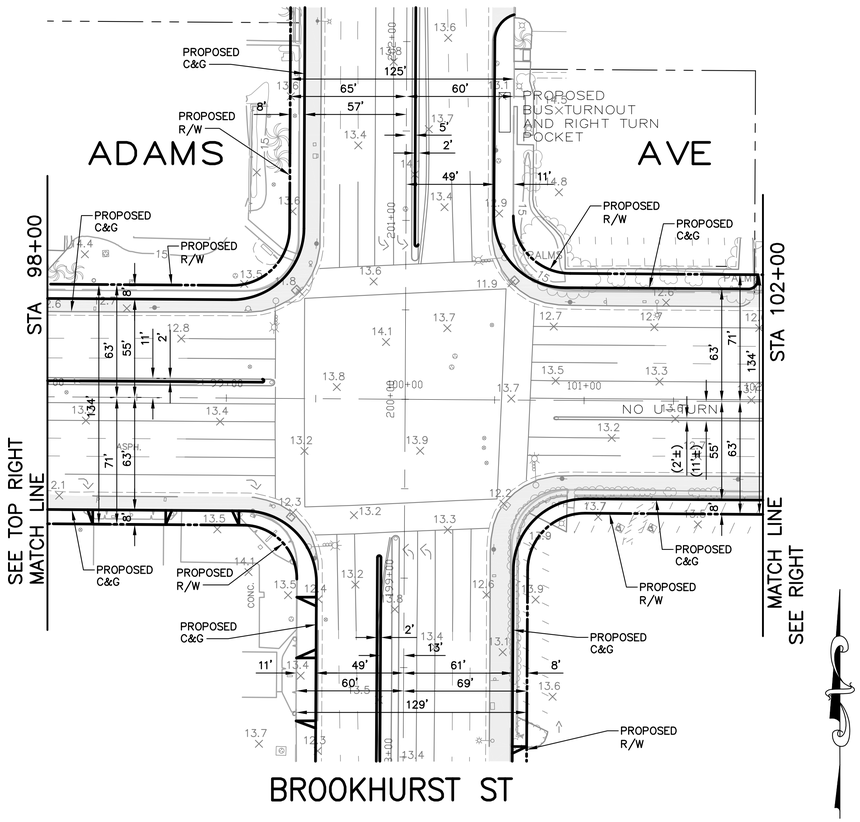
BROOKHURST STREET AND ADAMS AVENUE STREET WIDENING PROJECT

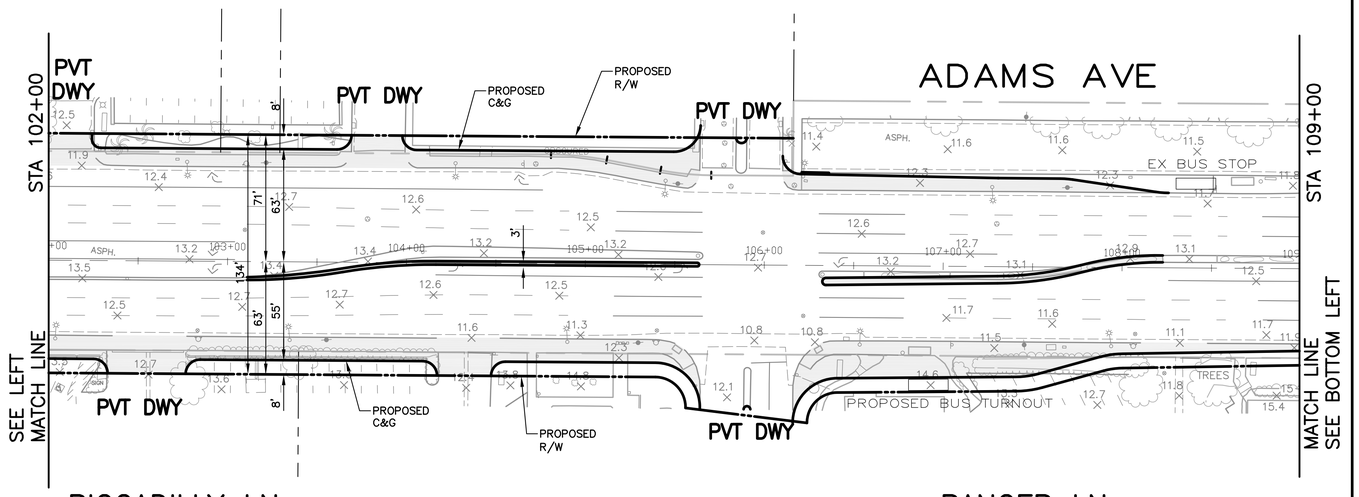
ALTERNATIVE 1 : 10' WIDE THRU LANES

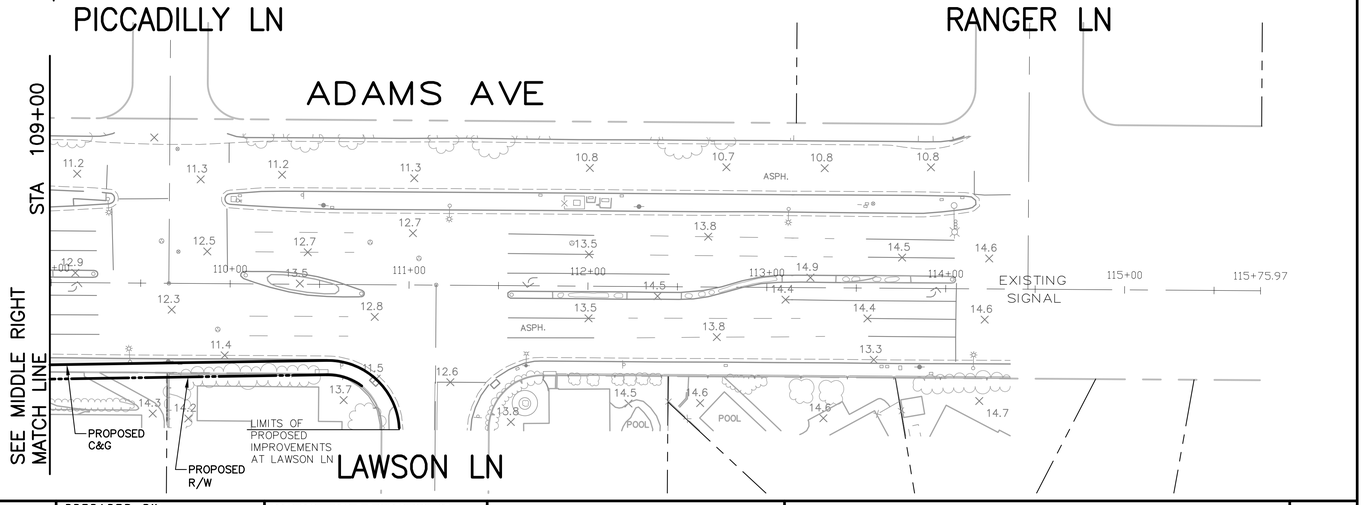
BROOKHURST STREET – GEOMETRIC PLAN

SHEET NO. 1 OF 2









LEGEND

PROPOSED IMPROVEMENTS (CURB, GUTTER, SIDEWALK, DRIVEWAYS, ETC)

PROPOSED R/W

LIMITS OF PROPOSED IMPROVEMENTS

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

Underground Service Alert

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TWO WORKING DAYS BEFORE YOU DIG

REVISIONS

REV.	DATE	BY	DESCRIPTION	APP'V'D	REV.	DATE	BY	DESCRIPTION	APP'V'D

PREPARED BY:
HARRIS & ASSOCIATES
34 Executive Park, Suite 150
Irvine, Ca. 92614-4705
(949) 655-3900 • FAX (949) 655-3995

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DESIGNED BY:			
CHECKED BY:			

PREPARED UNDER THE SUPERVISION OF:

RANDALL G. BERRY, P.E.
RCE #C44642 DATE:

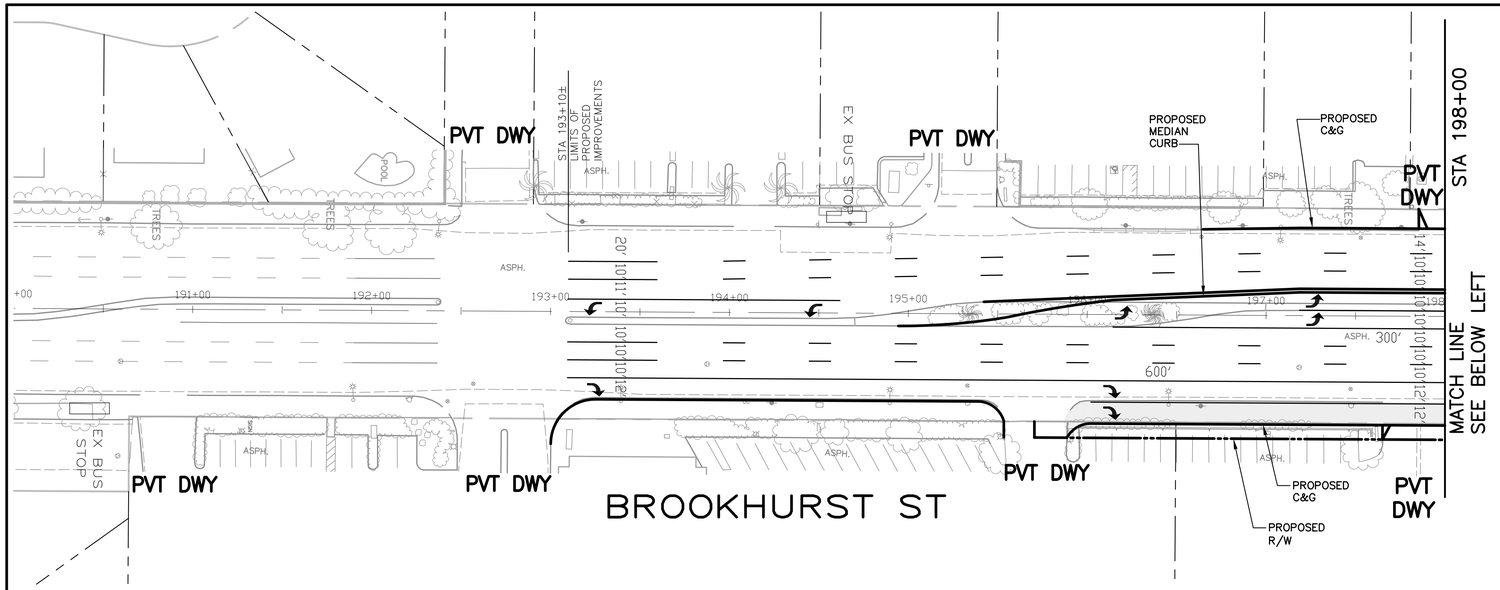
REVIEWED BY:

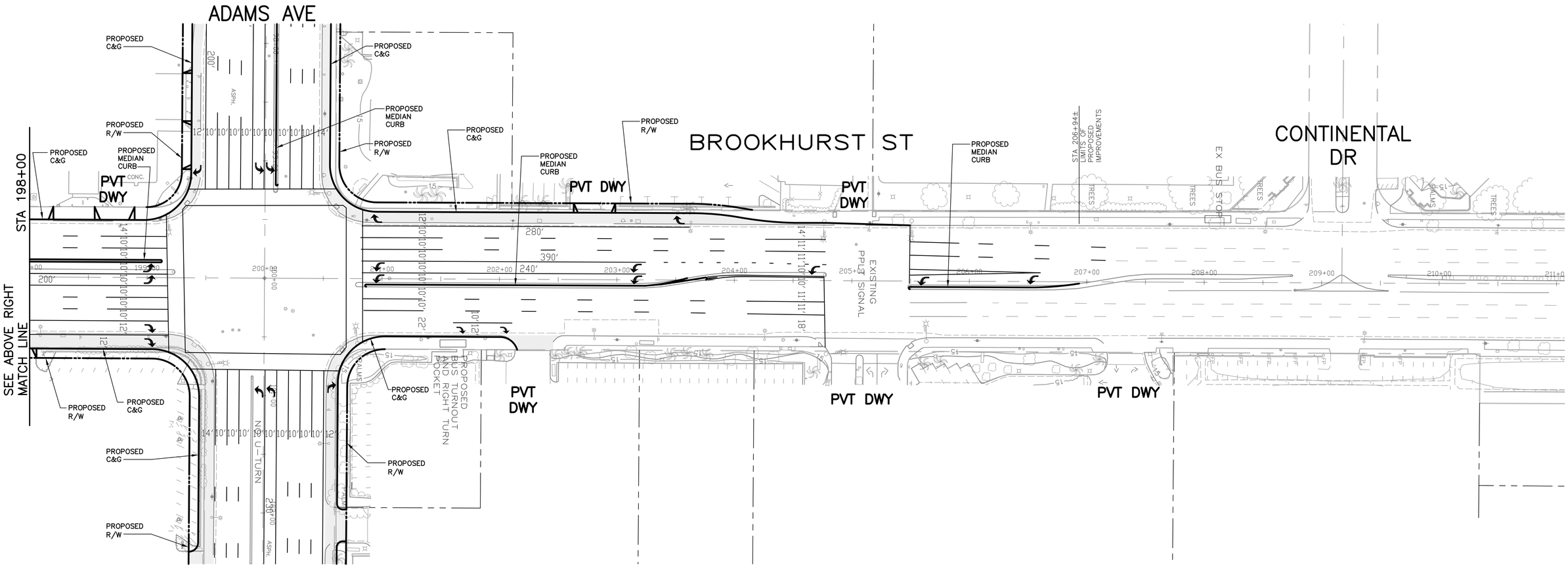
WILLIAM F. JANUSZ
R.C.E. NO.: #C44002 DATE:

CITY OF HUNTINGTON BEACH
DEPARTMENT OF PUBLIC WORKS

BROOKHURST STREET AND ADAMS AVENUE
STREET WIDENING PROJECT
ALTERNATIVE 1 : 10' WIDE THRU LANES
ADAMS AVENUE – GEOMETRIC PLAN

SHEET NO. 2 OF 2





GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

LEGEND

- PROPOSED IMPROVEMENTS (CURB, GUTTER, SIDEWALK, DRIVEWAYS, ETC)
- PROPOSED R/W
- LIMITS OF PROPOSED IMPROVEMENTS

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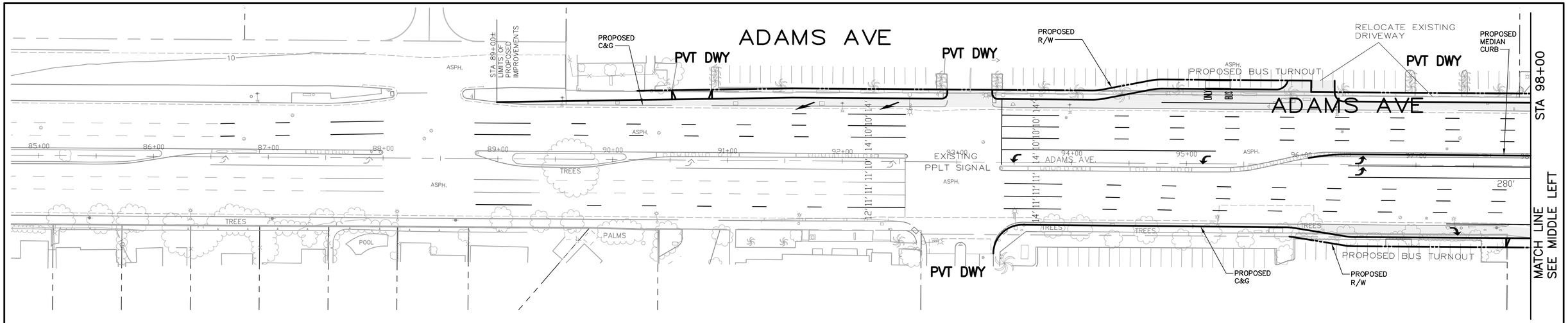
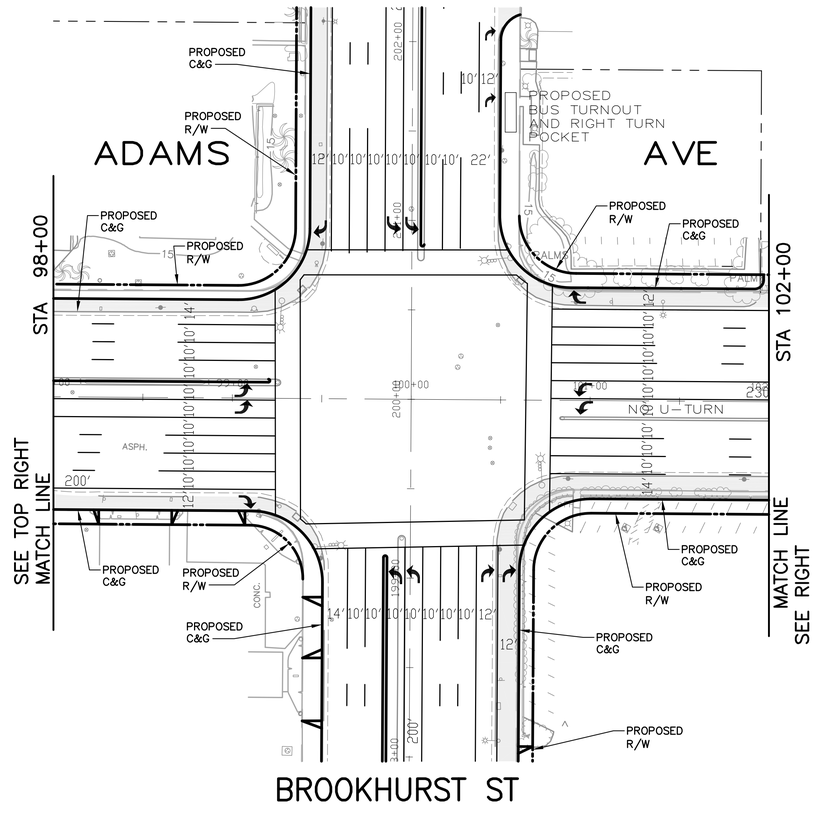
BROOKHURST STREET AND ADAMS AVENUE STREET WIDENING PROJECT

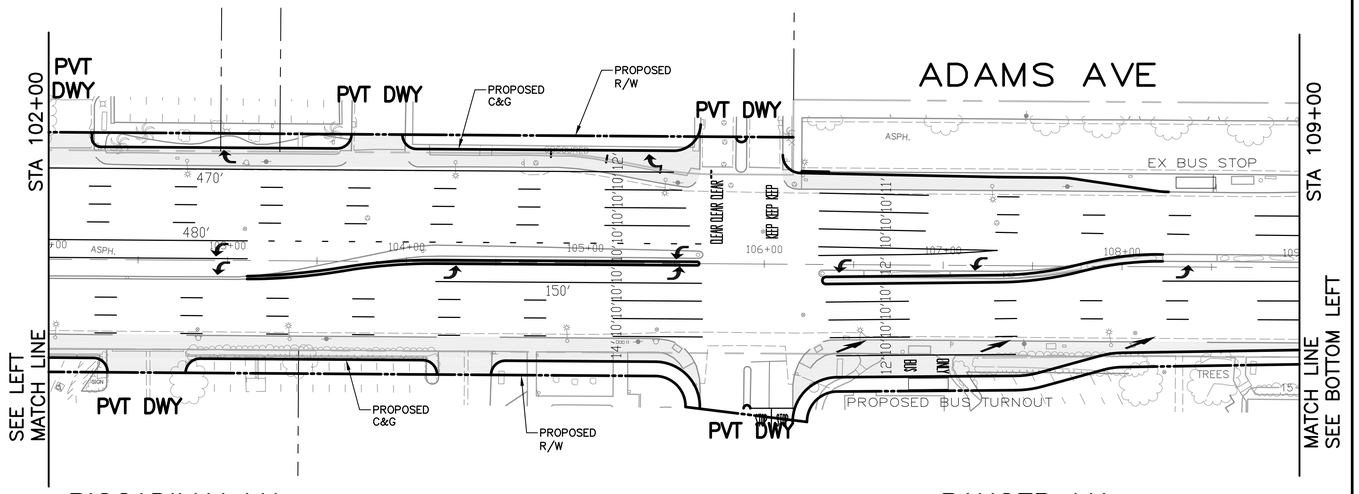
ALTERNATIVE 1 : 10' WIDE THRU LANES

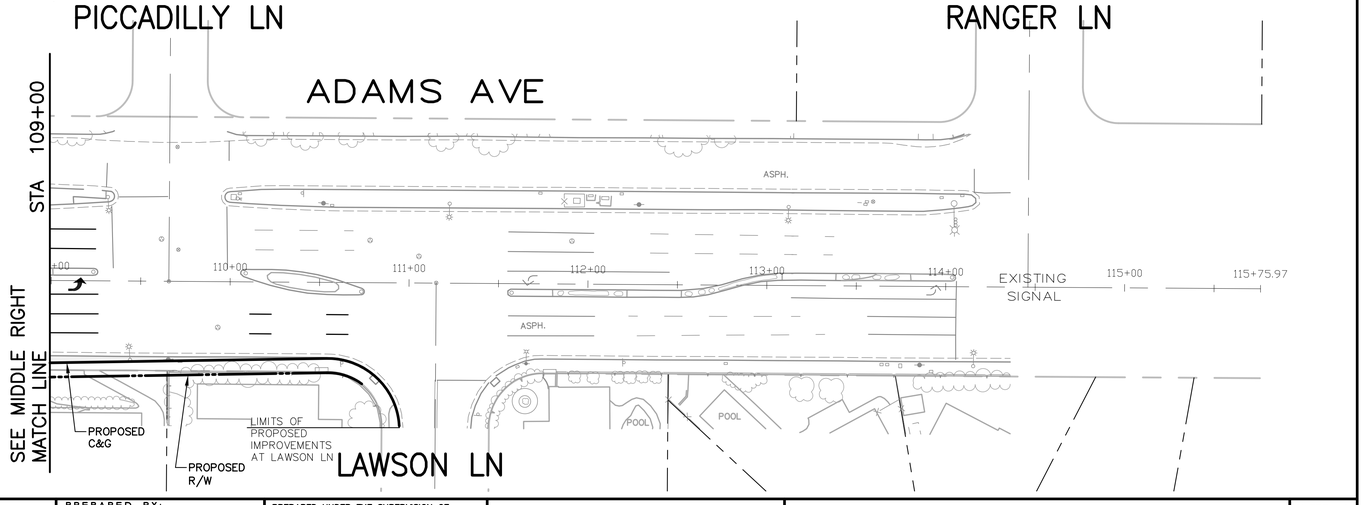
BROOKHURST STREET – PROPOSED STRIPING

SHEET NO. 1 OF 2









LEGEND

PROPOSED IMPROVEMENTS (CURB, GUTTER, SIDEWALK, DRIVEWAYS, ETC)

PROPOSED R/W

LIMITS OF PROPOSED IMPROVEMENTS

GRAPHIC SCALE

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(IN FEET)
1 inch = 40 ft.

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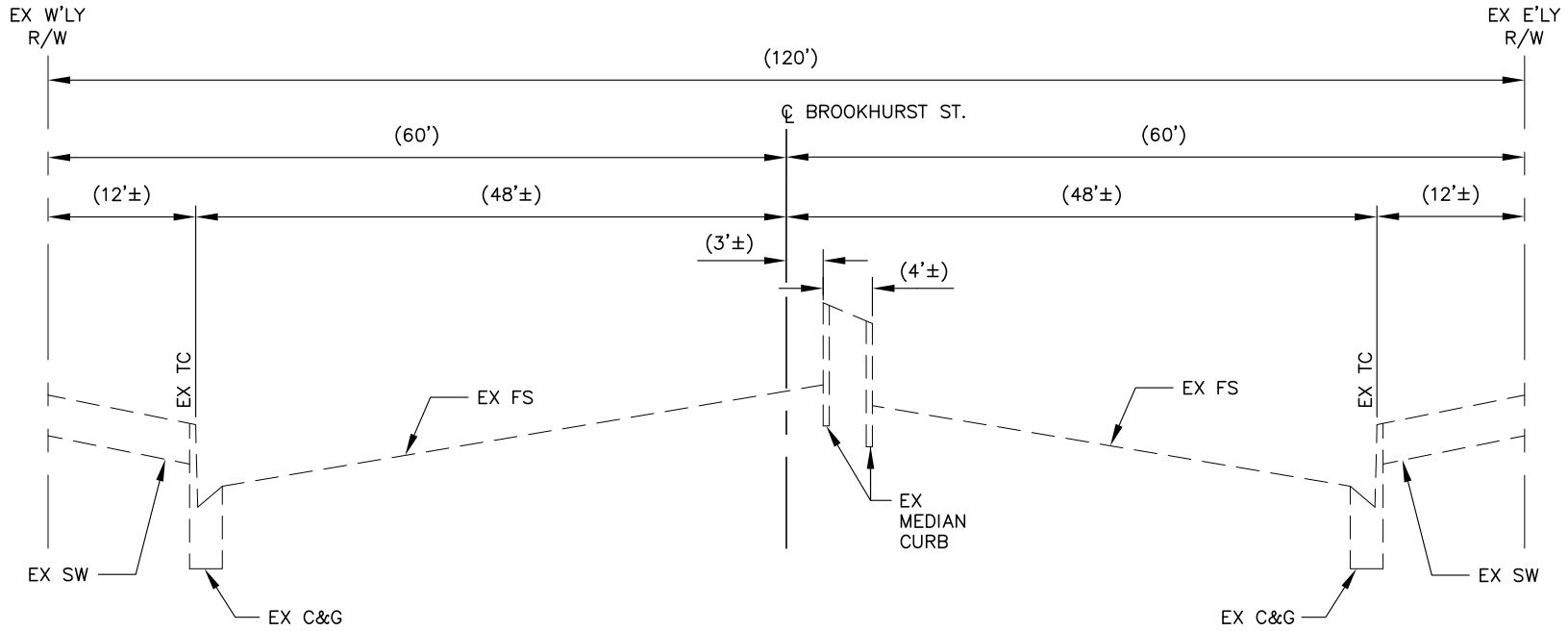
BROOKHURST STREET AND ADAMS AVENUE STREET WIDENING PROJECT

ALTERNATIVE 1 : 10' WIDE THRU LANES

ADAMS AVENUE – PROPOSED STRIPING

SHEET NO. 2 OF 2



EXISTING TYPICAL SECTION
BROOKHURST STREET

N.T.S.

ABBREVIATIONS

C&G	CURB AND GUTTER
℄ / CL	CENTERLINE
E'LY	EASTERLY
EX	EXISTING
FS	FINISHED SURFACE
N.T.S.	NOT TO SCALE
ST.	STREET
SW	SIDEWALK
TC	TOP OF CURB
W'LY	WESTERLY

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DEPARTMENT OF PUBLIC WORKS

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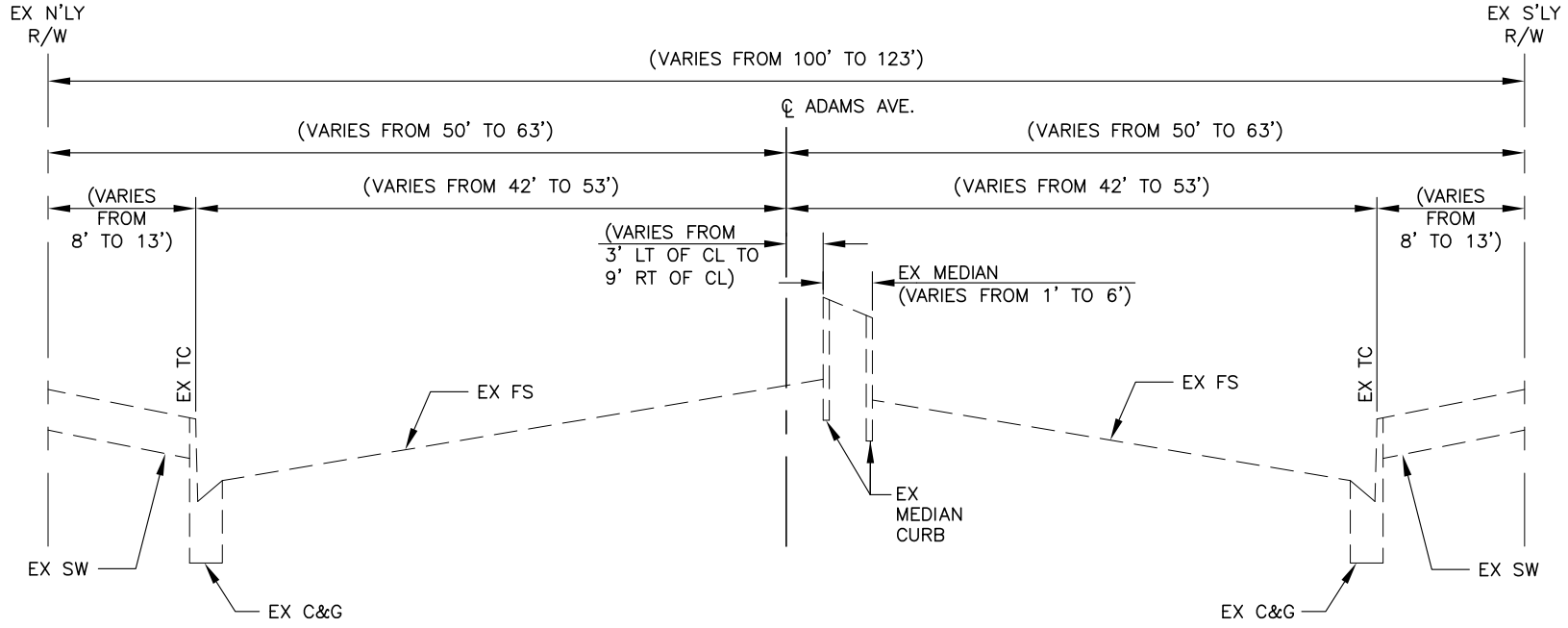
SHEET 1 OF 6



EXISTING TYPICAL SECTION
ADAMS AVENUE

N.T.S.

ABBREVIATIONS

AVE.	AVENUE
C&G	CURB AND GUTTER
℄ / CL	CENTERLINE
EX	EXISTING
FS	FINISHED SURFACE
N'LY	NORTHERLY
N.T.S.	NOT TO SCALE
S'LY	SOUTHERLY
SW	SIDEWALK
TC	TOP OF CURB

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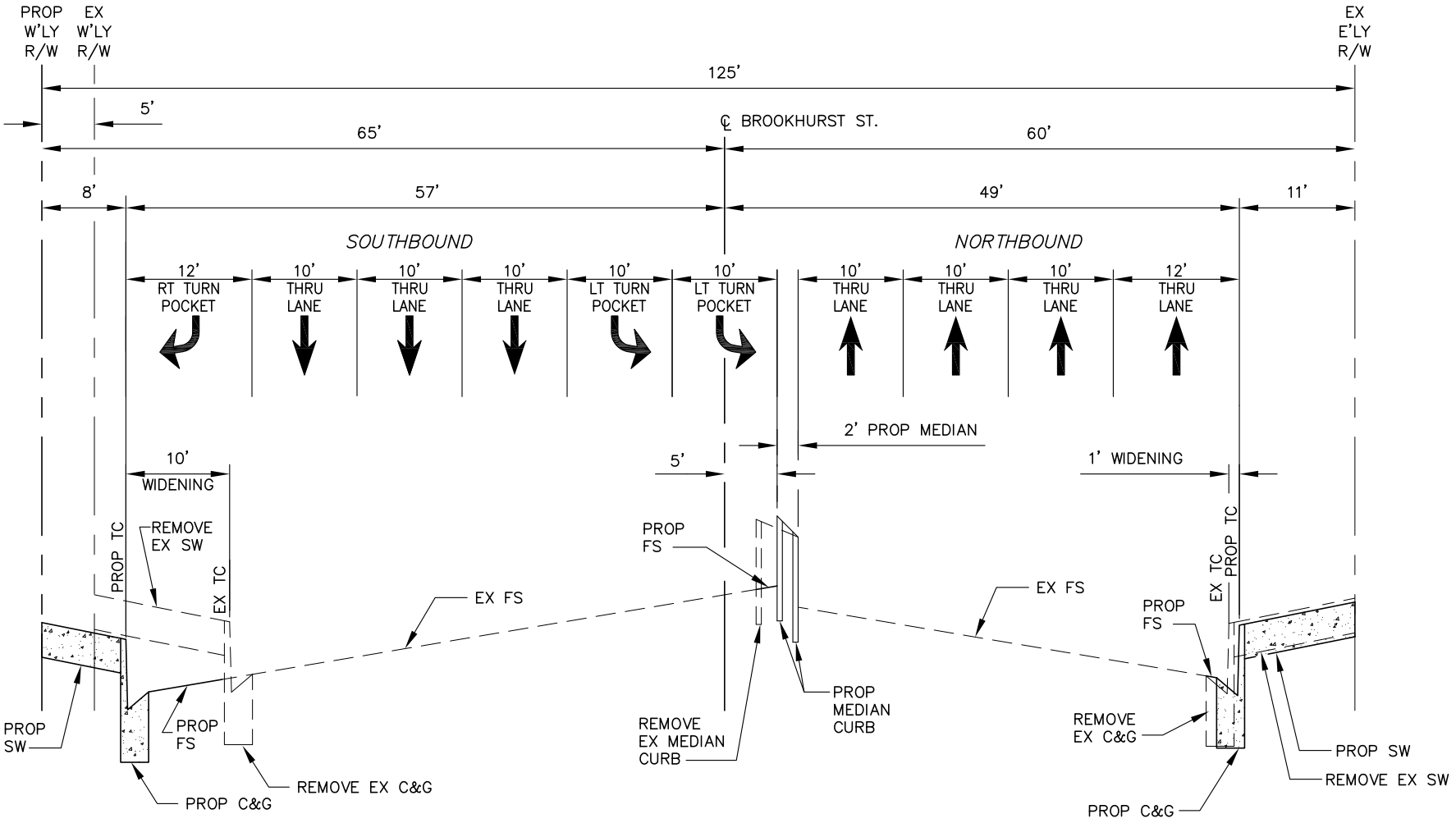

ABBREVIATIONS

C&G	CURB AND GUTTER
℄ / CL	CENTERLINE
E'LY	EASTERLY
EX	EXISTING
FS	FINISHED SURFACE
LT	LEFT
N.T.S.	NOT TO SCALE
PROP	PROPOSED
RT	RIGHT
ST.	STREET
SW	SIDEWALK
TC	TOP OF CURB
W'LY	WESTERLY

ALTERNATIVE 1
PROPOSED TYPICAL SECTION
BROOKHURST STREET

JUST NORTH OF INTERSECTION
N.T.S.

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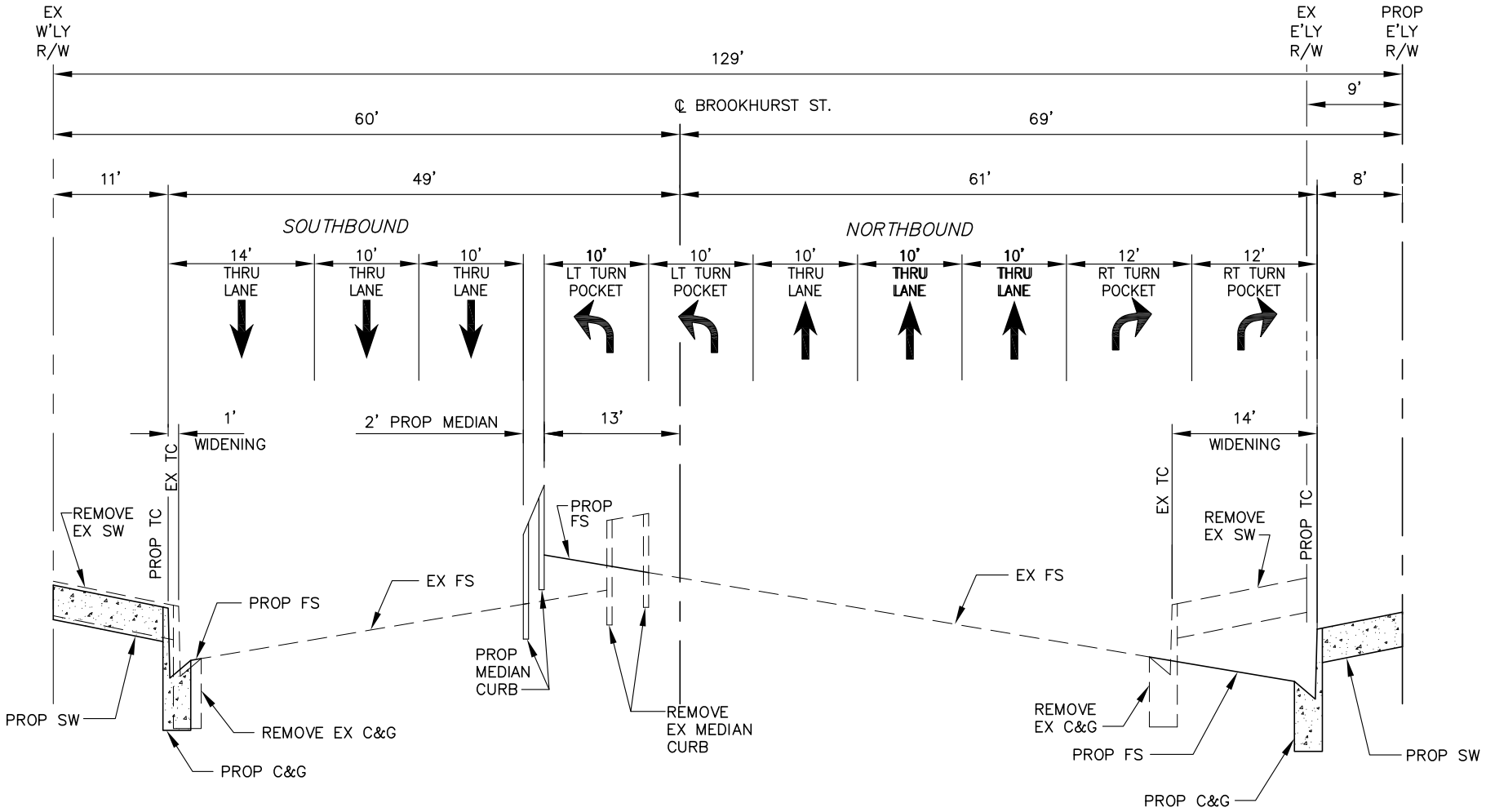

ABBREVIATIONS

C&G	CURB AND GUTTER
℄ / CL	CENTERLINE
E'LY	EASTERLY
EX	EXISTING
FS	FINISHED SURFACE
LT	LEFT
N.T.S.	NOT TO SCALE
PROP	PROPOSED
RT	RIGHT
ST.	STREET
SW	SIDEWALK
TC	TOP OF CURB
W'LY	WESTERLY

ALTERNATIVE 1
PROPOSED TYPICAL SECTION
BROOKHURST STREET

JUST SOUTH OF INTERSECTION
N.T.S.

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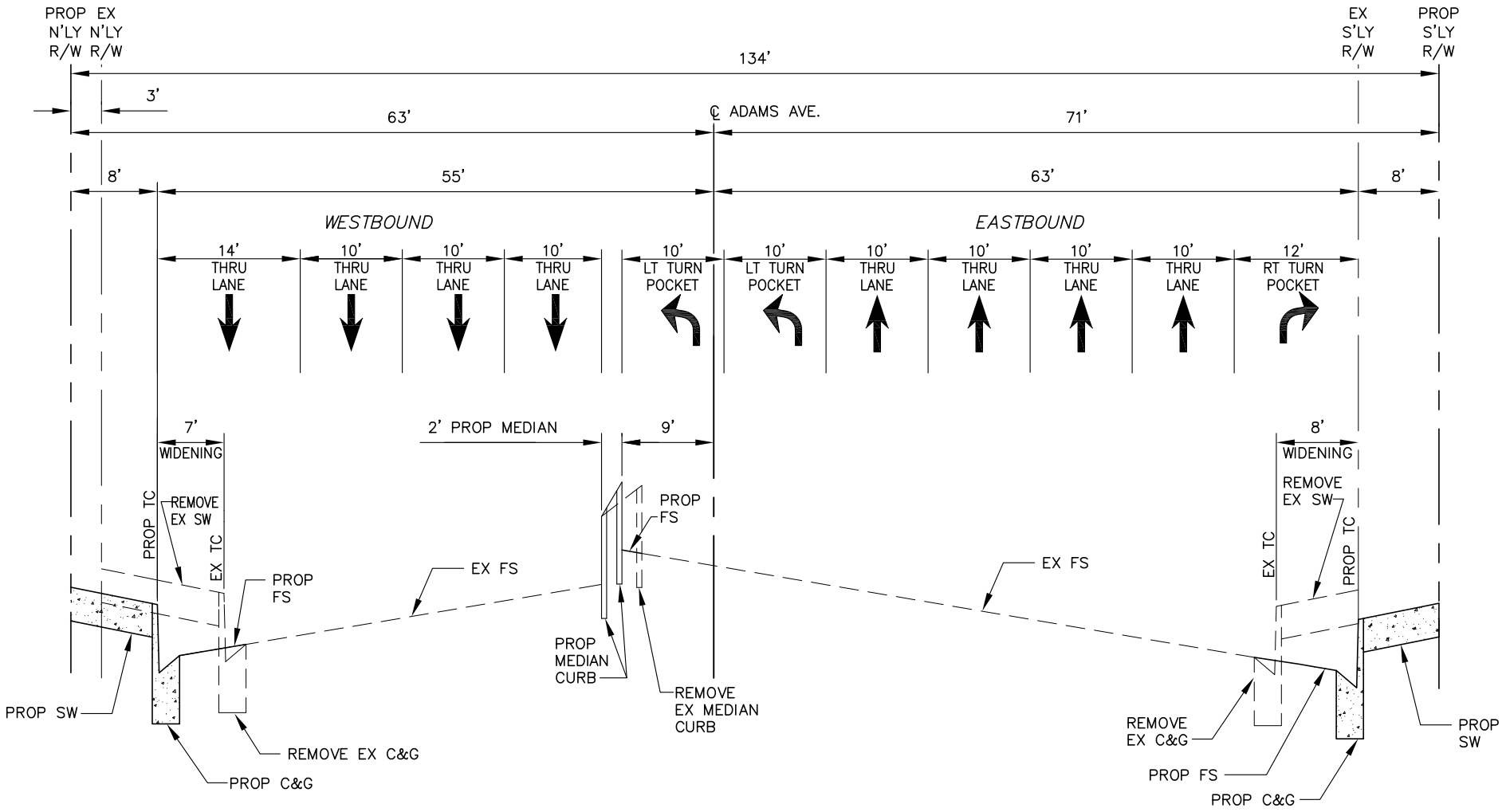

ABBREVIATIONS

AVE.	AVENUE
C&G	CURB AND GUTTER
℄ / CL	CENTERLINE
EX	EXISTING
FS	FINISHED SURFACE
LT	LEFT
N'LY	NORTHERLY
N.T.S.	NOT TO SCALE
PROP	PROP
RT	RIGHT
S'LY	SOUTHERLY
SW	SIDEWALK
TC	TOP OF CURB

ALTERNATIVE 1
PROPOSED TYPICAL SECTION
ADAMS AVENUE

JUST WEST OF INTERSECTION
N.T.S.

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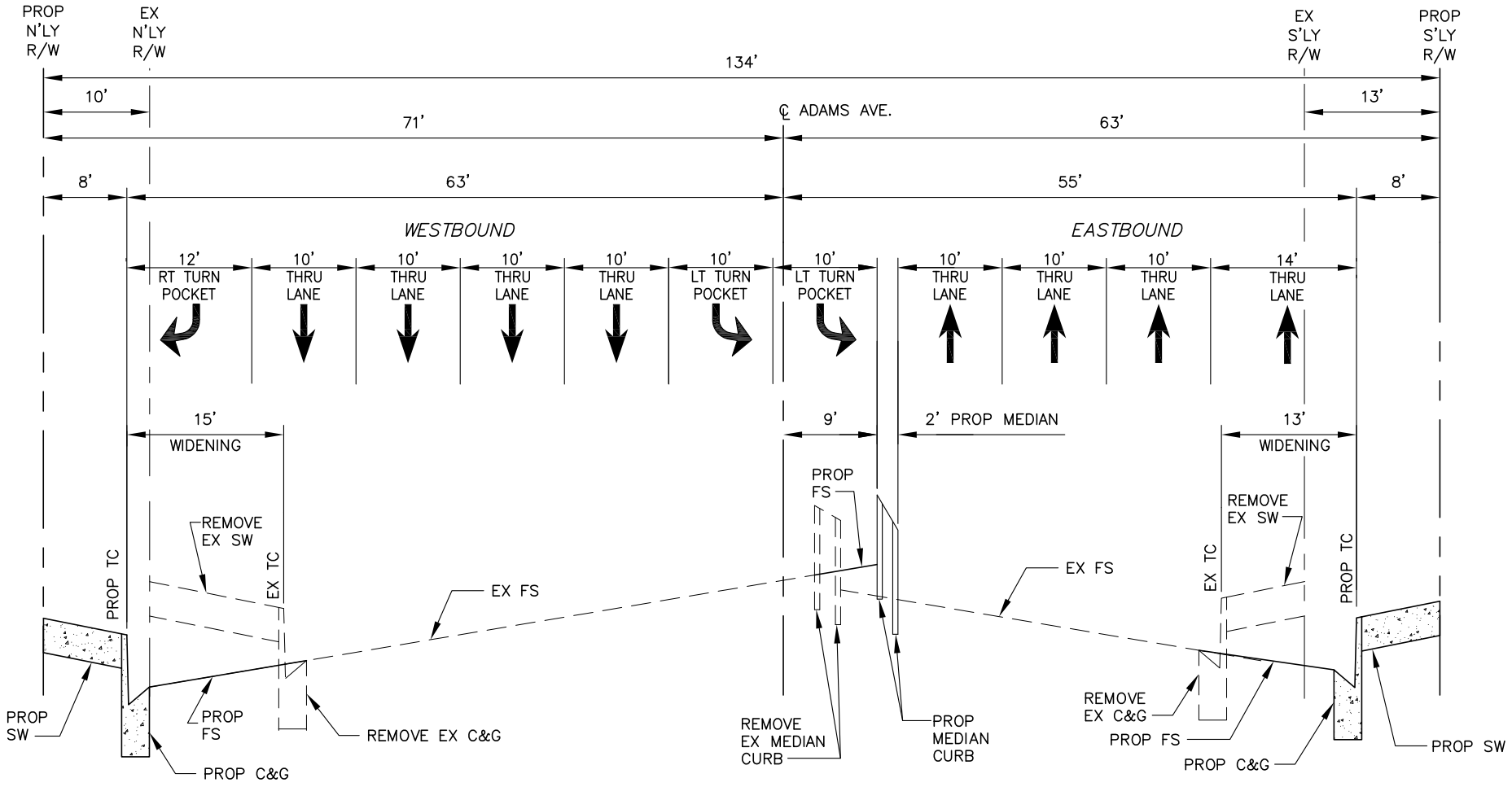

ABBREVIATIONS

AVE.	AVENUE
C&G	CURB AND GUTTER
℄ / CL	CENTERLINE
EX	EXISTING
FS	FINISHED SURFACE
LT	LEFT
N'LY	NORTHERLY
N.T.S.	NOT TO SCALE
PROP	PROP
RT	RIGHT
S'LY	SOUTHERLY
SW	SIDEWALK
TC	TOP OF CURB

ALTERNATIVE 1
PROPOSED TYPICAL SECTION
ADAMS AVENUE

JUST EAST OF INTERSECTION
N.T.S.

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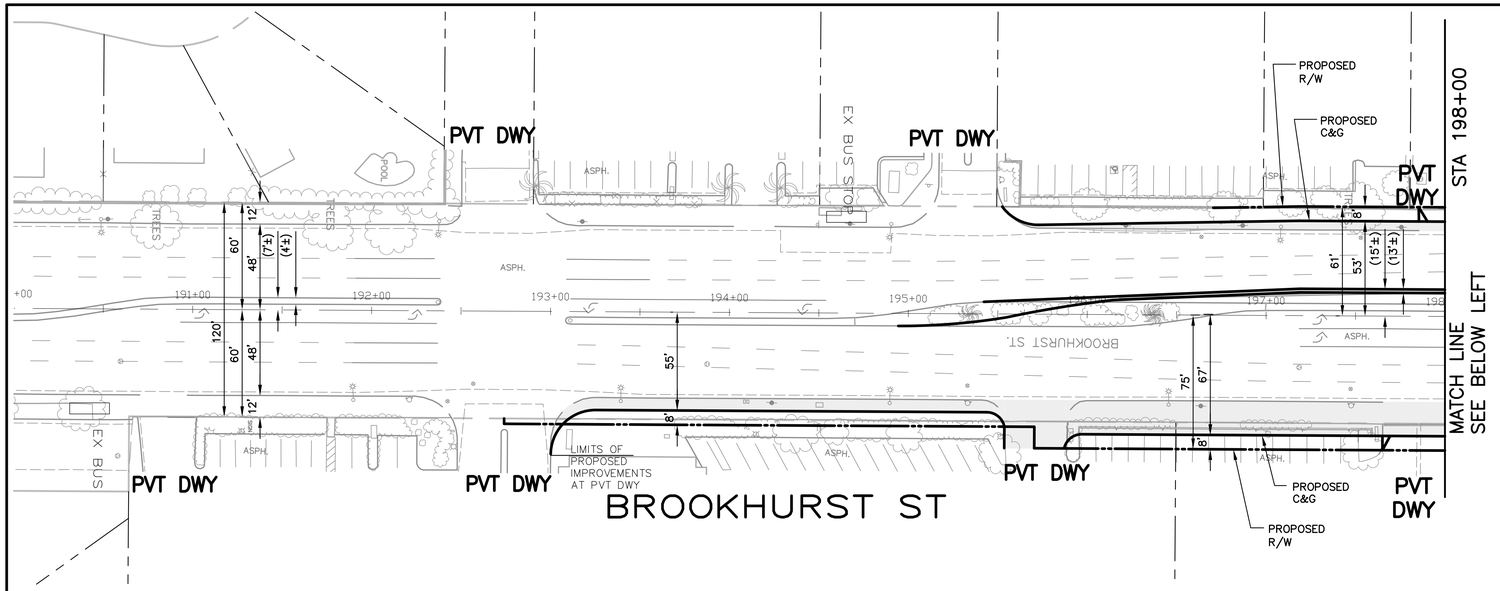
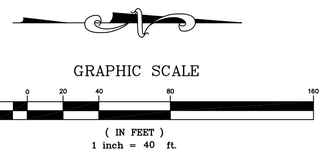
SHEET 6 OF 6

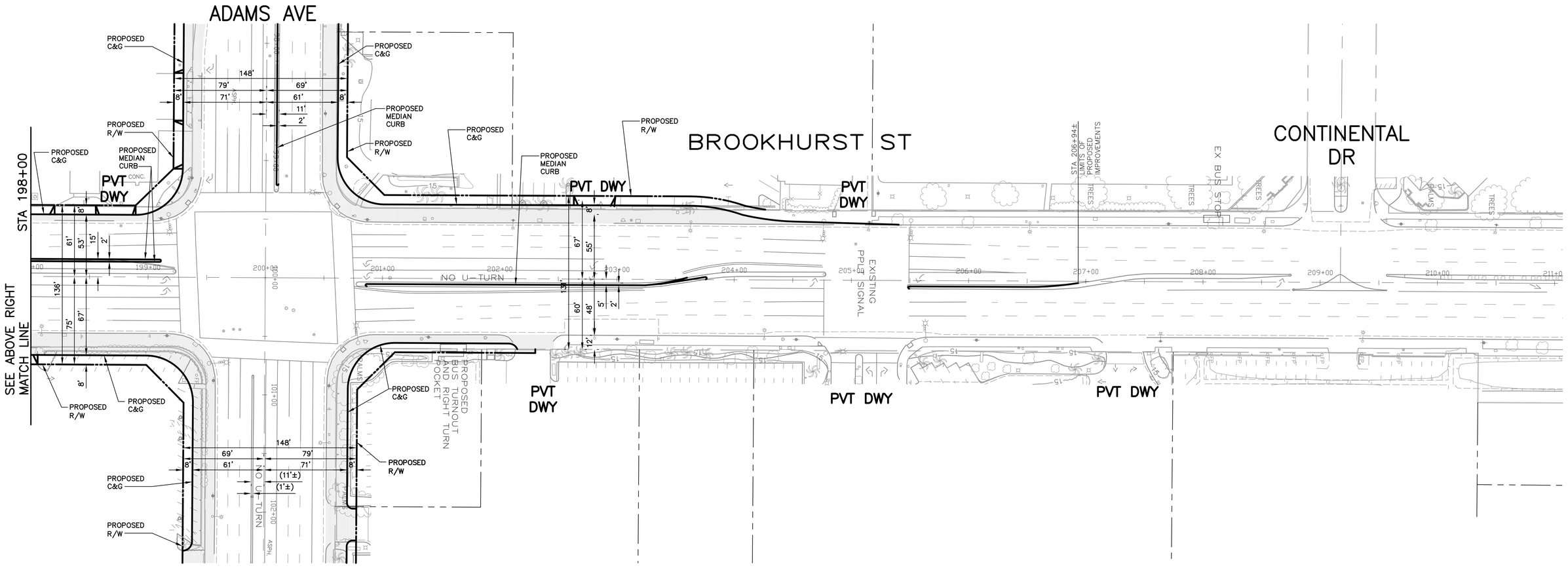
ATTACHMENT C

Alternative 2: 12’ wide thru lanes

- Geometric Plan
- Typical Cross Sections
- Proposed Striping Plan







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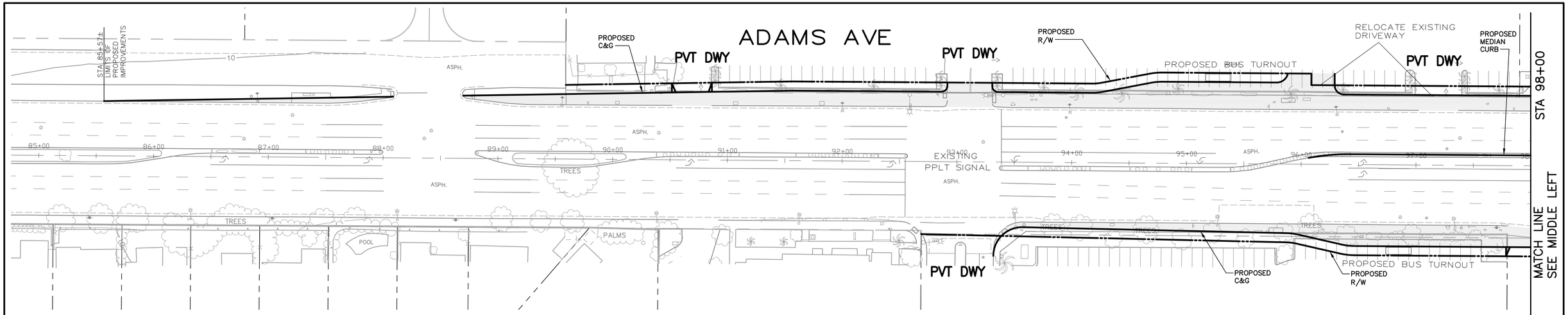
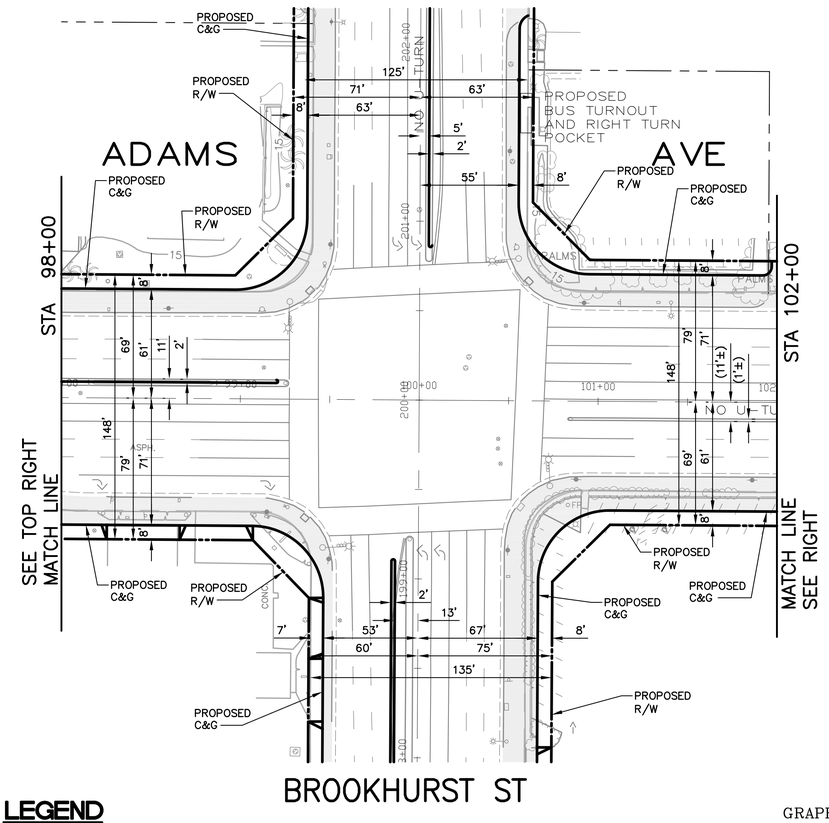
BROOKHURST STREET AND ADAMS AVENUE STREET WIDENING PROJECT

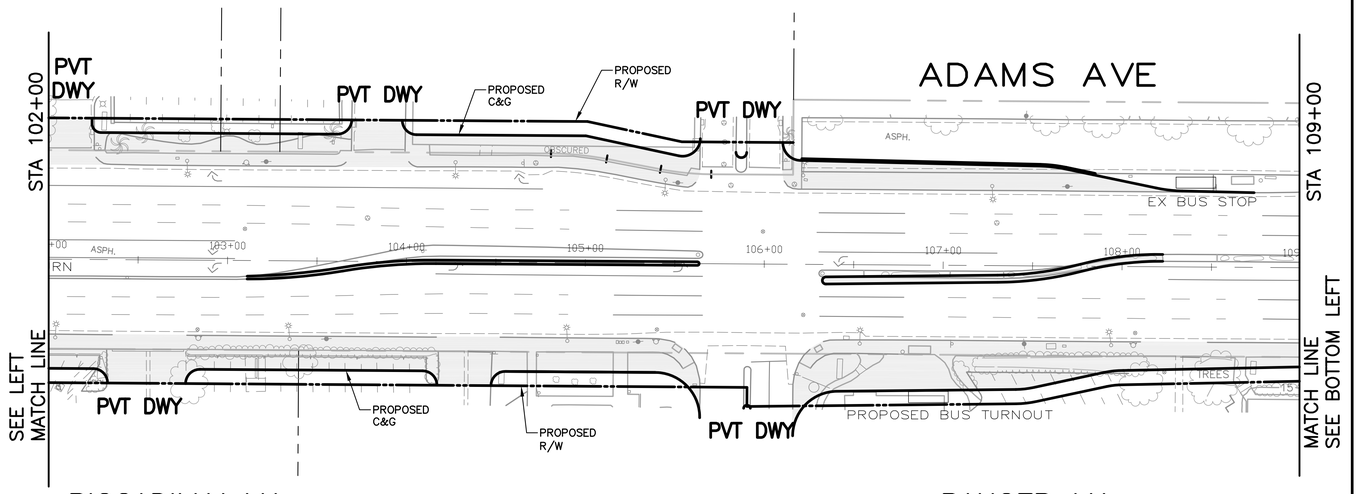
ALTERNATIVE 2 : 12' WIDE THRU LANES

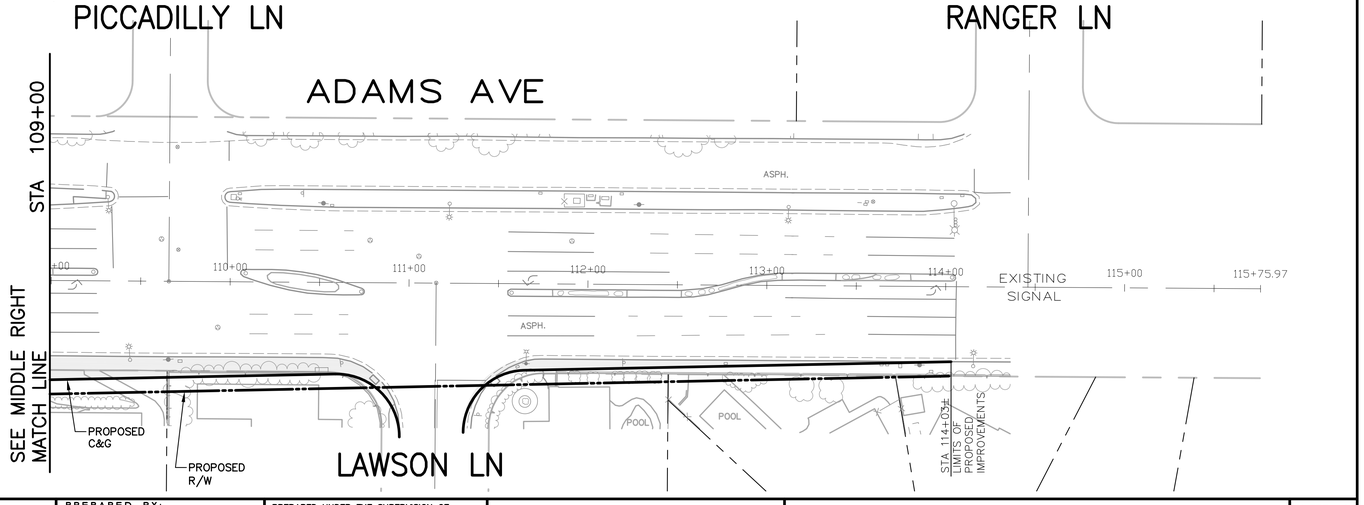
BROOKHURST STREET – GEOMETRIC PLAN

SHEET NO. 1 OF 2









LEGEND

PROPOSED IMPROVEMENTS (CURB, GUTTER, SIDEWALK, DRIVEWAYS, ETC)

PROPOSED R/W

LIMITS OF PROPOSED IMPROVEMENTS

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

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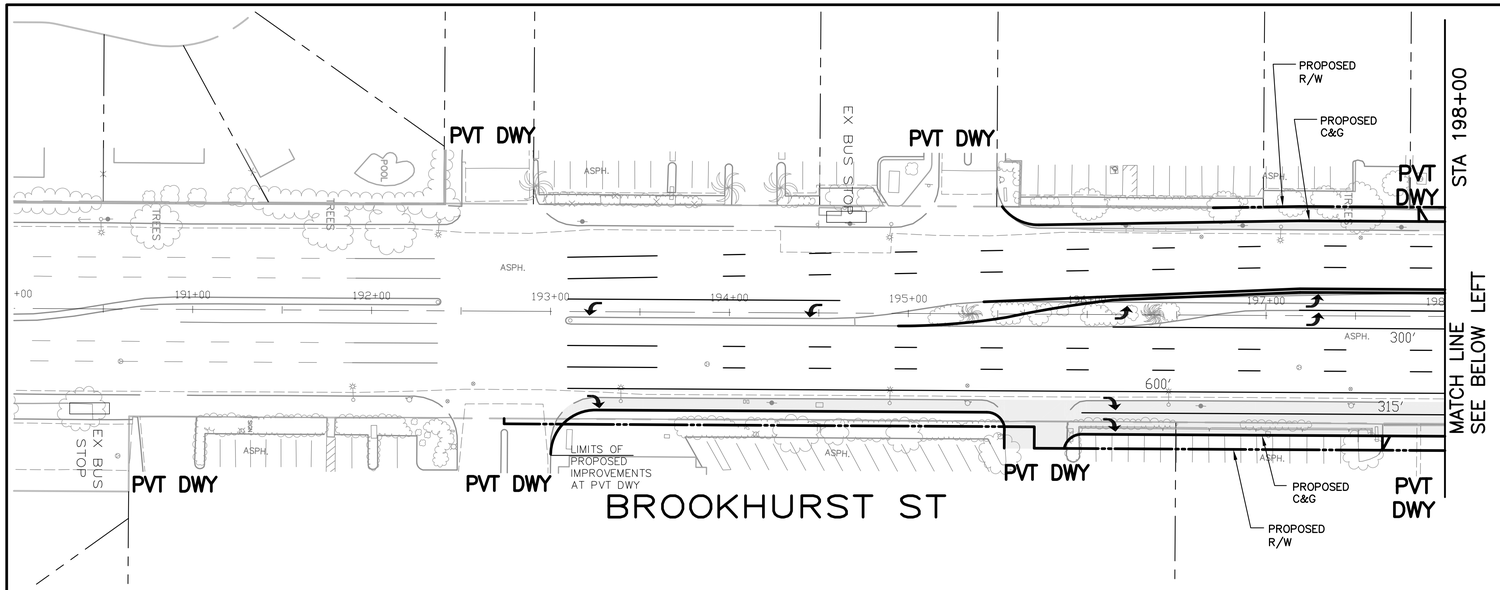
BROOKHURST STREET AND ADAMS AVENUE STREET WIDENING PROJECT

ALTERNATIVE 2 : 12' WIDE THRU LANES

ADAMS AVENUE – GEOMETRIC PLAN

SHEET NO. 2 OF 2



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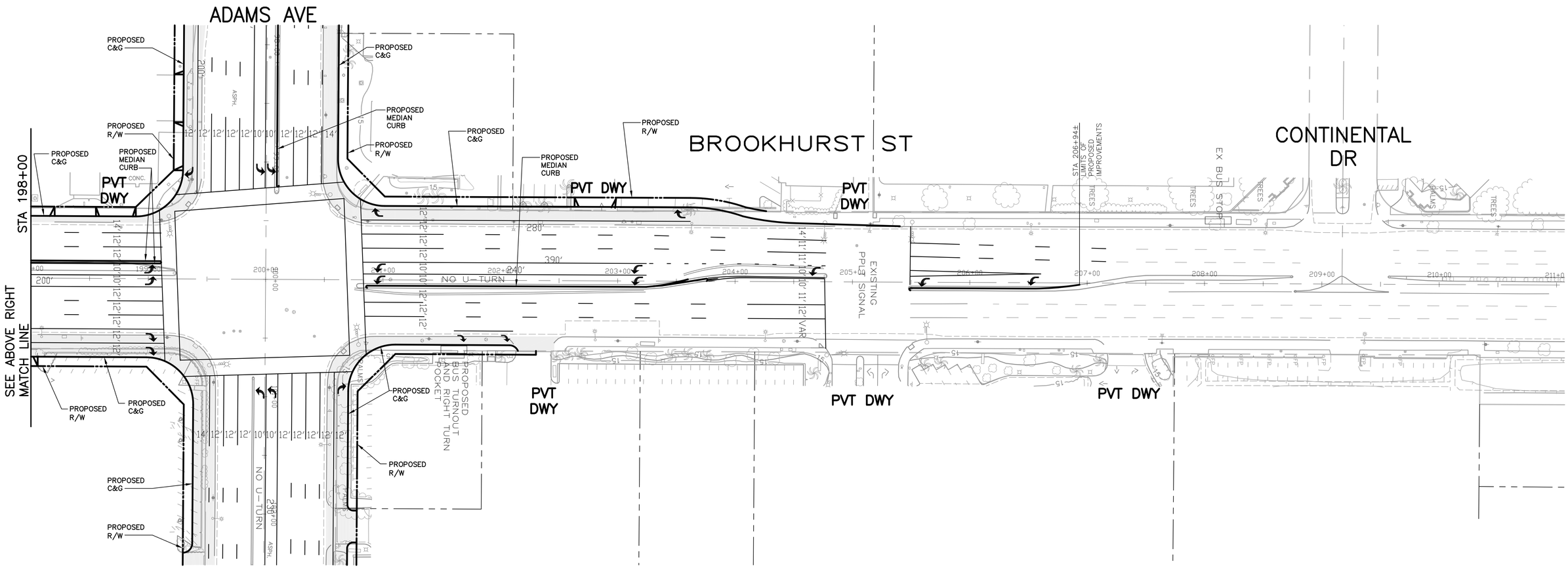

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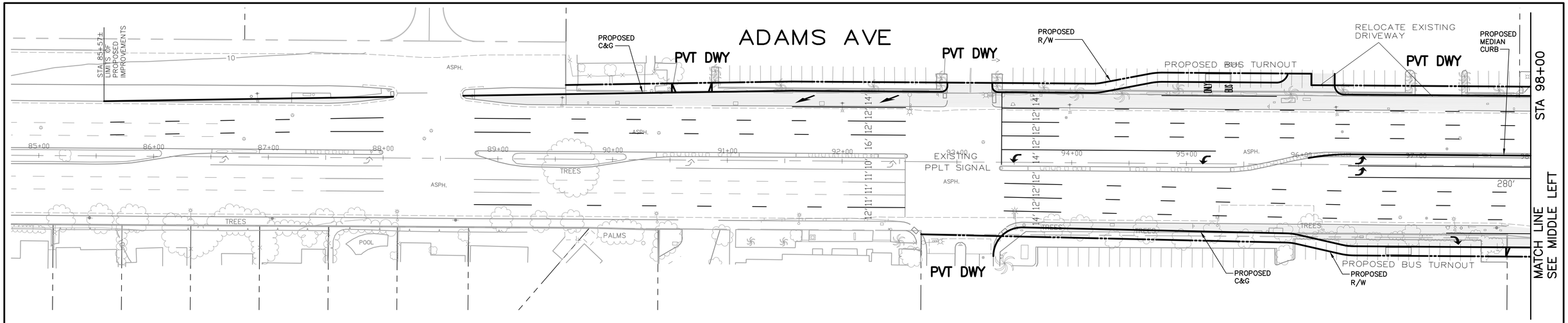
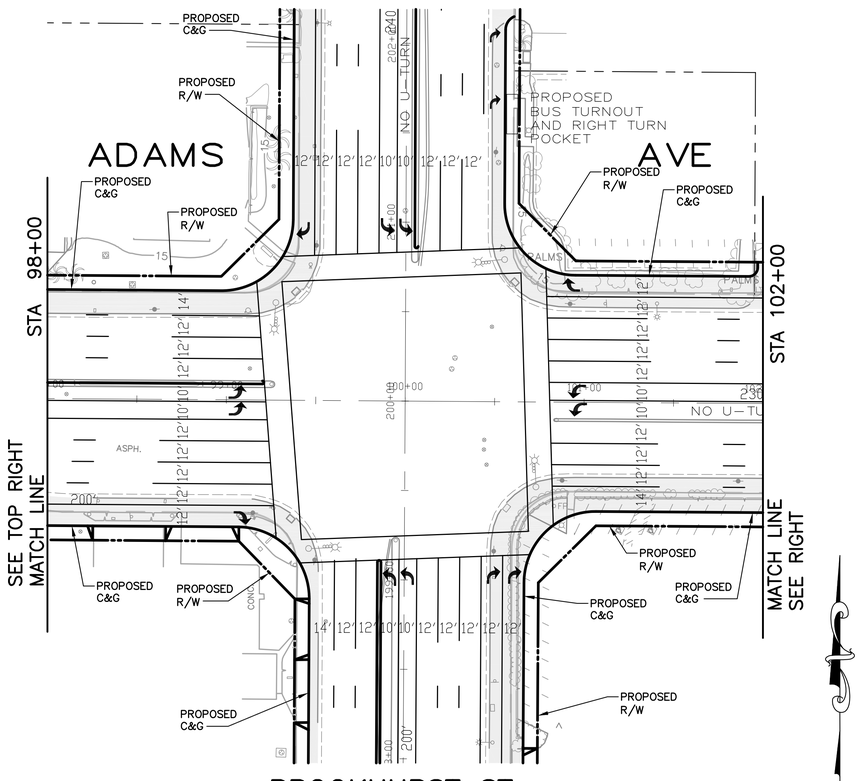
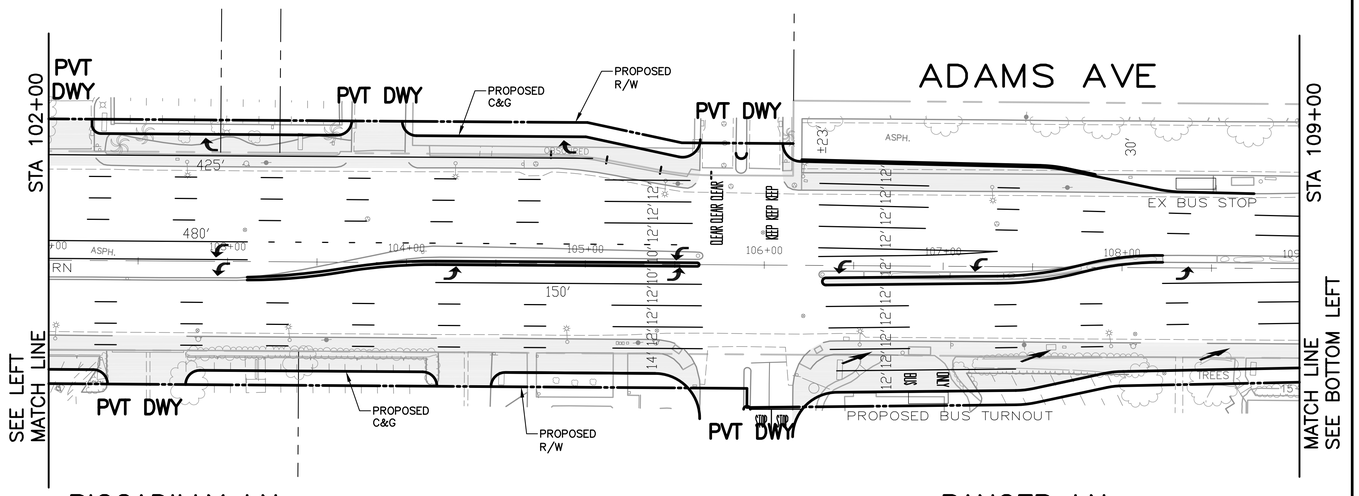
ALTERNATIVE 2 : 12' WIDE THRU LANES

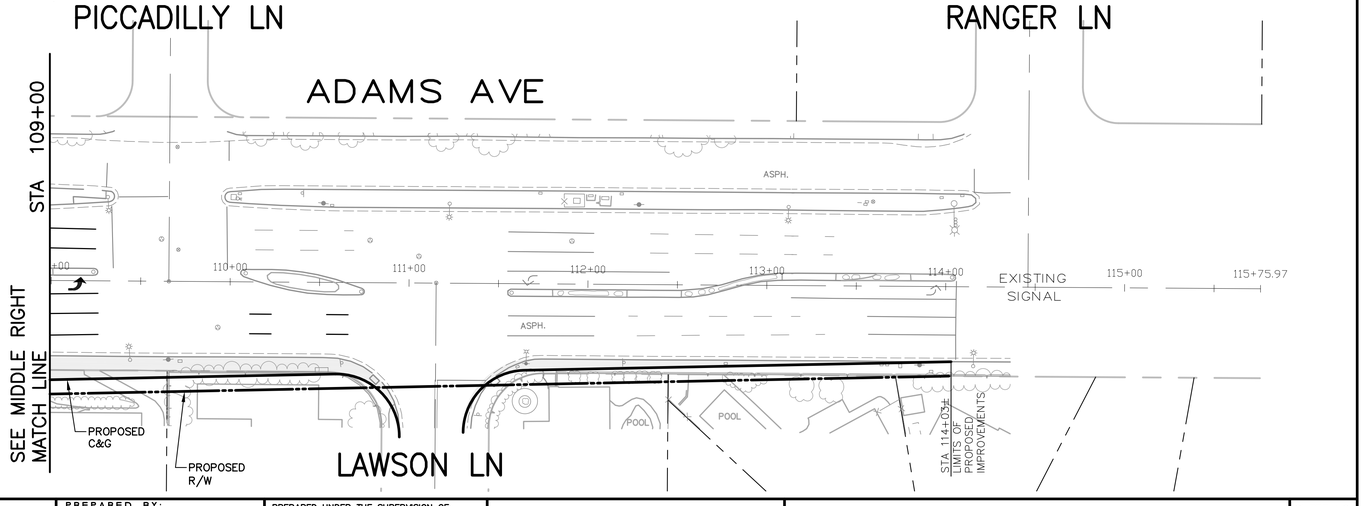
BROOKHURST STREET – PROPOSED STRIPING

SHEET NO. 1 OF 2









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PROPOSED IMPROVEMENTS (CURB, GUTTER, SIDEWALK, DRIVEWAYS, ETC)

PROPOSED R/W

LIMITS OF PROPOSED IMPROVEMENTS

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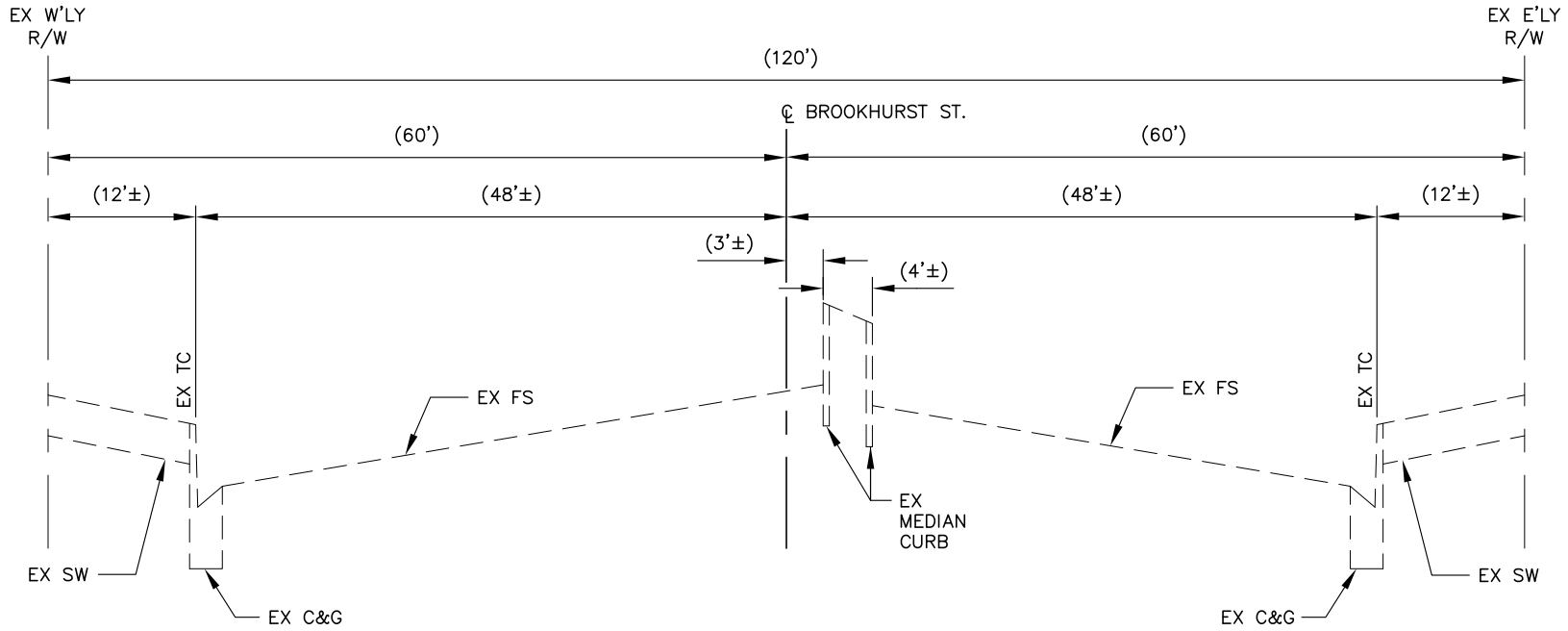
BROOKHURST STREET AND ADAMS AVENUE STREET WIDENING PROJECT

ALTERNATIVE 2 : 12' WIDE THRU LANES

ADAMS AVENUE – PROPOSED STRIPING

SHEET NO. 2 OF 2



EXISTING TYPICAL SECTION
BROOKHURST STREET

N.T.S.

ABBREVIATIONS

C&G	CURB AND GUTTER
℄ / CL	CENTERLINE
E'LY	EASTERLY
EX	EXISTING
FS	FINISHED SURFACE
N.T.S.	NOT TO SCALE
ST.	STREET
SW	SIDEWALK
TC	TOP OF CURB
W'LY	WESTERLY

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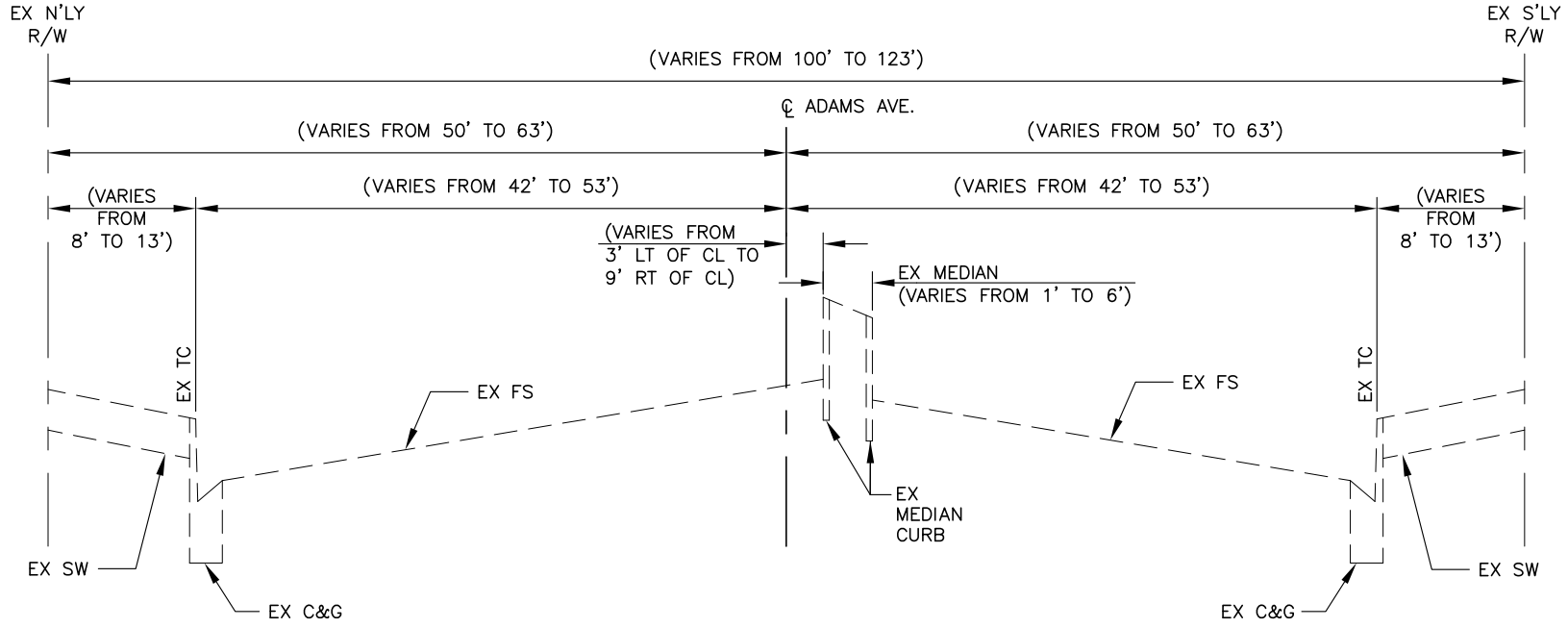
SHEET 1 OF 6



EXISTING TYPICAL SECTION
ADAMS AVENUE

N.T.S.

ABBREVIATIONS

AVE.	AVENUE
C&G	CURB AND GUTTER
℄ / CL	CENTERLINE
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FS	FINISHED SURFACE
N'LY	NORTHERLY
N.T.S.	NOT TO SCALE
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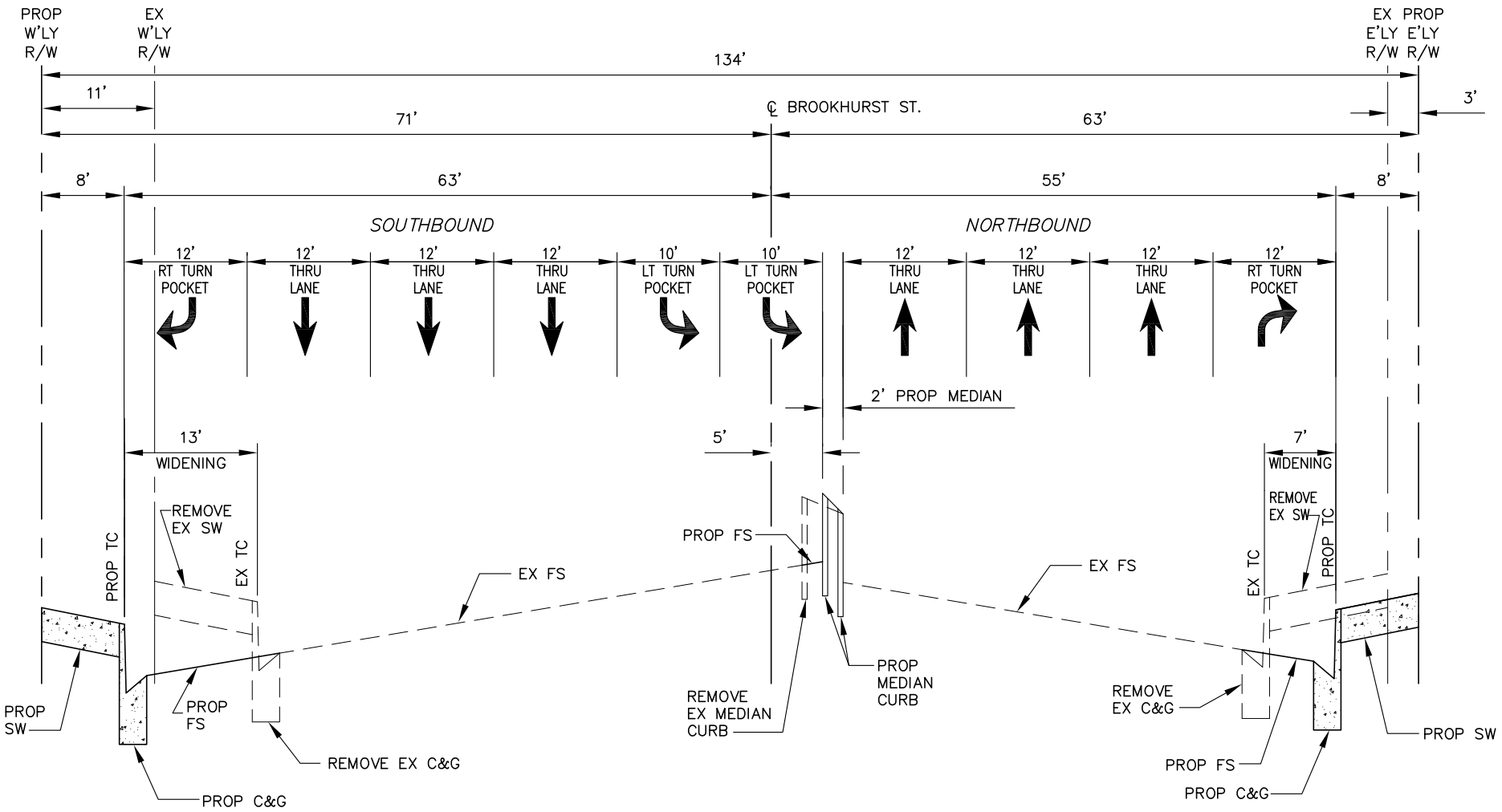

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PROP	PROPOSED
RT	RIGHT
ST.	STREET
SW	SIDEWALK
TC	TOP OF CURB
W'LY	WESTERLY

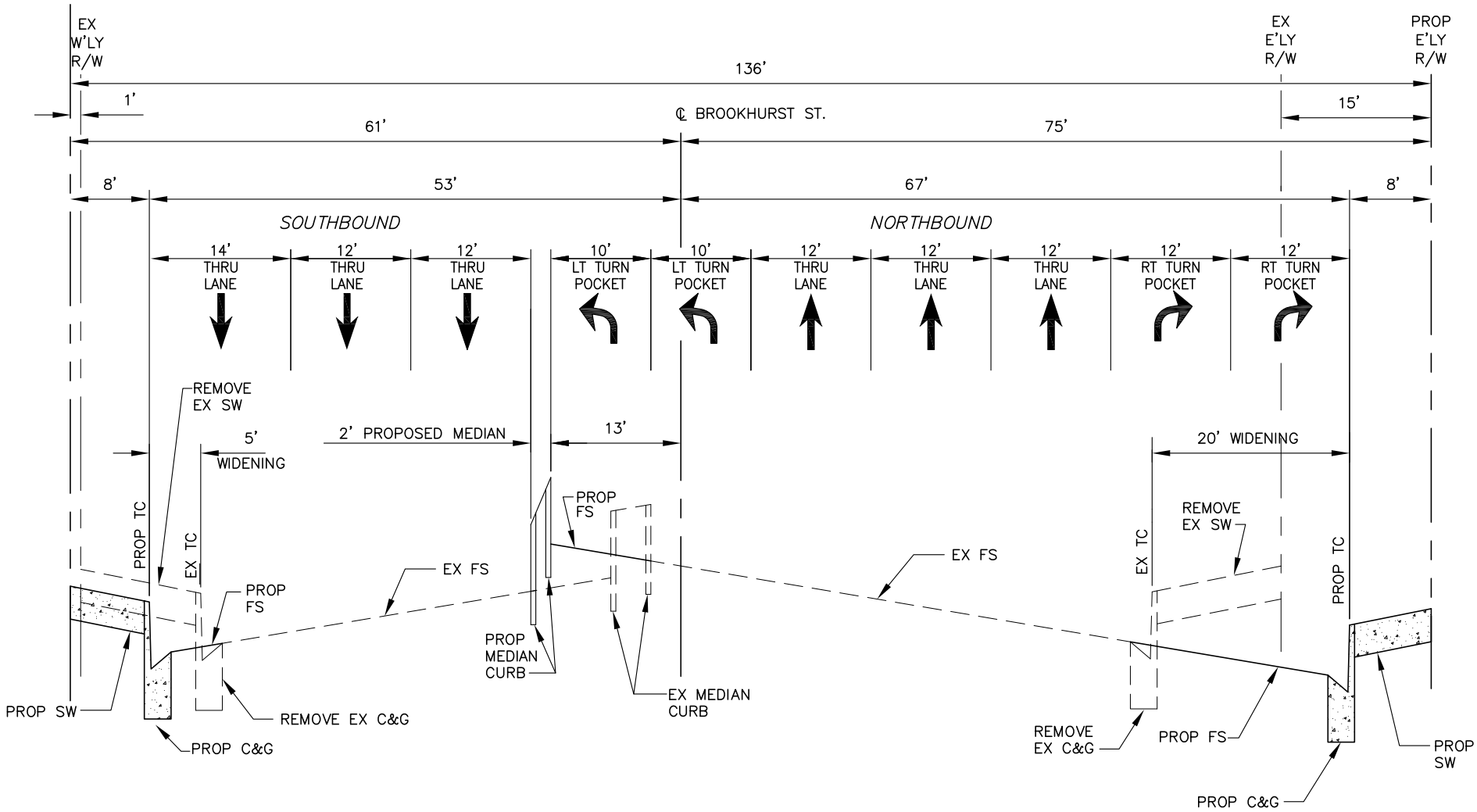
ALTERNATIVE 2
PROPOSED TYPICAL SECTION
BROOKHURST STREET

JUST NORTH OF INTERSECTION
N.T.S.

CITY OF HUNTINGTON BEACH
DEPARTMENT OF PUBLIC WORKS

PREPARED BY:

HARRIS & ASSOCIATES
34 Executive Park, Suite 150
Irvine, CA 92614-4705
(949) 655-3900 ● FAX (949) 655-3995



ABBREVIATIONS

C&G	CURB AND GUTTER
℄ / CL	CENTERLINE
E'LY	EASTERLY
EX	EXISTING
FS	FINISHED SURFACE
LT	LEFT
N.T.S.	NOT TO SCALE
PROP	PROPOSED
RT	RIGHT
ST.	STREET
SW	SIDEWALK
TC	TOP OF CURB
W'LY	WESTERLY

ALTERNATIVE 2
PROPOSED TYPICAL SECTION
BROOKHURST STREET

JUST SOUTH OF INTERSECTION
N.T.S.

CITY OF HUNTINGTON BEACH
DEPARTMENT OF PUBLIC WORKS

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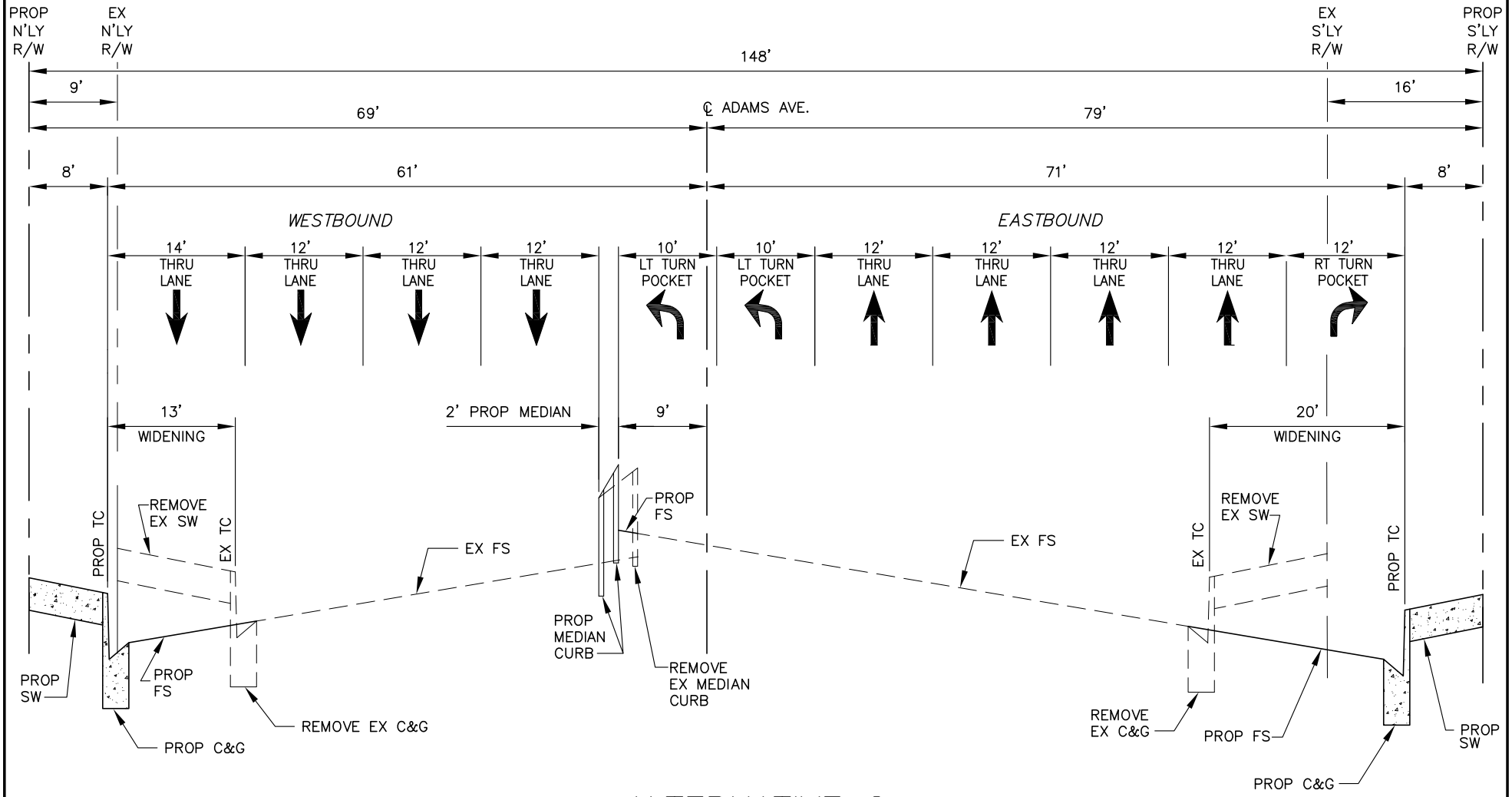

ABBREVIATIONS

AVE.	AVENUE
C&G	CURB AND GUTTER
℄ / CL	CENTERLINE
EX	EXISTING
FS	FINISHED SURFACE
LT	LEFT
N'LY	NORTHERLY
N.T.S.	NOT TO SCALE
PROP	PROP
RT	RIGHT
S'LY	SOUTHERLY
SW	SIDEWALK
TC	TOP OF CURB

ALTERNATIVE 2
PROPOSED TYPICAL SECTION
ADAMS AVENUE

JUST WEST OF INTERSECTION
N.T.S.

CITY OF HUNTINGTON BEACH
DEPARTMENT OF PUBLIC WORKS

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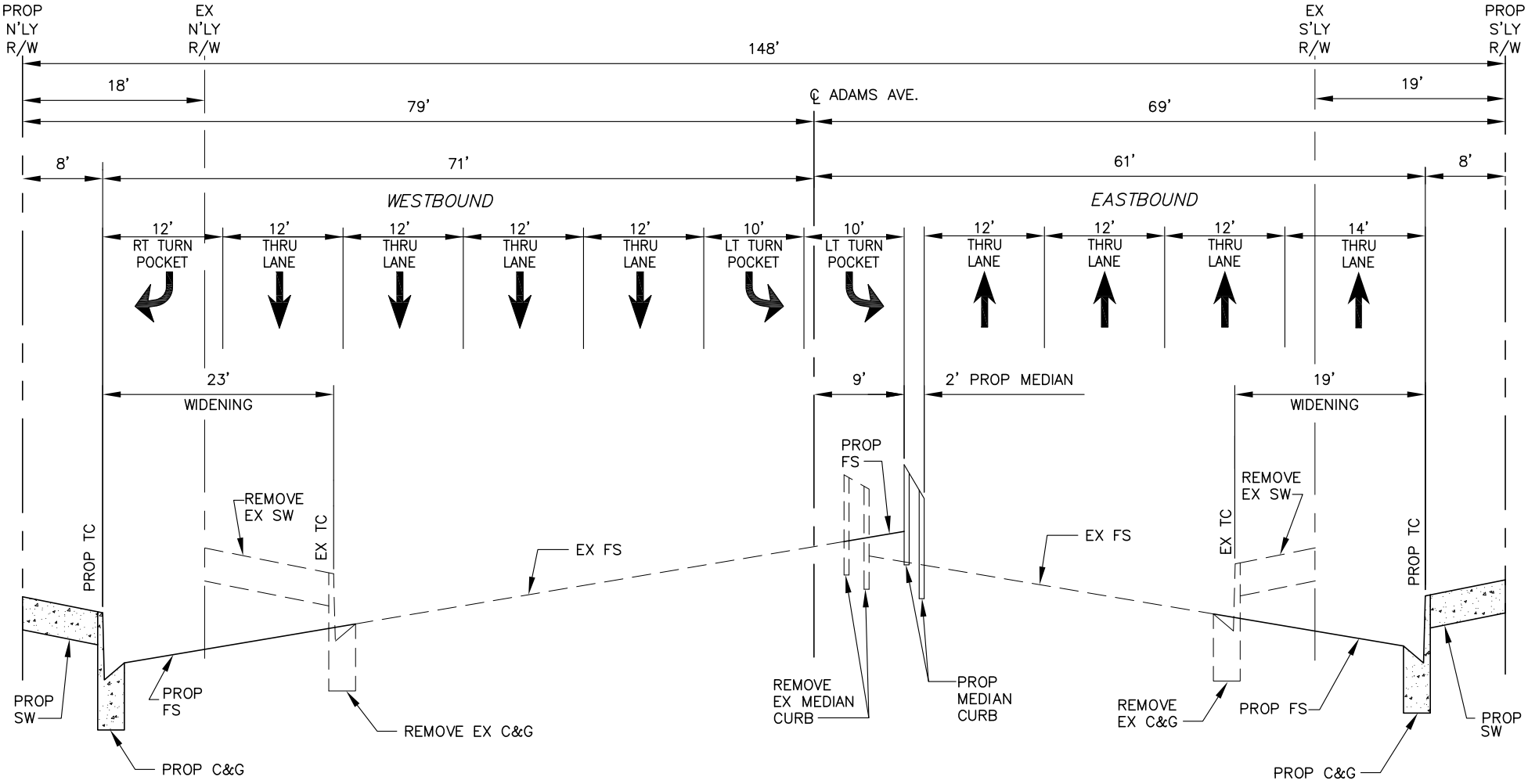
34 Executive Park, Suite 150
Irvine, CA 92614-4705
(949) 655-3900 ● FAX (949) 655-3995



ABBREVIATIONS

AVE.	AVENUE
C&G	CURB AND GUTTER
℄ / CL	CENTERLINE
EX	EXISTING
FS	FINISHED SURFACE
LT	LEFT
N'LY	NORTHERLY
N.T.S.	NOT TO SCALE
PROP	PROP
RT	RIGHT
S'LY	SOUTHERLY
SW	SIDEWALK
TC	TOP OF CURB

ALTERNATIVE 2
PROPOSED TYPICAL SECTION
ADAMS AVENUE

JUST EAST OF INTERSECTION
N.T.S.

CITY OF HUNTINGTON BEACH
DEPARTMENT OF PUBLIC WORKS

PREPARED BY:
HARRIS & ASSOCIATES
34 Executive Park, Suite 150
Irvine, CA 92614-4705
(949) 655-3900 ● FAX (949) 655-3995

SHEET 6 OF 6

ATTACHMENT D

Opinion of Probable Costs

Alternatives 1 and 2

Opinion of Probable Construction Costs

Harris & Associates

Agency: **City of Huntington Beach**

Project: **CC-1377, Brookhurst St & Adams Ave Intersection Improvements**

Phase: **Planning Level Estimates for Alternatives 1 & 2**

Date: **July 27, 2011**

Imp. Type	Item No.	Description	Unit	Unit Price	ALTERNATIVE 1 (Preferred): 10' thru lanes	ALTERNATIVE 2: 12' thru lanes
					Total Quantity / Cost	
General	1	Mobilization	LS	-	$170,000	$200,000
	2	Clearing & Grubbing (Includes ALL removals)	LS	-	$300,000	$400,000
	3	Prepare Traffic Control Plan	LS	-	$50,000	$50,000
	4	Implement Project Traffic Control	LS	-	$150,000	$200,000
	5	SWPPP	LS	-	$50,000	$75,000
	6	Construction Survey	LS	-	$50,000	$75,000
				Subtotal ($) =	***$770,000***	***$1,000,000***
Roadway & Parkway Improvements	7	Unclassified Excavation (Median, Widening, & Parkway areas)	CY	$55.00	5,500	7,600
	8	AC Pavement Base Course (Widening areas)	TON	$65.00	2,300	3,800
	9	AC Pavement Surface Course (Widening areas)	TON	$75.00	800	1,300
	10	PCC Bus Pad	SF	$35.00	6,800	8,400
	11	PCC Sidewalk	SF	$12.00	30,800	32,500
	12	PCC Driveway (with Ramps)	SF	$15.00	9,300	9,500
	13	PCC Curb & Gutter	LF	$25.00	4,000	5,000
	14	PCC Median Curb	SF	$15.00	2,700	2,700
	15	PCC Cross Gutter	SF	$35.00	1,200	3,000
	16	PCC Curb Ramp (Including Cast-in-Place Detectable Warning Surface)	EA	$5,000.00	7	11
	17	Install Catch Basin and Local Depression and Reconnect Storm Drain Lateral	EA	$10,000.00	5	5
	18	Retaining Wall (1.5' to 4'± high)	LF	$150.00	1,500	1,800
	19	Decorative Perimeter Wall (3'± high, non-retaining)	LF	$100.00	1,100	1,400
	20	6' High Perimeter Wall (non-retailing)	LF	$180.00	400	450
				Roadway & Parkway Improvements Subtotal ($) =	***$1,933,600***	***$2,455,500***
Traffic & Lighting Improvements	21	Traffic Signing and Striping Improvements	LS	-	$150,000	$200,000
	22	Traffic Signal Modifications at Brookhurst Street and Adams Avenue Intersection	LS	-	$250,000	$250,000
	23	Traffic Signal Modifications at Driveway on Brookhurst Street (north of intersection)	LS	-	$20,000	$20,000
	24	Traffic Signal Modifications at Driveway on Adams Avenue (west of intersection)	LS	-	$60,000	$100,000
	25	Street Light System Modifications	EA	-	$50,000	$75,000
				Traffic & Lighting Improvements Subtotal ($) =	***$530,000***	***$645,000***
Other	26	Landscaping and Irrigation Improvements	LS	-	$110,000	$160,000
	27	Utility Relocations and Adjustments	LS	-	$55,000	$80,000
				Landscape & Utility Improvements Subtotal ($) =	***$165,000***	***$240,000***
TOTALS				**Subtotal of Probable Construction Cost Per Alternative =**	**$3,398,600**	**$4,340,500**
				25% Contingency (Planning Level) =	$849,650	$1,085,125
				Total Probable Construction Cost Per Alternative =	**$4,248,250**	**$5,425,625**
				Design Phase (10% of Construction Cost) =	$424,825	$542,563
				Design Administration / CM / Inspection Phase (15% of Construction Cost) =	$637,238	$813,844
				*** R/W and Easement Acquisition (Includes Reimbursement for Private Improvement Impacts) 12 Parcels (approx. 63,500 SF at $15/SF) =**	$952,500	$952,500
				Power Pole Relocations (Responsibility for Payment to Be Determined) 28 Existing Power Poles at $20,000 per pole relocation =	$560,000	$560,000
				Total Probable "Soft Cost" Per Alternative =	**$2,574,563**	**$2,868,906**
				Probable GRAND TOTAL Cost Per Alternative =	**$6,822,813**	**$8,294,531**

* Note: Need City Input (Pending Pole Prior Rights Determination)

ATTACHMENT E

HCM Operations (WEBSTER) Analysis Worksheets

1. WEBSTER Overview
2. Existing Conditions
3. Future Year 2030 Conditions (no improvements)
4. Future Year 2030 Conditions

CAPACITY, LEVEL OF SERVICE AND SIGNAL TIMING ANALYSIS

WEBSTER Overview

WEBSTER is an interactive simulation and analysis program that provides for signal timing development, capacity analysis, queuing analysis, Level of Service (LOS) determination and numerous "What If" scenarios for individual intersections. WEBSTER is an acronym for **WE**bster **B**ased **S**ignal **T**iming **E**valuation **R**outine. The program is a valuable tool for both short and long term planning purposes, for signal design determinations, and for operational evaluations.

The WEBSTER program determines the Level of Service based on the Year 2000 Highway Capacity Manual (HCM) methodology as follows:

Level of Service	Veh. Delay (seconds)
A (minimal delay)	0 to 10
B (short delay)	10.1 to 20
C (average delay)	20.1 to 35
D (long delay)	35.1 to 55
E (very long delay)	55.1 to 80
F (extreme delay or jammed)	Over 80

Additionally, intersections which operate with volume-to-capacity (V/C) ratios greater than or equal to 1.0 are considered as LOS F, even if average vehicle delays are less than 80 seconds.

The main input data for WEBSTER are:

- Peak Hour Turning Movement Counts
- Phasing Sequence
- Saturation Flow Rates and Number of Lanes
- Minimum Split Times (defaults provided)
- Progression Factors (defaults provided)

Using WEBSTER, it is possible to test various scenarios at the study intersection. That is, WEBSTER can be run several times at the study intersection to test the impact of various conditions. This is useful for traffic impact analysis and Environmental Impact Reports (EIR) for both "before" and "after" conditions. Additionally, WEBSTER is a useful tool in street/intersection improvement evaluations. The program can be used to evaluate the existing signal timing at a particular intersection or to identify the optimum cycle length when developing new coordination timing, as well as to develop the splits at an intersection. WEBSTER is most useful for personnel familiar with signal operations who

can start using the program immediately. WEBSTER is only intended to serve as a tool for an intelligent analyzer; it would be improper for an uninformed user to merely input raw data and generate output, without engineering evaluation.

The output features of WEBSTER include the following:

- Provides the capability to optimize the green splits at the intersection using the HCM 2000 control delay equation.
- Identifies the optimum (i.e., minimum delay) cycle length for either vehicles only or considering both vehicles and pedestrian clearance times.
- Calculates delay for each lane group and determines the intersection LOS per HCM 2000.
- Provides the average queue (in vehicles) and the design queue length or required storage length (in feet) at the study intersection, based on certain input data and on a per lane basis.
- Allows the user to optimize splits while satisfying all minimum split times, including pedestrian crossing times.
- Optimizes traffic signal settings and/or measures project traffic impacts at a single signalized intersection.
- Evaluates protected/permissive left-turn phasing and considers signal coordination benefits in the analysis.

WEBSTER

WEbster **B**ased **S**ignal **T**iming **E**valuation **R**outine
For Capacity and Level of Service Analysis Using HCM 2000 Control Delay

Existing Conditions

Brookhurst Street & Adams Avenue **City of Huntington Beach** **AM Peak Hour**

Parameter Values (using default set 'Other Values')

Parameter	Other	Default	Min. Time Parameter	Other	Default	Sat. Flow Parameter	Other	Default
Duration of Peak Period (min)		15	Min. Time (Left Turns, sec)	15	10	Sat Flow (1 Left lane, vphg)		1800
Lost Time (sec)		2	Min/Ped Time (Thrus, sec)	Varies	Varies	Sat Flow (2 Left lanes, vphg)		3500
Vehicle Length (feet)		20				Sat Flow (1 Thru lane, vphg)		1900
						Sat Flow (1 Right lane, vphg)		1800

Input Values

	Eastbound			Westbound			Northbound			Southbound		
Movement Times	L	*T*	R	*L*	T	R	L	*T*	R	*L*	T	R
Movement 1: **15** secs	X			X								
Movement 2: **50** secs		X	X		X	X						
Movement 3: **15** secs							X			X		
Movement 4: **4** secs										X	X	X
Movement 5: **36** secs								X	X		X	X
Movement 6: **0** secs												
# of Lanes (#, S, P)	2	**3**	1	**2**	3	1	2	**3**	S	**2**	3	S
Unadjusted Volume	172	**2042**	78	**190**	634	198	112	**818**	478	**458**	604	136
Peak Hour Factor (PHF)	1.00	**1.00**	1.00	**1.00**	1.00	1.00	1.00	**1.00**	1.00	**1.00**	1.00	1.00
Min/Ped Time Override (sec)	15	**33**	33	**15**	33	33	15	**34**	34	**15**	35	35
Progression Adj. Factor (PAF)	1.00	**1.00**	1.00	**1.00**	1.00	1.00	1.00	**1.00**	-	**1.00**	1.00	-

Output		***		***				***		***		
Peak Hour Volume (vph)	172	**2042**	78	**190**	634	198	112	**818**	478	**458**	604	136
Saturation Flow (vph)	3500	**5700**	1800	**3500**	5700	1800	3500	**5700**	Shrd	**3500**	5700	Shrd
X or Volume/Capacity	0.45	**0.90**	0.11	**0.50**	0.28	0.28	0.30	**0.80**	-	**0.92**	0.41	-
Effective Green (sec)	13	**48**	48	**13**	48	48	13	**34**	-	**17**	38	-
Split Time (sec)	15	**50**	50	**15**	50	50	15	**36**	-	**19**	40	-
Min. Time or Ped. Time (sec)	15	**33**	33	**15**	33	33	15	**34**	-	**15**	35	-
Delay - 15 min pk (sec/veh)	54	**40**	23	**55**	25	25	51	**44**	-	**76**	33	-
Level of Service (LOS)	D-	**D+**	C+	**E+**	C+	C	D-	**D**	-	**E-**	C-	-
Average 'Q' (veh/ln)	3	**14**	2	**3**	4	4	2	**10**	-	**7**	6	-
Design 'Q'-ft/ln (1.5*Qavg)	100	**420**	60	**100**	120	120	60	**300**	-	**220**	180	-
Do Vehicles Clear?	YES	**YES**	YES	**YES**	YES	YES	YES	**YES**	-	**YES**	YES	-

Summary of Results

Whole Intersection		**Critical Movements**	
Weighted Average Delay (seconds) =	42	Weighted Average Delay (seconds) =	47
Level of Service - LOS =	D	Level of Service - LOS =	D
		Intersection Capacity Utilization - ICU =	0.83

Predetermined Cycle Length is 120 sec
Min./Ped. Times Satisfied

WEBSTER

WEbster **B**ased **S**ignal **T**iming **E**valuation **R**outine
For Capacity and Level of Service Analysis Using HCM 2000 Control Delay

Existing Conditions

Brookhurst Street & Adams Avenue City of Huntington Beach **PM Peak Hour**

Parameter Values (using default set 'Other Values')

Parameter	Other	Default	Min. Time Parameter	Other	Default	Sat. Flow Parameter	Other	Default
Duration of Peak Period (min)		15	Min. Time (Left Turns, sec)	15	10	Sat Flow (1 Left lane, vphg)		1800
Lost Time (sec)		2	Min/Ped Time (Thrus, sec)	Varies	Varies	Sat Flow (2 Left lanes, vphg)		3500
Vehicle Length (feet)		20				Sat Flow (1 Thru lane, vphg)		1900
						Sat Flow (1 Right lane, vphg)		1800

Input Values

	Eastbound			Westbound			Northbound			Southbound		
Movement Times	L	T	R	*L*	T	*R*	*L*	T	R	L	*T*	R
Movement 1: **17** secs	X			X								
Movement 2: **44** secs		X	X		X	X						
Movement 3: **15** secs							X			X		
Movement 4: **3** secs							X	X	X			
Movement 5: **41** secs								X	X		X	X
Movement 6: **0** secs												
# of Lanes (#, S, P)	2	3	1	2	3	1	2	3	S	2	3	S
Unadjusted Volume	258	660	126	268	1566	522	310	1084	192	172	1054	136
Peak Hour Factor (PHF)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Min/Ped Time Override (sec)	15	33	33	15	33	33	15	34	34	15	35	35
Progression Adj. Factor (PAF)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-	1.00	1.00	-

Output

				***		***	***				***	
Peak Hour Volume (vph)	258	660	126	268	1566	522	310	1084	192	172	1054	136
Saturation Flow (vph)	3500	5700	1800	3500	5700	1800	3500	5700	Shrd	3500	5700	Shrd
X or Volume/Capacity	0.59	0.33	0.20	0.61	0.78	0.83	0.66	0.64	-	0.45	0.64	-
Effective Green (sec)	15	42	42	15	42	42	16	42	-	13	39	-
Split Time (sec)	17	44	44	17	44	44	18	44	-	15	41	-
Min. Time or Ped. Time (sec)	15	33	33	15	33	33	15	34	-	15	35	-
Delay - 15 min pk (sec/veh)	55	29	28	56	38	48	57	34	-	54	36	-
Level of Service (LOS)	E+	C	C	E+	D+	D	E+	C-	-	D-	D+	-
Average 'Q' (veh/ln)	4	5	3	4	11	12	5	9	-	3	9	-
Design 'Q'-ft/ln (1.5*Qavg)	120	160	100	120	340	360	160	280	-	100	280	-
Do Vehicles Clear?	YES	YES	YES	YES	YES	YES	YES	YES	-	YES	YES	-

Summary of Results

Whole Intersection		Critical Movements	
Weighted Average Delay (seconds) =	40	Weighted Average Delay (seconds) =	44
Level of Service - LOS =	D+	Level of Service - LOS =	D
		Intersection Capacity Utilization - ICU =	0.71

Predetermined Cycle Length is 120 sec
Min./Ped. Times Satisfied

WEBSTER

WEbster **B**ased **S**ignal **T**iming **E**valuation **R**outine
For Capacity and Level of Service Analysis Using HCM 2000 Control Delay

Future Traffic with Existing Geometrics

Brookhurst Street & Adams Avenue **City of Huntington Beach** **AM Peak Hour**

Parameter Values (using default set 'Other Values')

Parameter	Other	Default	Min. Time Parameter	Other	Default	Sat. Flow Parameter	Other	Default
Duration of Peak Period (min)		15	Min. Time (Left Turns, sec)	15	10	Sat Flow (1 Left lane, vphg)		1800
Lost Time (sec)		2	Min/Ped Time (Thrus, sec)	Varies	Varies	Sat Flow (2 Left lanes, vphg)		3500
Vehicle Length (feet)		20				Sat Flow (1 Thru lane, vphg)		1900
						Sat Flow (1 Right lane, vphg)		1800

Input Values

	Eastbound			Westbound			Northbound			Southbound		
Movement Times	*L*	*T*	R	L	T	R	L	*T*	R	*L*	T	R
Movement 1: **15** secs	X			X								
Movement 2: **65** secs		X	X		X	X						
Movement 3: **15** secs							X			X		
Movement 4: **6** secs										X	X	X
Movement 5: **40** secs								X	X		X	X
Movement 6: **0** secs												
# of Lanes (#, S, P)	**2**	**3**	1	2	3	1	2	**3**	S	**2**	3	S
Unadjusted Volume	**240**	**2480**	80	200	750	280	140	**860**	630	**490**	940	130
Peak Hour Factor (PHF)	**1.00**	**1.00**	1.00	1.00	1.00	1.00	1.00	**1.00**	1.00	**1.00**	1.00	1.00
Min/Ped Time Override (sec)	**15**	**33**	33	15	33	33	15	**34**	34	**15**	35	35
Progression Adj. Factor (PAF)	**1.00**	**0.90**	0.90	1.00	0.90	0.90	1.00	**0.90**	-	**1.00**	0.90	-

Output	***	***						***		***		
Peak Hour Volume (vph)	**240**	**2480**	80	200	750	280	140	**860**	630	**490**	940	130
Saturation Flow (vph)	**3500**	**5700**	1800	3500	5700	1800	3500	**5700**	Shrd	**3500**	5700	Shrd
X or Volume/Capacity	**0.74**	**0.97**	0.10	0.62	0.29	0.35	0.43	**0.97**	-	**1.04**	0.60	-
Effective Green (sec)	**13**	**63**	63	13	63	63	13	**38**	-	**19**	44	-
Split Time (sec)	**15**	**65**	65	15	65	65	15	**40**	-	**21**	46	-
Min. Time or Ped. Time (sec)	**15**	**33**	33	15	33	33	15	**34**	-	**15**	35	-
Delay - 15 min pk (sec/veh)	**77**	**47**	21	70	23	24	65	**63**	-	**113**	38	-
Level of Service (LOS)	**E-**	**D**	C+	E	C+	C+	E	**E**	-	**F**	D+	-
Average 'Q' (veh/ln)	**4**	**17**	2	4	5	5	2	**13**	-	**9**	9	-
Design 'Q'-ft/ln (1.5*Qavg)	**120**	**520**	60	120	160	160	60	**400**	-	**280**	280	-
Available Storage (ft)	**280**	**580**	200	355	625	470	250	**600**	600	**315**	390	280
Do Vehicles Clear?	**YES**	**YES**	YES	YES	YES	YES	YES	**YES**	-	**NO**	YES	-

Summary of Results

Intersection Unstable-Consider Mitigation

Whole Intersection		Critical Movements	
Weighted Average Delay (seconds) =	52	Weighted Average Delay (seconds) =	61
Level of Service - LOS =	D-	Level of Service - LOS =	E
		Intersection Capacity Utilization - ICU =	0.96

Required Cycle Length is 141 sec
Min./Ped. Times Satisfied

WEBSTER

WEbster **B**ased **S**ignal **T**iming **E**valuation **R**outine
For Capacity and Level of Service Analysis Using HCM 2000 Control Delay

Future Traffic with Existing Geometrics

Brookhurst Street & Adams Avenue **City of Huntington Beach** **PM Peak Hour**

Parameter Values (using default set 'Other Values')

Parameter	Other	Default	Min. Time Parameter	Other	Default	Sat. Flow Parameter	Other	Default
Duration of Peak Period (min)		15	Min. Time (Left Turns, sec)	15	10	Sat Flow (1 Left lane, vphg)		1800
Lost Time (sec)		2	Min/Ped Time (Thrus, sec)	Varies	Varies	Sat Flow (2 Left lanes, vphg)		3500
Vehicle Length (feet)		20				Sat Flow (1 Thru lane, vphg)		1900
						Sat Flow (1 Right lane, vphg)		1800

Input Values

	Eastbound			Westbound			Northbound			Southbound		
Movement Times	L	T	R	*L*	*T*	R	L	*T*	R	*L*	T	R
Movement 1: **18** secs	X			X								
Movement 2: **49** secs		X	X		X	X						
Movement 3: **15** secs							X			X		
Movement 4: **3** secs										X	X	X
Movement 5: **35** secs								X	X		X	X
Movement 6: **0** secs												
# of Lanes (#, S, P)	2	3	1	**2**	**3**	1	2	**3**	S	**2**	3	S
Unadjusted Volume	340	1270	100	**460**	**2300**	380	300	**1290**	290	**480**	1340	160
Peak Hour Factor (PHF)	1.00	1.00	1.00	**1.00**	**1.00**	1.00	1.00	**1.00**	1.00	**1.00**	1.00	1.00
Min/Ped Time Override (sec)	15	33	33	**15**	**33**	33	15	**34**	34	**15**	35	35
Progression Adj. Factor (PAF)	1.00	0.90	0.90	**1.00**	**0.90**	0.90	1.00	**0.90**	-	**1.00**	0.90	-

Output

				***	***			***		***		
Peak Hour Volume (vph)	340	1270	100	**460**	**2300**	380	300	**1290**	290	**480**	1340	160
Saturation Flow (vph)	3500	5700	1800	**3500**	**5700**	1800	3500	**5700**	Shrd	**3500**	5700	Shrd
X or Volume/Capacity	0.73	0.57	0.14	**0.99**	**1.03**	0.54	0.79	**1.01**	-	**1.03**	0.88	-
Effective Green (sec)	16	47	47	**16**	**47**	47	13	**33**	-	**16**	36	-
Split Time (sec)	18	49	49	**18**	**49**	49	15	**35**	-	**18**	38	-
Min. Time or Ped. Time (sec)	15	33	33	**15**	**33**	33	15	**34**	-	**15**	35	-
Delay - 15 min pk (sec/veh)	60	27	22	**90**	**61**	28	68	**64**	-	**101**	43	-
Level of Service (LOS)	E+	C	C+	**F**	**E**	C	E	**E**	-	**F**	D	-
Average 'Q' (veh/ln)	5	8	2	**7**	**15**	7	5	**12**	-	**8**	11	-
Design 'Q'-ft/ln (1.5*Qavg)	160	240	60	**220**	**460**	220	160	**360**	-	**240**	340	-
Available Storage (ft)	280	580	200	**355**	**625**	470	250	**600**	600	**315**	390	280
Do Vehicles Clear?	YES	YES	YES	**NO**	**NO**	YES	YES	**YES**	-	**NO**	YES	-

Summary of Results

Oversaturated - Mitigation Required

Whole Intersection		Critical Movements	
Weighted Average Delay (seconds) =	56	Weighted Average Delay (seconds) =	69
Level of Service - LOS =	E+	Level of Service - LOS =	F
		Intersection Capacity Utilization - ICU =	1.02

Predetermined Cycle Length is 120 sec
Min./Ped. Times Satisfied

WEBSTER

WEbster **B**ased **S**ignal **T**iming **E**valuation **R**outine
For Capacity and Level of Service Analysis Using HCM 2000 Control Delay

Future Traffic with Mitigations - 10' Thru Lanes

Brookhurst Street & Adams Avenue City of Huntington Beach **AM Peak Hour**

Parameter Values (using default set 'Other Values')

Parameter	Other	Default	Min. Time Parameter	Other	Default	Sat. Flow Parameter	Other	Default
Duration of Peak Period (min)		15	Min. Time (Left Turns, sec)	15	10	Sat Flow (1 Left lane, vphg)		1800
Lost Time (sec)		2	Min/Ped Time (Thrus, sec)	Varies	Varies	Sat Flow (2 Left lanes, vphg)		3500
Vehicle Length (feet)		20				Sat Flow (1 Thru lane, vphg)		1900
						Sat Flow (1 Right lane, vphg)		1800

Input Values

	Eastbound			Westbound			Northbound			Southbound		
Movement Times	*L*	*T*	R	L	T	R	L	*T*	R	*L*	T	R
Movement 1: **15** secs	X			X					X			
Movement 2: **53** secs		X	X		X	X						
Movement 3: **15** secs							X			X		
Movement 4: **8** secs										X	X	X
Movement 5: **39** secs								X	X		X	X
Movement 6: **0** secs												
# of Lanes (#, S, P)	**2**	**4**	1	2	4	1	2	**3**	2	**2**	3	1
Unadjusted Volume	**240**	**2480**	80	200	750	280	140	**860**	630	**490**	940	130
Peak Hour Factor (PHF)	**1.00**	**1.00**	1.00	1.00	1.00	1.00	1.00	**1.00**	1.00	**1.00**	1.00	1.00
Sat. Flow Override (vph)		**7315**										
Min/Ped Time Override (sec)	**15**	**37**	37	15	35	35	15	**39**	39	**15**	39	39
Progression Adj. Factor (PAF)	**1.00**	**0.90**	0.90	1.00	0.90	0.90	1.00	**0.90**	0.90	**1.00**	0.90	0.90

Output

	***	***						***		***		
Peak Hour Volume (vph)	**240**	**2480**	80	200	750	280	140	**860**	630	**490**	940	130
Saturation Flow (vph)	**3500**	***7315***	1800	3500	7600	1800	3500	**5700**	3400	**3500**	5700	1800
X or Volume/Capacity	**0.69**	**0.86**	0.11	0.57	0.25	0.40	0.40	**0.53**	0.46	**0.87**	0.48	0.21
Effective Green (sec)	**13**	**51**	51	13	51	51	13	**37**	52	**21**	45	45
Split Time (sec)	**15**	**53**	53	15	53	53	15	**39**	54	**23**	47	47
Min. Time or Ped. Time (sec)	**15**	**37**	37	15	35	35	15	**39**	39	**15**	39	39
Delay - 15 min pk (sec/veh)	**67**	**36**	23	62	24	27	58	**37**	27	**69**	31	28
Level of Service (LOS)	**E**	**D+**	C+	E	C+	C	E+	**D+**	C	**E**	C-	C
Average 'Q' (veh/ln)	**4**	**12**	2	3	4	6	2	**7**	6	**8**	7	3
Design 'Q'-ft/ln (1.5*Qavg)	**120**	**360**	60	100	120	180	60	**220**	180	**240**	220	100
Available Storage (ft)	**280**	**580**	200	355	625	470	250	**600**	600	**315**	390	280
Do Vehicles Clear?	**YES**	**YES**	YES	YES	YES	YES	YES	**YES**	YES	**YES**	YES	YES

Summary of Results

Whole Intersection		**Critical Movements**	
Weighted Average Delay (seconds) =	38	Weighted Average Delay (seconds) =	43
Level of Service - LOS =	D+	Level of Service - LOS =	D
		Intersection Capacity Utilization - ICU =	0.74

Predetermined Cycle Length is 130 sec
Min./Ped. Times Satisfied
Analysis Based on User Selected Splits

Notes: Reduced EB Thru Capacity, NB Right Turn Overlap, 4.0 ft/sec walking speed, Beach/Edinger Specific Plan Volumes

WEBSTER

WEbster **B**ased **S**ignal **T**iming **E**valuation **R**outine
For Capacity and Level of Service Analysis Using HCM 2000 Control Delay

Future Traffic with Mitigations - 10' Thru Lanes

Brookhurst Street & Adams Avenue **City of Huntington Beach** **PM Peak Hour**

Parameter Values (using default set 'Other Values')

Parameter	Other	Default	Min. Time Parameter	Other	Default	Sat. Flow Parameter	Other	Default
Duration of Peak Period (min)		15	Min. Time (Left Turns, sec)	15	10	Sat Flow (1 Left lane, vphg)		1800
Lost Time (sec)		2	Min/Ped Time (Thrus, sec)	Varies	Varies	Sat Flow (2 Left lanes, vphg)		3500
Vehicle Length (feet)		20				Sat Flow (1 Thru lane, vphg)		1900
						Sat Flow (1 Right lane, vphg)		1800

Input Values

	Eastbound			Westbound			Northbound			Southbound		
Movement Times	L	T	R	*L*	*T*	R	L	*T*	R	*L*	T	R
Movement 1: **23** secs	X			X					X			
Movement 2: **46** secs		X	X		X	X						
Movement 3: **15** secs							X			X		
Movement 4: **7** secs										X	X	X
Movement 5: **39** secs								X	X		X	X
Movement 6: **0** secs												
# of Lanes (#, S, P)	2	4	1	**2**	**4**	1	2	**3**	2	**2**	3	1
Unadjusted Volume	340	1270	100	**460**	**2300**	380	300	**1290**	290	**480**	1340	160
Peak Hour Factor (PHF)	1.00	1.00	1.00	**1.00**	**1.00**	1.00	1.00	**1.00**	1.00	**1.00**	1.00	1.00
Sat. Flow Override (vph)		7315										
Min/Ped Time Override (sec)	15	37	37	**15**	**35**	35	15	**39**	39	**15**	39	39
Progression Adj. Factor (PAF)	1.00	0.90	0.90	**1.00**	**0.90**	0.90	1.00	**0.90**	0.90	**1.00**	0.90	0.90

Output

				***	***			***		***		
Peak Hour Volume (vph)	340	1270	100	**460**	**2300**	380	300	**1290**	290	**480**	1340	160
Saturation Flow (vph)	3500	*7315*	1800	**3500**	**7600**	1800	3500	**5700**	3400	**3500**	5700	1800
X or Volume/Capacity	0.60	0.51	0.16	**0.81**	**0.89**	0.62	0.86	**0.80**	0.18	**0.89**	0.69	0.26
Effective Green (sec)	21	44	44	**21**	**44**	44	13	**37**	60	**20**	44	44
Split Time (sec)	23	46	46	**23**	**46**	46	15	**39**	62	**22**	46	46
Min. Time or Ped. Time (sec)	15	37	37	**15**	**35**	35	15	**39**	39	**15**	39	39
Delay - 15 min pk (sec/veh)	55	32	28	**65**	**42**	37	80	**43**	19	**74**	36	29
Level of Service (LOS)	E+	C-	C	**E**	**D**	D+	F	**D**	B	**E**	D+	C
Average 'Q' (veh/ln)	5	7	2	**7**	**12**	8	5	**10**	3	**8**	10	3
Design 'Q'-ft/ln (1.5*Qavg)	160	220	60	**220**	**360**	240	160	**300**	100	**240**	300	100
Available Storage (ft)	280	580	200	**355**	**625**	471	250	**600**	600	**315**	390	280
Do Vehicles Clear?	YES	YES	YES	**YES**	**YES**	YES	YES	**YES**	YES	**YES**	YES	YES

Summary of Results

Whole Intersection		Critical Movements	
Weighted Average Delay (seconds) =	44	Weighted Average Delay (seconds) =	48
Level of Service - LOS =	D	Level of Service - LOS =	D
		Intersection Capacity Utilization - ICU =	0.85

Predetermined Cycle Length is 130 sec
Min./Ped. Times Satisfied
Analysis Based on User Selected Splits

Notes: Reduced EB Thru Capacity, NB Right Turn Overlap, 4.0 ft/sec walking speed, Beach/Edinger Specific Plan Volumes

WEBSTER

WEbster **B**ased **S**ignal **T**iming **E**valuation **R**outine
For Capacity and Level of Service Analysis Using HCM 2000 Control Delay

Future Traffic with Mitigations - 12' Thru Lanes

Brookhurst Street & Adams Avenue **City of Huntington Beach** **AM Peak Hour**

Parameter Values (using default set 'Other Values')

Parameter	Other	Default	Min. Time Parameter	Other	Default	Sat. Flow Parameter	Other	Default
Duration of Peak Period (min)		15	Min. Time (Left Turns, sec)	15	10	Sat Flow (1 Left lane, vphg)		1800
Lost Time (sec)		2	Min/Ped Time (Thrus, sec)	Varies	Varies	Sat Flow (2 Left lanes, vphg)		3500
Vehicle Length (feet)		20				Sat Flow (1 Thru lane, vphg)		1900
						Sat Flow (1 Right lane, vphg)		1800

Input Values

	Eastbound			Westbound			Northbound			Southbound		
Movement Times	*L*	*T*	R	L	T	R	L	*T*	R	*L*	T	R
Movement 1: **15** secs	X			X					X			
Movement 2: **49** secs		X	X		X	X						
Movement 3: **15** secs							X			X		
Movement 4: **7** secs										X	X	X
Movement 5: **44** secs								X	X		X	X
Movement 6: **0** secs												
# of Lanes (#, S, P)	**2**	**4**	1	2	4	1	2	**3**	2	**2**	3	1
Unadjusted Volume	**240**	**2480**	80	200	750	280	140	**860**	630	**490**	940	130
Peak Hour Factor (PHF)	**1.00**	**1.00**	1.00	1.00	1.00	1.00	1.00	**1.00**	1.00	**1.00**	1.00	1.00
Sat. Flow Override (vph)		**7315**										
Min/Ped Time Override (sec)	**15**	**39**	39	15	41	41	15	**44**	44	**15**	44	44
Progression Adj. Factor (PAF)	**1.00**	**0.90**	0.90	1.00	0.90	0.90	1.00	**0.90**	0.90	**1.00**	0.90	0.90

Output

	***	***						***		***		
Peak Hour Volume (vph)	**240**	**2480**	80	200	750	280	140	**860**	630	**490**	940	130
Saturation Flow (vph)	**3500**	***7315***	1800	3500	7600	1800	3500	**5700**	3400	**3500**	5700	1800
X or Volume/Capacity	**0.69**	**0.94**	0.12	0.57	0.27	0.43	0.40	**0.47**	0.42	**0.91**	0.44	0.19
Effective Green (sec)	**13**	**47**	47	13	47	47	13	**42**	57	**20**	49	49
Split Time (sec)	**15**	**49**	49	15	49	49	15	**44**	59	**22**	51	51
Min. Time or Ped. Time (sec)	**15**	**39**	39	15	41	41	15	**44**	44	**15**	44	44
Delay - 15 min pk (sec/veh)	**67**	**44**	25	62	27	30	58	**32**	24	**76**	28	25
Level of Service (LOS)	**E**	**D**	C	E	C	C-	E+	**C-**	C+	**E-**	C	C
Average 'Q' (veh/ln)	**4**	**13**	2	3	4	6	2	**6**	6	**8**	6	3
Design 'Q'-ft/ln (1.5*Qavg)	**120**	**400**	60	100	120	180	60	**180**	180	**240**	180	100
Available Storage (ft)	**280**	**580**	200	355	610	425	250	**600**	450	**315**	390	280
Do Vehicles Clear?	**YES**	**YES**	YES	YES	YES	YES	YES	**YES**	YES	**YES**	YES	YES

Summary of Results

Whole Intersection		Critical Movements	
Weighted Average Delay (seconds) =	40	Weighted Average Delay (seconds) =	47
Level of Service - LOS =	D+	Level of Service - LOS =	D
		Intersection Capacity Utilization - ICU =	0.74

Predetermined Cycle Length is 130 sec
Min./Ped. Times Satisfied
Analysis Based on User Selected Splits

Notes: Reduced EB Thru Capacity, NB Right Turn Overlap, 4.0 ft/sec walking speed, Beach/Edinger Specific Plan Volumes

WEBSTER

WEbster **B**ased **S**ignal **T**iming **E**valuation **R**outine
For Capacity and Level of Service Analysis Using HCM 2000 Control Delay

Future Traffic with Mitigations - 12' Thru Lanes

Brookhurst Street & Adams Avenue **City of Huntington Beach** **PM Peak Hour**

Parameter Values (using default set 'Other Values')

Parameter	Other	Default	Min. Time Parameter	Other	Default	Sat. Flow Parameter	Other	Default
Duration of Peak Period (min)		15	Min. Time (Left Turns, sec)	15	10	Sat Flow (1 Left lane, vphg)		1800
Lost Time (sec)		2	Min/Ped Time (Thrus, sec)	Varies	Varies	Sat Flow (2 Left lanes, vphg)		3500
Vehicle Length (feet)		20				Sat Flow (1 Thru lane, vphg)		1900
						Sat Flow (1 Right lane, vphg)		1800

Input Values

	Eastbound			Westbound			Northbound			Southbound		
Movement Times	L	T	R	*L*	*T*	R	L	*T*	R	*L*	T	R
Movement 1: **21** secs	X			X					X			
Movement 2: **46** secs		X	X		X	X						
Movement 3: **16** secs							X			X		
Movement 4: **6** secs										X	X	X
Movement 5: **41** secs								X	X		X	X
Movement 6: **0** secs												
# of Lanes (#, S, P)	2	4	1	**2**	**4**	1	2	**3**	1	**2**	3	1
Unadjusted Volume	340	1270	100	**460**	**2300**	380	300	**1290**	290	**480**	1340	160
Peak Hour Factor (PHF)	1.00	1.00	1.00	**1.00**	**1.00**	1.00	1.00	**1.00**	1.00	**1.00**	1.00	1.00
Sat. Flow Override (vph)		7315										
Min/Ped Time Override (sec)	15	38	38	**15**	**41**	41	15	**41**	41	**15**	44	44
Progression Adj. Factor (PAF)	1.00	0.90	0.90	**1.00**	**0.90**	0.90	1.00	**0.90**	0.90	**1.00**	0.90	0.90

Output

				***	***			***		***		
Peak Hour Volume (vph)	340	1270	100	**460**	**2300**	380	300	**1290**	290	**480**	1340	160
Saturation Flow (vph)	3500	*7315*	1800	**3500**	**7600**	1800	3500	**5700**	1800	**3500**	5700	1800
X or Volume/Capacity	0.66	0.51	0.16	**0.90**	**0.89**	0.62	0.80	**0.75**	0.35	**0.89**	0.68	0.26
Effective Green (sec)	19	44	44	**19**	**44**	44	14	**39**	60	**20**	45	45
Split Time (sec)	21	46	46	**21**	**46**	46	16	**41**	62	**22**	47	47
Min. Time or Ped. Time (sec)	15	38	38	**15**	**41**	41	15	**41**	41	**15**	44	44
Delay - 15 min pk (sec/veh)	59	32	28	**76**	**42**	37	72	**40**	21	**74**	35	28
Level of Service (LOS)	E+	C-	C	**E-**	**D**	D+	E	**D**	C+	**E**	C-	C
Average 'Q' (veh/ln)	5	7	2	**7**	**12**	8	5	**10**	5	**8**	9	3
Design 'Q'-ft/ln (1.5*Qavg)	160	220	60	**220**	**360**	240	160	**300**	160	**240**	280	100
Available Storage (ft)	280	580	200	**355**	**610**	425	250	**600**	450	**315**	390	280
Do Vehicles Clear?	YES	YES	YES	**YES**	**YES**	YES	YES	**YES**	YES	**YES**	YES	YES

Summary of Results

Whole Intersection		Critical Movements	
Weighted Average Delay (seconds) =	44	Weighted Average Delay (seconds) =	49
Level of Service - LOS =	D	Level of Service - LOS =	D
		Intersection Capacity Utilization - ICU =	0.85

Predetermined Cycle Length is 130 sec
Min./Ped. Times Satisfied
Analysis Based on User Selected Splits

Notes: Reduced EB, NB Right Turn Overlap, 4.0 ft/sec walking speed, Beach/Edinger Specific Plan Volumes

ATTACHMENT F

ICU Analysis Worksheets

1. Existing Conditions
2. Future Year 2030 Conditions (no improvements)
3. Future Year 2030 Conditions

INTERSECTION CAPACITY UTILIZATION

Intersection: Brookhurst St / Adams Ave (Existing Conditions)

Date: 1/11/2011 Peak Hr: AM

Analyst: AGA Agency: City of Huntington Beach

Movement	Volume	No. of Lanes	Capacity*	V/C Ratio	Critical V/C	Total
NB Left	112	2	3400	112/3,400= 0.03		
NB Thru	818	3	5100	1,296/5,100= 0.25	< ==	
NB Right	478	0	0	----		
SB Left	458	2	3400	458/3,400= 0.14	< ==	
SB Thru	604	3	5100	740/5,100= 0.15		
SB Right	136	0	0	----		0.39
EB Left	172	2	3400	172/3,400= 0.05		
EB Thru	2042	3	5100	2,042/5,100= 0.40	< ==	
EB Right	78	1	1700	78/1,700= 0.05		
WB Left	190	2	3400	190/3,400= 0.06	< ==	
WB Thru	634	3	5100	634/5,100= 0.12		
WB Right	198	1	1700	198/1,700= 0.12		0.46

Sum of Critical V/C Ratios	0.84
Adjustment for Lost Time	0.05
Intersection Capacity Utilization (ICU)	**0.89**
Level of Service (LOS) - Refer to table below	**D**

* NOTES

Per-lane Capacity = 1,700 vehicles/hour

dual left turn lane capacity = 3,400 vph

LOS	Maximum V/C
A	0.60
B	0.70
C	0.80
D	0.90
E	1.00
F	n/a

INTERSECTION CAPACITY UTILIZATION

Intersection: Brookhurst St / Adams Ave (Existing Conditions)

Date: 1/11/2011 Peak Hr: PM

Analyst: AGA Agency: City of Huntington Beach

Movement	Volume	No. of Lanes	Capacity*	V/C Ratio	Critical V/C	Total
NB Left	310	2	3400	310/3,400= 0.09	< ==	
NB Thru	1084	3	5100	1,276/5,100= 0.25		
NB Right	192	0	0	----		
SB Left	172	2	3400	172/3,400= 0.05		
SB Thru	1054	3	5100	1,190/5,100= 0.23	< ==	
SB Right	136	0	0	----		0.32
EB Left	258	2	3400	258/3,400= 0.08	< ==	
EB Thru	660	3	5100	660/5,100= 0.13		
EB Right	126	1	1700	126/1,700= 0.07		
WB Left	268	2	3400	268/3,400= 0.08		
WB Thru	1566	3	5100	1,566/5,100= 0.31	< ==	
WB Right	522	1	1700	522/1,700= 0.31		0.38

Sum of Critical V/C Ratios	0.71
Adjustment for Lost Time	0.05
Intersection Capacity Utilization (ICU)	**0.76**
Level of Service (LOS) - Refer to table below	**C**

* NOTES

Per-lane Capacity = 1,700 vehicles/hour

dual left turn lane capacity = 3,400 vph

LOS	Maximum V/C
A	0.60
B	0.70
C	0.80
D	0.90
E	1.00
F	n/a

INTERSECTION CAPACITY UTILIZATION

Intersection: Brookhurst St / Adams Ave (2030 Volumes No Improvements)

Date: 1/11/2011 Peak Hr: AM

Analyst: AGA Agency: City of Huntington Beach

Movement	Volume	No. of Lanes	Capacity*	V/C Ratio	Critical V/C	Total
NB Left	140	2	3400	140/3,400= 0.04		
NB Thru	860	3	5100	1,490/5,100= 0.29	< ==	
NB Right	630	0	0	----		
SB Left	490	2	3400	490/3,400= 0.14	< ==	
SB Thru	940	3	5100	1,070/5,100= 0.21		
SB Right	130	0	0	----		0.43
EB Left	240	2	3400	240/3,400= 0.07		
EB Thru	2480	3	5100	2,480/5,100= 0.49	< ==	
EB Right	80	1	1700	80/1,700= 0.05		
WB Left	200	2	3400	200/3,400= 0.06	< ==	
WB Thru	750	3	5100	750/5,100= 0.15		
WB Right	280	1	1700	280/1,700= 0.17		0.55
Sum of Critical V/C Ratios						0.98
Adjustment for Lost Time						0.05
Intersection Capacity Utilization (ICU)						**1.03**
Level of Service (LOS) - Refer to table below						**F**

* NOTES

Per-lane Capacity = 1,700 vehicles/hour

dual left turn lane capacity = 3,400 vph

LOS	Maximum V/C
A	0.60
B	0.70
C	0.80
D	0.90
E	1.00
F	n/a

INTERSECTION CAPACITY UTILIZATION

Intersection: Brookhurst St / Adams Ave (2030 Volumes No Improvements)

Date: 1/11/2011 Peak Hr: PM

Analyst: AGA Agency: City of Huntington Beach

Movement	Volume	No. of Lanes	Capacity*	V/C Ratio	Critical V/C	Total
NB Left	300	2	3400	300/3,400= 0.09		
NB Thru	1290	3	5100	1,580/5,100= 0.31	< ==	
NB Right	290	0	0	----		
SB Left	480	2	3400	480/3,400= 0.14	< ==	
SB Thru	1340	3	5100	1,500/5,100= 0.29		
SB Right	160	0	0	----		0.45
EB Left	340	2	3400	340/3,400= 0.10	< ==	
EB Thru	1270	3	5100	1,270/5,100= 0.25		
EB Right	100	1	1700	100/1,700= 0.06		
WB Left	460	2	3400	460/3,400= 0.14		
WB Thru	2300	3	5100	2,300/5,100= 0.45	< ==	
WB Right	380	1	1700	380/1,700= 0.22		0.55

Sum of Critical V/C Ratios	1.00
Adjustment for Lost Time	0.05
Intersection Capacity Utilization (ICU)	**1.05**
Level of Service (LOS) - Refer to table below	**F**

* NOTES

Per-lane Capacity = 1,700 vehicles/hour

dual left turn lane capacity = 3,400 vph

LOS	Maximum V/C
A	0.60
B	0.70
C	0.80
D	0.90
E	1.00
F	n/a

INTERSECTION CAPACITY UTILIZATION

Intersection: Brookhurst St / Adams Ave (2030 Volumes with Improvements)

Date: 1/11/2011 Peak Hr: AM

Analyst: AGA Agency: City of Huntington Beach

Movement	Volume	No. of Lanes	Capacity*	V/C Ratio	Critical V/C	Total
NB Left	140	2	3400	140/3,400= 0.04		
NB Thru	860	3	5100	860/5,100= 0.17	< ==	
NB Right	630	2	3400	630/3,400= 0.19		
SB Left	490	2	3400	490/3,400= 0.14	< ==	
SB Thru	940	3	5100	940/5,100= 0.18		
SB Right	130	1	1700	130/1,700= 0.08		0.31
EB Left	240	2	3400	240/3,400= 0.07		
EB Thru	2480	4	6800	2,480/6,800= 0.37	< ==	
EB Right	80	1	1700	80/1,700= 0.05		
WB Left	200	2	3400	200/3,400= 0.06	< ==	
WB Thru	750	4	6800	750/6,800= 0.11		
WB Right	280	1	1700	280/1,700= 0.17		0.42
Sum of Critical V/C Ratios						0.74
Adjustment for Lost Time						0.05
Intersection Capacity Utilization (ICU)						**0.79**
Level of Service (LOS) - Refer to table below						**C**

* NOTES

Per-lane Capacity = 1,700 vehicles/hour

dual left turn lane capacity = 3,400 vph

LOS	Maximum V/C
A	0.60
B	0.70
C	0.80
D	0.90
E	1.00
F	n/a

INTERSECTION CAPACITY UTILIZATION

Intersection: Brookhurst St / Adams Ave (2030 Volumes with Improvements)

Date: 1/11/2011 Peak Hr: PM

Analyst: AGA Agency: City of Huntington Beach

Movement	Volume	No. of Lanes	Capacity*	V/C Ratio	Critical V/C	Total
NB Left	300	2	3400	300/3,400= 0.09		
NB Thru	1290	3	5100	1,290/5,100= 0.25	< ==	
NB Right	290	2	3400	290/3,400= 0.09		
SB Left	480	2	3400	480/3,400= 0.14	< ==	
SB Thru	1340	3	5100	1,340/5,100= 0.26		
SB Right	160	1	1700	160/1,700= 0.09		0.39
EB Left	340	2	3400	340/3,400= 0.10	< ==	
EB Thru	1270	4	6800	1,270/6,800= 0.19		
EB Right	100	1	1700	100/1,700= 0.06		
WB Left	460	2	3400	460/3,400= 0.14		
WB Thru	2300	4	6800	2,300/6,800= 0.34	< ==	
WB Right	380	1	1700	380/1,700= 0.22		0.44

Sum of Critical V/C Ratios	0.83
Adjustment for Lost Time	0.05
Intersection Capacity Utilization (ICU)	**0.88**
Level of Service (LOS) - Refer to table below	**D**

* NOTES

Per-lane Capacity = 1,700 vehicles/hour

dual left turn lane capacity = 3,400 vph

LOS	Maximum V/C
A	0.60
B	0.70
C	0.80
D	0.90
E	1.00
F	n/a

ATTACHMENT G

Right-of-Way Exhibits – Alternative 1

BASIS OF BEARINGS:

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE CALIFORNIA COORDINATE SYSTEM, ZONE 6 NAD 83 (EPOCH 1991.35) AS DETERMINED LOCALLY BY A LINE BETWEEN ORANGE COUNTY HORIZONTAL CONTROL MONUMENTS 5028 AND 5043 BEING N 0°15'05" E AS DERIVED FROM GEODETIC VALUES PUBLISHED BY THE ORANGE COUNTY SURVEYOR.

NOTE:

RECORD DISTANCES AND BEARINGS SHOWN HAVE BEEN ADJUSTED TO THE PROPOSED PLAN BASIS OF BEARING.

LEGEND

- RIGHT-OF-WAY ACQUISITION
- EXISTING CURB
- EXISTING RIGHT-OF-WAY
- PROPOSED CURB
- PROPOSED RIGHT-OF-WAY

PROPERTY DATA (NORTHWEST QUADRANT)

PARCEL NO.	BUSINESS OR RESIDENT NAME	BUSINESS OR RESIDENT ADDRESS	EXISTING LOT AREA	R/W ACQUISITION	PROPOSED LOT AREA	LANDSCAPE AREA LOST	PARKING SPACES LOST
153-171-01	POLLY'S PIES	9791 ADAMS AVENUE	425,905± SQ. FEET	4,644± SQ. FEET	421,261± SQ. FEET	2,215± SQ. FEET	29 SPACES
	TOWN LIQUOR & MINI MART	9795 ADAMS AVENUE					
	HB LAPTOPS	9803 ADAMS AVENUE					
	SPLASH SALON	9807 ADAMS AVENUE					
	KOHL'S	9811 ADAMS AVENUE					
	SPROUTS	9861 ADAMS AVENUE					
	JO-ANN FABRICS & CRAFTS	9901 ADAMS AVENUE					
	CRIVELLO RISTORANTE ITALIANO	19881 BROOKHURST STREET, SUITE A					
	SUBWAY	19881 BROOKHURST STREET, SUITE B					
	SURF CITY MAIL	19881 BROOKHURST STREET, SUITE C					
	SAKURAI JAPANESE GRILL	19881 BROOKHURST STREET, SUITE D					
	LOKELANI'S	19883 BROOKHURST STREET, SUITE A					
	HB TANNING	19883 BROOKHURST STREET, SUITE B					
	SO CAL GOLD COMPANY	19883 BROOKHURST STREET, SUITE C					
	BEAUTY QUEEN NAILS & SPA	19885 BROOKHURST STREET					
	SALON DOMANE	19887 BROOKHURST STREET					
	LOVING HUT VEGAN CUISINE	19891 BROOKHURST STREET					
	PIZZA HUT	19893 BROOKHURST STREET					
153-171-02	WELLS FARGO	9971 ADAMS AVENUE	22,329± SQ. FEET	1,212± SQ. FEET	21,117± SQ. FEET	1,230± SQ. FEET	0 SPACES
	YOGURTLAND	9961 ADAMS AVENUE					
	DIGI PHOTO	9951 ADAMS AVENUE					
	TIME CENTER	9941 ADAMS AVENUE					
		TOTALS =	448,234± SQ. FEET	5,856± SQ. FEET	442,378± SQ. FEET	3,445± SQ. FEET	29 SPACES

LINE DATA

#	BEARING	DISTANCE
L1	N89°35'57"W	62.40'
L2	N79°17'01"E	42.13'
L3	N00°24'03"E	10.00'

CURVE DATA

#	DELTA	RADIUS	LENGTH
C1	11°07'02"	42.00'	8.15'
C2	11°07'02"	58.00'	11.25'
C3	90°08'58"	32.00'	50.35'
C4	09°33'49"	275.80'	46.04'
C5	01°29'23"	292.73'	7.61'
C6	90°08'58"	30.00'	47.20'

ALTERNATIVE 1:
10-FOOT WIDE LANES

SCALE: 1" = 50' (22" X 34" PLOT)
1" = 100' (11" X 17" PLOT)

RIGHT-OF-WAY EXHIBIT

NORTHWEST QUADRANT OF
ADAMS AVENUE & BROOKHURST STREET
IN THE CITY OF HUNTINGTON BEACH,
COUNTY OF ORANGE, STATE OF CALIFORNIA

SHEET 1 OF 4 SHEETS

SCALE:	PER PLAN
JOB NUMBER:	10-HAR-07
DWG NUMBER:	ROW
SURVEY DATE:	N/A
DRAFTED BY:	KMK
CHECKED BY:	RCM

REVISIONS

HARRIS & ASSOCIATES
34 Executive Park, Suite 150
Irvine, Ca. 92614-4705
(949) 655-3900 • FAX (949) 655-3995

KDM Meridian
22541 Aspan Street
Suite C
Lake Forest, CA 92630
Phone: 949-768-0731
Fax: 949-768-3731

BASIS OF BEARINGS:

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE CALIFORNIA COORDINATE SYSTEM, ZONE 6 NAD 83 (EPOCH 1991.35) AS DETERMINED LOCALLY BY A LINE BETWEEN ORANGE COUNTY HORIZONTAL CONTROL MONUMENTS 5028 AND 5043 BEING N 0°15'05" E AS DERIVED FROM GEODETIC VALUES PUBLISHED BY THE ORANGE COUNTY SURVEYOR.

NOTE:

RECORD DISTANCES AND BEARINGS SHOWN HAVE BEEN ADJUSTED TO THE PROPOSED PLAN BASIS OF BEARING.

LEGEND

- RIGHT-OF-WAY ACQUISITION
- EXISTING CURB
- EXISTING RIGHT-OF-WAY
- PROPOSED CURB
- PROPOSED RIGHT-OF-WAY

LINE DATA

#	BEARING	DISTANCE
L4	N00°19'21"E	3.00'
L5	N83°53'18"W	30.15'
L6	N00°19'21"E	8.00'
L7	N80°45'21"W	45.15'

CURVE DATA

#	DELTA	RADIUS	LENGTH
C7	89°55'18"	30.00'	47.08'
C8	89°55'18"	30.00'	47.08'
C9	08°50'36"	58.00'	8.95'
C10	04°20'12"	42.00'	3.18'

PROPERTY DATA (SOUTHWEST QUADRANT)

PARCEL NO.	BUSINESS OR RESIDENT NAME	BUSINESS OR RESIDENT ADDRESS	EXISTING LOT AREA	R/W ACQUISITION	PROPOSED LOT AREA	LANDSCAPE AREA LOST	PARKING SPACES LOST
151-461-28	TARGET	9882 ADAMS AVENUE	509,292± SQ. FEET	1,307± SQ. FEET	507,985± SQ. FEET	1,767± SQ. FEET	18 SPACES
151-461-30	BROOKHURST CLASSIC SHELL	20001 BROOKHURST STREET	24,972± SQ. FEET	1,325± SQ. FEET	23,647± SQ. FEET	455± SQ. FEET	0 SPACES
		TOTALS =	534,264± SQ. FEET	2,632± SQ. FEET	531,632± SQ. FEET	2,222± SQ. FEET	18 SPACES

SCALE: 1" = 50' (22" X 34" PLOT)
1" = 100' (11" X 17" PLOT)

ALTERNATIVE 1:
10-FOOT WIDE LANES

HARRIS & ASSOCIATES
34 Executive Park, Suite 150
Irvine, Ca. 92614-4705
(949) 655-3900 ● FAX (949) 655-3995

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22541 Aspan Street
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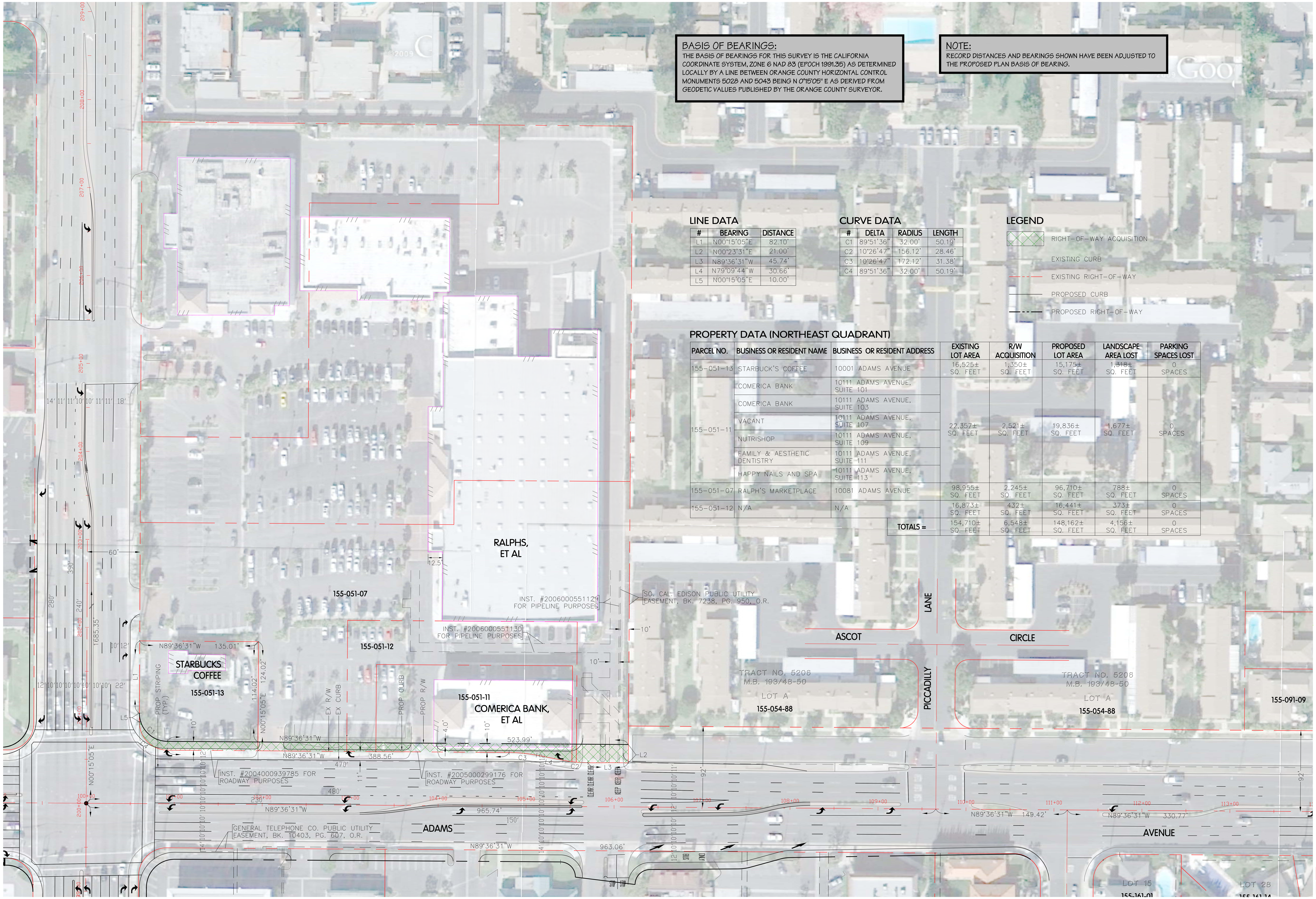
RIGHT-OF-WAY EXHIBIT

SOUTHWEST QUADRANT OF
ADAMS AVENUE & BROOKHURST STREET
IN THE CITY OF HUNTINGTON BEACH,
COUNTY OF ORANGE, STATE OF CALIFORNIA

REVISIONS

SURVEY DATE: N/A	SCALE: PER PLAN
DRAFTED BY: KMK	JOB NUMBER: 10-HAR-07
CHECKED BY: RCM	DWG NUMBER: ROW

SHEET 2 OF 4 SHEETS



BASIS OF BEARINGS:

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE CALIFORNIA COORDINATE SYSTEM, ZONE 6 NAD 83 (EPOCH 1991.35) AS DETERMINED LOCALLY BY A LINE BETWEEN ORANGE COUNTY HORIZONTAL CONTROL MONUMENTS 5028 AND 5043 BEING N 0°15'05" E AS DERIVED FROM GEODETIC VALUES PUBLISHED BY THE ORANGE COUNTY SURVEYOR.

NOTE:

RECORD DISTANCES AND BEARINGS SHOWN HAVE BEEN ADJUSTED TO THE PROPOSED PLAN BASIS OF BEARING.

LINE DATA

#	BEARING	DISTANCE
L1	N00°15'05"E	82.10'
L2	N00°23'31"E	21.00'
L3	N89°36'31"W	45.74'
L4	N79°09'44"W	30.66'
L5	N00°15'05"E	10.00'

CURVE DATA

#	DELTA	RADIUS	LENGTH
C1	89°51'36"	32.00'	50.19'
C2	10°26'47"	156.12'	28.46'
C3	10°26'47"	172.12'	31.38'
C4	89°51'36"	32.00'	50.19'

LEGEND

- RIGHT-OF-WAY ACQUISITION
- EXISTING CURB
- EXISTING RIGHT-OF-WAY
- PROPOSED CURB
- PROPOSED RIGHT-OF-WAY

PROPERTY DATA (NORTHEAST QUADRANT)

PARCEL NO.	BUSINESS OR RESIDENT NAME	BUSINESS OR RESIDENT ADDRESS	EXISTING LOT AREA	R/W ACQUISITION	PROPOSED LOT AREA	LANDSCAPE AREA LOST	PARKING SPACES LOST
155-051-13	STARBUCK'S COFFEE	10001 ADAMS AVENUE	16,525± SQ. FEET	1,350± SQ. FEET	15,175± SQ. FEET	1,318± SQ. FEET	0 SPACES
155-051-11	COMERICA BANK	10111 ADAMS AVENUE, SUITE 101	22,357± SQ. FEET	2,521± SQ. FEET	19,836± SQ. FEET	1,677± SQ. FEET	0 SPACES
	COMERICA BANK	10111 ADAMS AVENUE, SUITE 103					
	VACANT	10111 ADAMS AVENUE, SUITE 107					
	NUTRISHOP	10111 ADAMS AVENUE, SUITE 109					
	FAMILY & AESTHETIC DENTISTRY	10111 ADAMS AVENUE, SUITE 111					
	HAPPY NAILS AND SPA	10111 ADAMS AVENUE, SUITE 113					
155-051-07	RALPH'S MARKETPLACE	10081 ADAMS AVENUE	98,955± SQ. FEET	2,245± SQ. FEET	96,710± SQ. FEET	788± SQ. FEET	0 SPACES
155-051-12	N/A	N/A	16,873± SQ. FEET	432± SQ. FEET	16,441± SQ. FEET	373± SQ. FEET	0 SPACES
		TOTALS =	154,710± SQ. FEET	6,548± SQ. FEET	148,162± SQ. FEET	4,156± SQ. FEET	0 SPACES

SCALE: 1" = 50' (22" X 34" PLOT)
1" = 100' (11" X 17" PLOT)

ALTERNATIVE 1:
10-FOOT WIDE LANES

HARRIS & ASSOCIATES

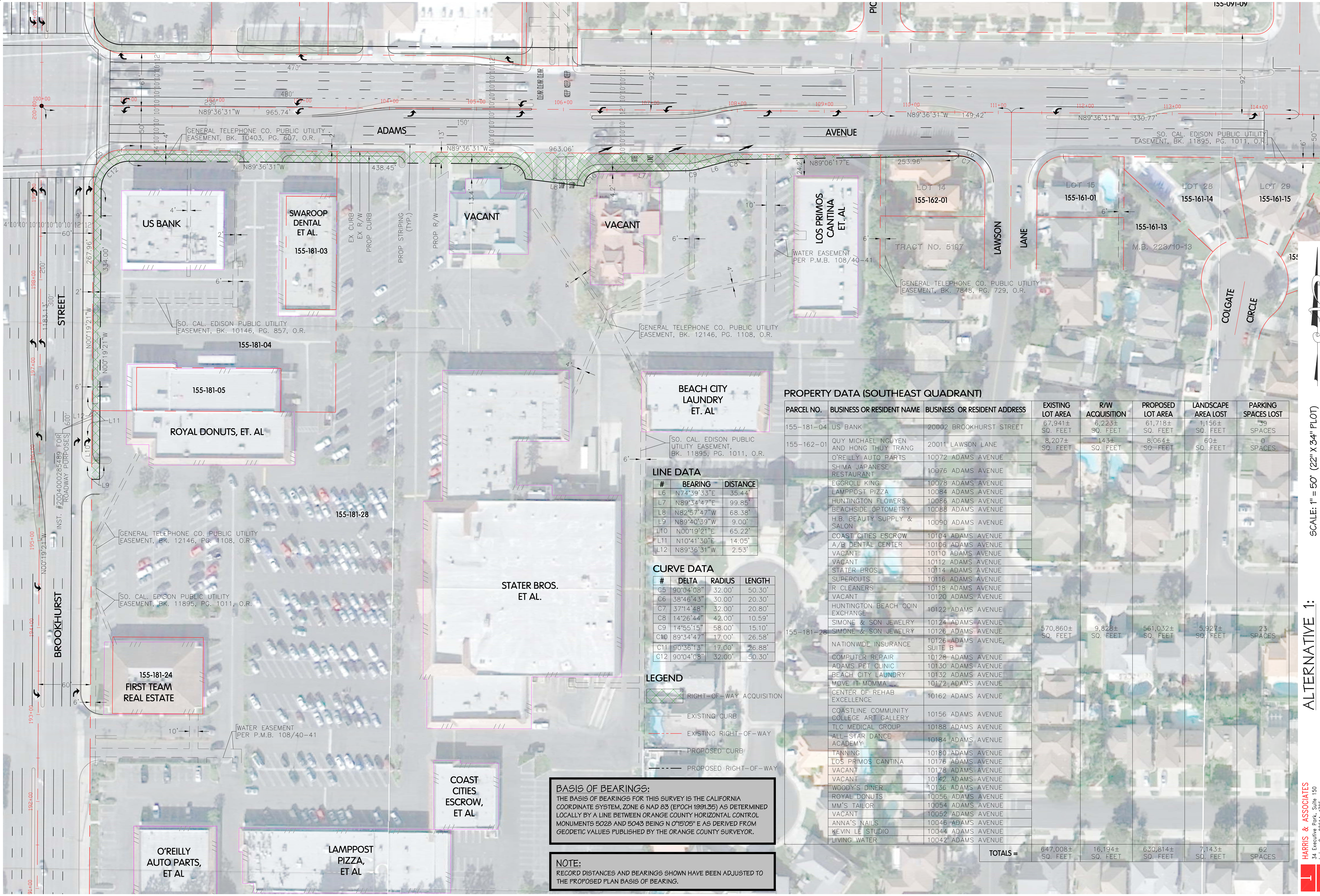
RIGHT-OF-WAY EXHIBIT

NORTHEAST QUADRANT OF
ADAMS AVENUE & BROOKHURST STREET
IN THE CITY OF HUNTINGTON BEACH,
COUNTY OF ORANGE, STATE OF CALIFORNIA

KDM Meridian
22541 Aspan Street
Suite C
Lake Forest, CA 92630
Phone: 949-768-0731
Fax: 949-768-3731

REVISIONS

SURVEY DATE: N/A	SCALE: PER PLAN
DRAFTED BY: KMK	JOB NUMBER: 10-HAR-07
CHECKED BY: RCM	DWG NUMBER: ROW



PROPERTY DATA (SOUTHEAST QUADRANT)

PARCEL NO.	BUSINESS OR RESIDENT NAME	BUSINESS OR RESIDENT ADDRESS	EXISTING LOT AREA	R/W ACQUISITION	PROPOSED LOT AREA	LANDSCAPE AREA LOST	PARKING SPACES LOST
155-181-04	US BANK	20002 BROOKHURST STREET	67,941± SQ. FEET	6,223± SQ. FEET	61,718± SQ. FEET	1,156± SQ. FEET	39 SPACES
155-162-01	QUY MICHAEL NGUYEN AND HONG THUY TRANG	20011 LAWSON LANE	8,207± SQ. FEET	143± SQ. FEET	8,064± SQ. FEET	60± SQ. FEET	0 SPACES
155-181-28	O'REILLY AUTO PARTS	10072 ADAMS AVENUE	570,860± SQ. FEET	9,828± SQ. FEET	561,032± SQ. FEET	5,927± SQ. FEET	23 SPACES
	SHIMA JAPANESE RESTAURANT	10076 ADAMS AVENUE					
	EGGROLL KING	10078 ADAMS AVENUE					
	LAMPPOST PIZZA	10084 ADAMS AVENUE					
	HUNTINGTON FLOWERS	10086 ADAMS AVENUE					
	BEACHSIDE OPTOMETRY	10088 ADAMS AVENUE					
	H.B. BEAUTY SUPPLY & SALON	10090 ADAMS AVENUE					
	COAST CITIES ESCROW	10104 ADAMS AVENUE					
	A/B DENTAL CENTER	10106 ADAMS AVENUE					
	VACANT	10110 ADAMS AVENUE					
	VACANT	10112 ADAMS AVENUE					
	STATER BROS	10114 ADAMS AVENUE					
	SUPERCUTS	10116 ADAMS AVENUE					
	R CLEANERS	10118 ADAMS AVENUE					
	VACANT	10120 ADAMS AVENUE					
	HUNTINGTON BEACH COIN EXCHANGE	10122 ADAMS AVENUE					
	SIMONE & SON JEWELRY	10124 ADAMS AVENUE					
	SIMONE & SON JEWELRY	10126 ADAMS AVENUE					
	NATIONWIDE INSURANCE	10126 ADAMS AVENUE, SUITE B					
	COMPUTER REPAIR	10128 ADAMS AVENUE					
	ADAMS PET CLINIC	10130 ADAMS AVENUE					
	BEACH CITY LAUNDRY	10132 ADAMS AVENUE					
	MOVE IT MOMMA	10172 ADAMS AVENUE					
	CENTER OF REHAB EXCELLENCE	10162 ADAMS AVENUE					
	COASTLINE COMMUNITY COLLEGE ART GALLERY	10156 ADAMS AVENUE					
	TLC MEDICAL GROUP	10188 ADAMS AVENUE					
	ALL-STAR DANCE ACADEMY	10184 ADAMS AVENUE					
	TANNING	10180 ADAMS AVENUE					
	LOS PRIMOS CANTINA	10176 ADAMS AVENUE					
	VACANT	10178 ADAMS AVENUE					
	VACANT	10142 ADAMS AVENUE					
	WOODY'S DINER	10136 ADAMS AVENUE					
	ROYAL DONUTS	10056 ADAMS AVENUE					
	MM'S TAILOR	10054 ADAMS AVENUE					
	VACANT	10052 ADAMS AVENUE					
	ANNA'S NAILS	10046 ADAMS AVENUE					
	KEVIN LE STUDIO	10044 ADAMS AVENUE					
	LIVING WATER	10042 ADAMS AVENUE					
		TOTALS =	647,008± SQ. FEET	16,194± SQ. FEET	630,814± SQ. FEET	7,143± SQ. FEET	62 SPACES

LINE DATA

#	BEARING	DISTANCE
L6	N74°39'33"E	35.44'
L7	N89°34'47"E	99.85'
L8	N82°57'47"W	68.38'
L9	N89°40'39"W	9.00'
L10	N00°19'21"E	65.22'
L11	N10°41'30"E	14.05'
L12	N89°36'31"W	2.53'

CURVE DATA

#	DELTA	RADIUS	LENGTH
C5	90°04'08"	32.00'	50.30'
C6	38°46'43"	30.00'	20.30'
C7	37°14'48"	32.00'	20.80'
C8	14°26'44"	42.00'	10.59'
C9	14°55'15"	58.00'	15.10'
C10	89°34'47"	17.00'	26.58'
C11	90°36'13"	17.00'	26.88'
C12	90°04'08"	32.00'	50.30'

LEGEND

- RIGHT-OF-WAY ACQUISITION
- EXISTING CURB
- EXISTING RIGHT-OF-WAY
- PROPOSED CURB
- PROPOSED RIGHT-OF-WAY

BASIS OF BEARINGS:
THE BASIS OF BEARINGS FOR THIS SURVEY IS THE CALIFORNIA COORDINATE SYSTEM, ZONE 6 NAD 83 (EPOCH 1991.35) AS DETERMINED LOCALLY BY A LINE BETWEEN ORANGE COUNTY HORIZONTAL CONTROL MONUMENTS 5028 AND 5043 BEING N 0°15'05" E AS DERIVED FROM GEODETIC VALUES PUBLISHED BY THE ORANGE COUNTY SURVEYOR.

NOTE:
RECORD DISTANCES AND BEARINGS SHOWN HAVE BEEN ADJUSTED TO THE PROPOSED PLAN BASIS OF BEARING.

SCALE: 1" = 50' (22" X 34" PLOT)
1" = 100' (11" X 17" PLOT)

ALTERNATIVE 1:
10-FOOT WIDE LANES

HARRIS & ASSOCIATES
34 Executive Park, Suite 150
Irvine, Ca. 92614-4705
(949) 655-3900 • FAX (949) 655-3995

REVISIONS

SURVEY DATE: N/A
DRAFTED BY: KMK
CHECKED BY: RCM
SCALE: PER PLAN
JOB NUMBER: 10-HAR-07
DWG NUMBER: ROW

SHEET 4 OF 4 SHEETS

RIGHT-OF-WAY EXHIBIT

SOUTHEAST QUADRANT OF
ADAMS AVENUE & BROOKHURST STREET
IN THE CITY OF HUNTINGTON BEACH,
COUNTY OF ORANGE, STATE OF CALIFORNIA

KDM Meridian
22541 Aspan Street
Suite C
Lake Forest, CA 92630
Phone: 949-768-0731
Fax: 949-768-3731

ATTACHMENT H

Right-of-Way Exhibits – Alternative 2

BASIS OF BEARINGS:

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE CALIFORNIA COORDINATE SYSTEM, ZONE 6 NAD 83 (EPOCH 1991.35) AS DETERMINED LOCALLY BY A LINE BETWEEN ORANGE COUNTY HORIZONTAL CONTROL MONUMENTS 5028 AND 5043 BEING N 0°15'05" E AS DERIVED FROM GEODETIC VALUES PUBLISHED BY THE ORANGE COUNTY SURVEYOR.

NOTE:

RECORD DISTANCES AND BEARINGS SHOWN HAVE BEEN ADJUSTED TO THE PROPOSED PLAN BASIS OF BEARING.

LEGEND

- RIGHT-OF-WAY ACQUISITION
- EXISTING CURB
- EXISTING RIGHT-OF-WAY
- PROPOSED CURB
- PROPOSED RIGHT-OF-WAY

PROPERTY DATA (NORTHWEST QUADRANT)

PARCEL NO.	BUSINESS OR RESIDENT NAME	BUSINESS OR RESIDENT ADDRESS	EXISTING LOT AREA	R/W ACQUISITION	PROPOSED LOT AREA	LANDSCAPE AREA LOST	PARKING SPACES LOST
153-171-01	POLLY'S PIES	9791 ADAMS AVENUE	425,905± SQ. FEET	10,736± SQ. FEET	415,169± SQ. FEET	2,799± SQ. FEET	75 SPACES
	TOWN LIQUOR & MINI MART	9795 ADAMS AVENUE					
	HB LAPTOPS	9803 ADAMS AVENUE					
	SPLASH SALON	9807 ADAMS AVENUE					
	KOHL'S	9811 ADAMS AVENUE					
	SPROUTS	9861 ADAMS AVENUE					
	JO-ANN FABRICS & CRAFTS	9901 ADAMS AVENUE					
	CRIVELLO RISTORANTE ITALIANO	19881 BROOKHURST STREET, SUITE A					
	SUBWAY	19881 BROOKHURST STREET, SUITE B					
	SURF CITY MAIL	19881 BROOKHURST STREET, SUITE C					
	SAKURAI JAPANESE GRILL	19881 BROOKHURST STREET, SUITE D					
	LOKELANI'S	19883 BROOKHURST STREET, SUITE A					
	HB TANNING	19883 BROOKHURST STREET, SUITE B					
	SO CAL GOLD COMPANY	19883 BROOKHURST STREET, SUITE C					
	BEAUTY QUEEN NAILS & SPA	19885 BROOKHURST STREET					
	SALON DOMANE	19887 BROOKHURST STREET					
	LOVING HUT VEGAN CUISINE	19891 BROOKHURST STREET					
	PIZZA HUT	19893 BROOKHURST STREET					
153-171-02	WELLS FARGO	9971 ADAMS AVENUE	22,329± SQ. FEET	3,223± SQ. FEET	19,106± SQ. FEET	3,041± SQ. FEET	1 SPACE
	YOGURTLAND	9961 ADAMS AVENUE					
	DIGI PHOTO	9951 ADAMS AVENUE					
	TIME CENTER	9941 ADAMS AVENUE					
TOTALS =			448,234± SQ. FEET	13,959± SQ. FEET	434,275± SQ. FEET	5,840± SQ. FEET	76 SPACES

LINE DATA

#	BEARING	DISTANCE
L1	N00°15'05"E	4.61'
L2	N79°17'01"E	42.13'
L3	N00°24'03"E	10.00'
L4	N45°19'34"E	45.31'

CURVE DATA

#	DELTA	RADIUS	LENGTH
C1	11°07'02"	42.00'	8.15'
C2	11°07'02"	58.00'	11.25'
C3	18°55'29"	146.75'	48.47'
C4	07°29'31"	89.66'	11.72'
C5	90°08'58"	30.00'	47.20'

SCALE: 1" = 50' (22" X 34" PLOT)
1" = 100' (11" X 17" PLOT)

ALTERNATIVE 2:
12-FOOT WIDE LANES

HARRIS & ASSOCIATES
34 Executive Park, Suite 150
Irvine, Ca. 92614-4705
(949) 655-3900 ● FAX (949) 655-3995

RIGHT-OF-WAY EXHIBIT

NORTHWEST QUADRANT OF
ADAMS AVENUE & BROOKHURST STREET
IN THE CITY OF HUNTINGTON BEACH,
COUNTY OF ORANGE, STATE OF CALIFORNIA

KDM Meridian
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Suite C
Lake Forest, CA 92630
Phone: 949-768-0731
Fax: 949-768-3731

SHEET 1 OF 4 SHEETS

REVISIONS	SURVEY DATE: N/A	SCALE: PER PLAN
	DRAFTED BY: KMK	JOB NUMBER: 10-HAR-07
	CHECKED BY: RCM	DWG NUMBER: ROW

RIGHT-OF-WAY EXHIBIT

SOUTHWEST QUADRANT OF ADAMS AVENUE & BROOKHURST STREET IN THE CITY OF HUNTINGTON BEACH, COUNTY OF ORANGE, STATE OF CALIFORNIA

ALTERNATIVE 2: 12-FOOT WIDE LANES

SCALE: 1" = 50' (22" X 34" PLOT)
1" = 100' (11" X 17" PLOT)

BASIS OF BEARINGS:
THE BASIS OF BEARINGS FOR THIS SURVEY IS THE CALIFORNIA COORDINATE SYSTEM, ZONE 6 NAD 83 (EPOCH 1991.35) AS DETERMINED LOCALLY BY A LINE BETWEEN ORANGE COUNTY HORIZONTAL CONTROL MONUMENTS 5028 AND 5043 BEING N 0°15'05" E AS DERIVED FROM GEODETIC VALUES PUBLISHED BY THE ORANGE COUNTY SURVEYOR.

NOTE:
RECORD DISTANCES AND BEARINGS SHOWN HAVE BEEN ADJUSTED TO THE PROPOSED PLAN BASIS OF BEARING.

LEGEND

- RIGHT-OF-WAY ACQUISITION
- EXISTING CURB
- EXISTING RIGHT-OF-WAY
- PROPOSED CURB
- PROPOSED RIGHT-OF-WAY

LINE DATA

#	BEARING	DISTANCE
L5	N00°19'21"E	3.00'
L6	N83°53'18"W	30.15'
L7	N00°53'23"W	47.26'
L8	N44°07'09"E	45.01'
L9	N77°08'44"W	39.31'
L10	N00°19'21"E	0.23'

CURVE DATA

#	DELTA	RADIUS	LENGTH
C6	89°55'18"	30.00'	47.08'
C7	12°27'12"	58.00'	12.61'
C8	11°33'49"	42.00'	8.48'

PROPERTY DATA (SOUTHWEST QUADRANT)

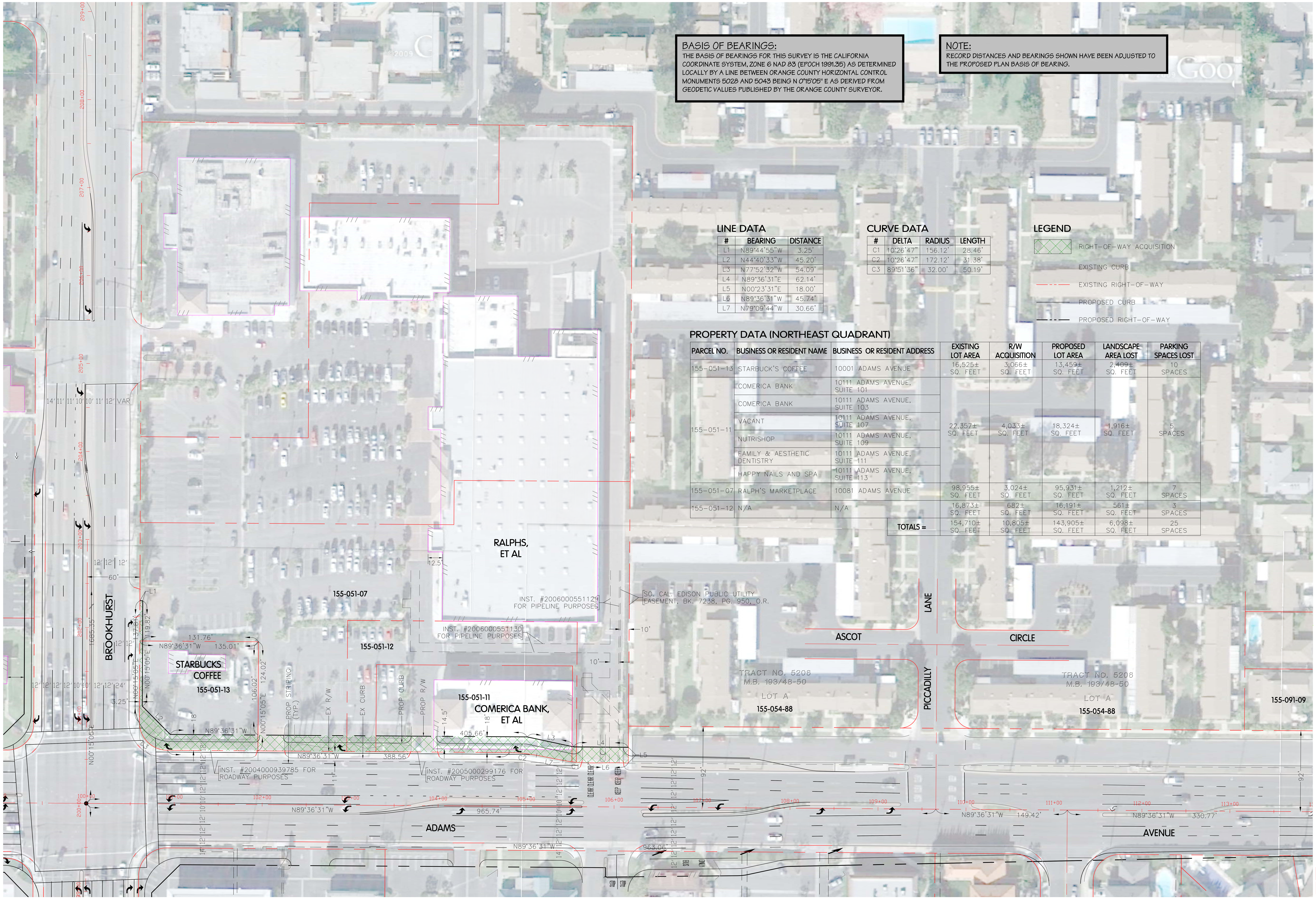
PARCEL NO.	BUSINESS OR RESIDENT NAME	BUSINESS OR RESIDENT ADDRESS	EXISTING LOT AREA	R/W ACQUISITION	PROPOSED LOT AREA	LANDSCAPE AREA LOST	PARKING SPACES LOST
151-461-28	TARGET	9882 ADAMS AVENUE	509,292± SQ. FEET	3,709± SQ. FEET	505,583± SQ. FEET	2,697± SQ. FEET	18 SPACES
151-461-30	BROOKHURST CLASSIC SHELL	20001 BROOKHURST STREET	24,972± SQ. FEET	3,059± SQ. FEET	21,913± SQ. FEET	678± SQ. FEET	0 SPACES
151-461-29	BANK OF AMERICA	20061 BROOKHURST STREET	31,290± SQ. FEET	8± SQ. FEET	31,282± SQ. FEET	0± SQ. FEET	0 SPACES
		TOTALS =	565,554± SQ. FEET	6,776± SQ. FEET	558,778± SQ. FEET	3,375± SQ. FEET	18 SPACES

REVISIONS

SURVEY DATE:	SCALE:
N/A	PER PLAN
DRAFTED BY: KMK	JOB NUMBER: 10-HAR-07
CHECKED BY: RCM	DWG NUMBER: ROW

KDM Meridian
22541 Aspan Street
Suite C
Lake Forest, CA 92630
Phone: 949-768-0731
Fax: 949-768-3731

HARRIS & ASSOCIATES
34 Executive Park, Suite 150
Irvine, Ca. 92614-4705
(949) 655-3900 • FAX (949) 655-3995



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NOTE:

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LINE DATA

#	BEARING	DISTANCE
L1	N89°44'55"W	3.25'
L2	N44°40'33"W	45.20'
L3	N77°52'32"W	54.09'
L4	N89°36'31"E	62.14'
L5	N00°23'31"E	18.00'
L6	N89°36'31"W	45.74'
L7	N79°09'44"W	30.66'

CURVE DATA

#	DELTA	RADIUS	LENGTH
C1	10°26'47"	156.12'	28.46'
C2	10°26'47"	172.12'	31.38'
C3	89°51'36"	32.00'	50.19'

LEGEND

- RIGHT-OF-WAY ACQUISITION
- EXISTING CURB
- EXISTING RIGHT-OF-WAY
- PROPOSED CURB
- PROPOSED RIGHT-OF-WAY

PROPERTY DATA (NORTHEAST QUADRANT)

PARCEL NO.	BUSINESS OR RESIDENT NAME	BUSINESS OR RESIDENT ADDRESS	EXISTING LOT AREA	R/W ACQUISITION	PROPOSED LOT AREA	LANDSCAPE AREA LOST	PARKING SPACES LOST
155-051-13	STARBUCK'S COFFEE	10001 ADAMS AVENUE	16,525± SQ. FEET	3,066± SQ. FEET	13,459± SQ. FEET	2,409± SQ. FEET	10 SPACES
155-051-11	COMERICA BANK	10111 ADAMS AVENUE, SUITE 101	22,357± SQ. FEET	4,033± SQ. FEET	18,324± SQ. FEET	1,916± SQ. FEET	5 SPACES
	COMERICA BANK	10111 ADAMS AVENUE, SUITE 103					
	VACANT	10111 ADAMS AVENUE, SUITE 107					
	NUTRISHOP	10111 ADAMS AVENUE, SUITE 109					
	FAMILY & AESTHETIC DENTISTRY	10111 ADAMS AVENUE, SUITE 111					
	HAPPY NAILS AND SPA	10111 ADAMS AVENUE, SUITE 113					
155-051-07	RALPH'S MARKETPLACE	10081 ADAMS AVENUE	98,955± SQ. FEET	3,024± SQ. FEET	95,931± SQ. FEET	1,212± SQ. FEET	7 SPACES
155-051-12	N/A	N/A	16,873± SQ. FEET	682± SQ. FEET	16,191± SQ. FEET	561± SQ. FEET	3 SPACES
		TOTALS =	154,710± SQ. FEET	10,805± SQ. FEET	143,905± SQ. FEET	6,098± SQ. FEET	25 SPACES

SCALE: 1" = 50' (22" X 34" PLOT)
1" = 100' (11" X 17" PLOT)

ALTERNATIVE 2:
12-FOOT WIDE LANES

HARRIS & ASSOCIATES
34 Executive Park, Suite 150
Irvine, Ca. 92614-4705
(949) 655-3900 • FAX (949) 655-3995

RIGHT-OF-WAY EXHIBIT

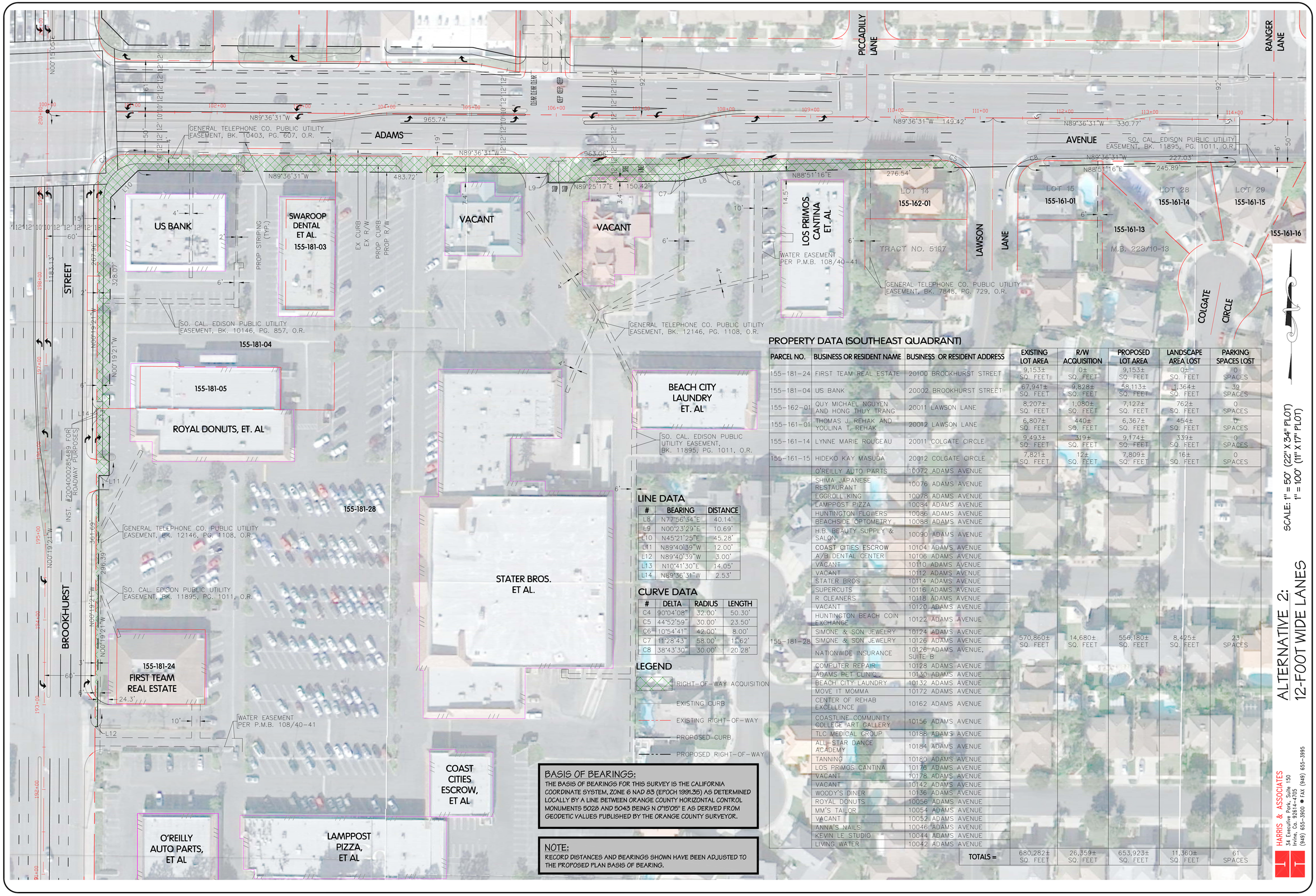
NORTHEAST QUADRANT OF
ADAMS AVENUE & BROOKHURST STREET
IN THE CITY OF HUNTINGTON BEACH,
COUNTY OF ORANGE, STATE OF CALIFORNIA

KDM Meridian
22541 Aspan Street
Suite C
Lake Forest, CA 92630
Phone: 949-768-0731
Fax: 949-768-3731

REVISIONS

SURVEY DATE: N/A	SCALE: PER PLAN
DRAFTED BY: KMK	JOB NUMBER: 10-MAR-07
CHECKED BY: RCM	DWG NUMBER: ROW

SHEET 3 OF 4 SHEETS



PROPERTY DATA (SOUTHEAST QUADRANT)

PARCEL NO.	BUSINESS OR RESIDENT NAME	BUSINESS OR RESIDENT ADDRESS	EXISTING LOT AREA	R/W ACQUISITION	PROPOSED LOT AREA	LANDSCAPE AREA LOST	PARKING SPACES LOST
155-181-24	FIRST TEAM REAL ESTATE	20100 BROOKHURST STREET	9,153± SQ. FEET	0± SQ. FEET	9,153± SQ. FEET	0± SQ. FEET	0 SPACES
155-181-04	US BANK	20002 BROOKHURST STREET	67,941± SQ. FEET	9,828± SQ. FEET	58,113± SQ. FEET	1,364± SQ. FEET	39 SPACES
155-162-01	QUY MICHAEL NGUYEN AND HONG THUY TRANG	20011 LAWSON LANE	8,207± SQ. FEET	1,080± SQ. FEET	7,127± SQ. FEET	762± SQ. FEET	0 SPACES
155-161-01	THOMAS J. REHAK AND YOULINA T. REHAK	20012 LAWSON LANE	6,807± SQ. FEET	440± SQ. FEET	6,367± SQ. FEET	464± SQ. FEET	5 SPACES
155-161-14	LYNNE MARIE ROUGEAU	20011 COLGATE CIRCLE	9,493± SQ. FEET	319± SQ. FEET	9,174± SQ. FEET	339± SQ. FEET	0 SPACES
155-161-15	HIDEKO KAY MASUDA	20012 COLGATE CIRCLE	7,821± SQ. FEET	12± SQ. FEET	7,809± SQ. FEET	16± SQ. FEET	0 SPACES
155-181-28	O'REILLY AUTO PARTS	10072 ADAMS AVENUE	570,860± SQ. FEET	14,680± SQ. FEET	556,180± SQ. FEET	8,425± SQ. FEET	23 SPACES
	SHIMA JAPANESE RESTAURANT	10076 ADAMS AVENUE					
	EGGROLL KING	10078 ADAMS AVENUE					
	LAMPPOST PIZZA	10084 ADAMS AVENUE					
	HUNTINGTON FLOWERS	10086 ADAMS AVENUE					
	BEACHSIDE OPTOMETRY	10088 ADAMS AVENUE					
	H.B. BEAUTY SUPPLY & SALON	10090 ADAMS AVENUE					
	COAST CITIES ESCROW	10104 ADAMS AVENUE					
	A/B DENTAL CENTER	10106 ADAMS AVENUE					
	VACANT	10110 ADAMS AVENUE					
	VACANT	10112 ADAMS AVENUE					
	STATER BROS	10114 ADAMS AVENUE					
	SUPERCUTS	10116 ADAMS AVENUE					
	R CLEANERS	10118 ADAMS AVENUE					
	VACANT	10120 ADAMS AVENUE					
	HUNTINGTON BEACH COIN EXCHANGE	10122 ADAMS AVENUE					
	SIMONE & SON JEWELRY	10124 ADAMS AVENUE					
	SIMONE & SON JEWELRY	10126 ADAMS AVENUE					
	NATIONWIDE INSURANCE	10126 ADAMS AVENUE, SUITE B					
	COMPUTER REPAIR	10128 ADAMS AVENUE					
	ADAMS PET CLINIC	10130 ADAMS AVENUE					
	BEACH CITY LAUNDRY	10132 ADAMS AVENUE					
	MOVE IT MOMMA	10172 ADAMS AVENUE					
	CENTER OF REHAB EXCELLENCE	10162 ADAMS AVENUE					
	COASTLINE COMMUNITY COLLEGE ART GALLERY	10156 ADAMS AVENUE					
	TLC MEDICAL GROUP	10188 ADAMS AVENUE					
	ALL-STAR DANCE ACADEMY	10184 ADAMS AVENUE					
	TANNING	10180 ADAMS AVENUE					
	LOS PRIMOS CANTINA	10176 ADAMS AVENUE					
	VACANT	10178 ADAMS AVENUE					
	VACANT	10142 ADAMS AVENUE					
	WOODY'S DINER	10136 ADAMS AVENUE					
	ROYAL DONUTS	10056 ADAMS AVENUE					
	MM'S TAILOR	10054 ADAMS AVENUE					
	VACANT	10052 ADAMS AVENUE					
	ANNA'S NAILS	10046 ADAMS AVENUE					
	KEVIN LE STUDIO	10044 ADAMS AVENUE					
	LIVING WATER	10042 ADAMS AVENUE					
	TOTALS =		680,282± SQ. FEET	26,359± SQ. FEET	653,923± SQ. FEET	11,360± SQ. FEET	61 SPACES

LINE DATA

#	BEARING	DISTANCE
L8	N77°56'34"E	40.14'
L9	N00°23'29"E	10.69'
L10	N45°21'25"E	45.28'
L11	N89°40'39"W	12.00'
L12	N89°40'39"W	3.00'
L13	N10°41'30"E	14.05'
L14	N89°36'31"W	2.53'

CURVE DATA

#	DELTA	RADIUS	LENGTH
C4	90°04'08"	32.00'	50.30'
C5	44°52'59"	30.00'	23.50'
C6	10°54'41"	42.00'	8.00'
C7	11°28'43"	58.00'	11.62'
C8	38°43'30"	30.00'	20.28'

LEGEND

- RIGHT-OF-WAY ACQUISITION
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SHEET 4 OF 4 SHEETS

REVISIONS

SURVEY DATE: N/A
SCALE: PER PLAN
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RIGHT-OF-WAY EXHIBIT

SOUTHEAST QUADRANT OF
ADAMS AVENUE & BROOKHURST STREET
IN THE CITY OF HUNTINGTON BEACH,
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ALTERNATIVE 2:
12-FOOT WIDE LANES

SCALE: 1" = 50' (22" X 34" PLOT)
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ATTACHMENT I

Hydrology and Hydraulics Study Report

HYDROLOGY

And

HYDRAULIC

STUDY

FOR

CITY OF HUNTINGTON BEACH
CC-1377 BROOKHURST STREET AND ADAMS AVENUE
INTERSECTION IMPROVEMENTS

PREPARED FOR:
CITY OF HUNTINGTON BEACH
2000 MAIN STREET
HUNTINGTON BEACH, CA 92848

PREPARED BY:
HARRIS & ASSOCIATES
34 EXECUTIVE PARK, SUITE 150
IRVINE, CA 92614-4705
(949) 655 - 3900

February 11, 2013

Prepared By:

Randall Berry

Randall Berry, PE
RCE # 44642

HYDROLOGY AND HYDRAULIC STUDY

FOR

CITY OF HUNTINGTON BEACH
BROOKHURST STREET AND ADAMS AVENUE
INTERSECTION IMPROVEMENTS

BASIS OF STUDY

1. OC FLOOD CONTROL DISTRICT RATIONAL METHOD HYDROLOGY

2. SOIL GROUP “B” & “C”, COMMERCIAL DEVELOPMENT

3. 25-YEAR STORM FREQUENCY FOR “SUMP” CONDITION CATCH BASINS AND 10-YEAR STORM FREQUENCY FOR “FLOW BY” CONDITION CATCH BASINS

REFERENCES

1. ORANGE COUNTY FLOOD CONTROL DISTRICT HYDROLOGY MANUAL, OCTOBER 1986, AS INCORPORATED IN RATIONAL METHOD HYDROLOGY (RMH) SOFTWARE PACKAGE BY JACK NORRIS, VERSION 6.5b, DATED NOV. 2000, COPYRIGHT 1999, SERIAL # 110.

2. ORANGE COUNTY LOCAL DRAINAGE MANUAL, JANUARY 1996.

HYDROLOGY AND HYDRAULICS STUDY

FOR

CITY OF HUNTINGTON BEACH
BROOKHURST STREET AND ADAMS AVENUE
INTERSECTION IMPROVEMENTS

TABLE OF CONTENTS

HYDROLOGY AND HYDRAULIC STUDY
BROOKHURST ST./ADAMS AVE. INTERSECTION IMPROVEMENTS
EXECUTIVE SUMMARY

The purpose of this study is to provide a hydrologic analysis for the existing drainage conditions within the project limits of the City of Huntington Beach, Brookhurst Street and Adams Avenue Intersection Improvements. The results of this study were utilized to analyze the existing catch basins and determine the adequacy of their length, local depression, and approaching grades to intercept the design flows for a 25-year frequency for a sump condition catch basin and 10-year frequency for a flow by condition catch basin. The primary goal is to better protect the affected commercial businesses within the tributary area of the Brookhurst Street and Adams Avenue Intersection Improvements from flooding by upsizing the catch basins to accept the same tributary drainage areas currently conveyed via the existing catch basins.

The analyses determined that most of the catch basins area adequate to handle the 25-year storm frequency at the existing length, local depression and approach grade. Only the catch basin at the south east leg of Adams Avenue will need to be upsized to be able to intercept the 25-year storm frequency flows. See chart that follows for analyses of existing catch basins.

HYDROLOGY AND HYDRAULIC STUDY
BROOKHURST ST./ADAMS AVE INTERSECTION IMPROVEMENTS
HYDROLOGY SUMMARY

This report was prepared to define the overall drainage boundaries and sub-areas that are tributary to the existing catch basins with in the proposed "Brookhurst Street and Adams Avenue Intersection Improvements" and to determine the 25-year frequency storm flows (to design the sump condition catch basins) and 10-year frequency storm flow (to design the flow by condition catch basins) using Orange County Rational Method.

A hydrology map was prepared for the drainage area (**see Hydrology Map in the back pocket of this report**), which shows all tributary areas as well as the proposed storm drain reaches.

Drainage Area

The watershed for this system is generally bounded by Bismark Drive to the north, Derbyshire Lane to the east, Adams to the south, and Lawson Lane to the west. The watershed terrain is primarily commercial development with soil values of "B" and "C".

Existing Drainage Conditions

The existing drainage conditions in this watershed flows via an existing underground storm drain beginning approximately 750' north of Adams Street and continuing south for approximately 750 +/- feet to along Brookhurst Street and then continuing west along Adams Avenue to the Santa Ana River Channel. The commercial developments within the four corners of the intersection are primarily intercepted by onsite grate inlets and are discharged into the existing mainline storm drain. The tributary areas to the catch basin inlets within the street are primarily Brookhurst Street and Adams Avenue street flows. No additional (non-tributary) flows will be introduced to this existing storm drain system.

Rational Method Hydrology Criteria

The Rational Method Hydrology criteria used for this study are outlined in the latest (1986) Orange County Hydrology Manual. The computerized version of the OC Hydrology Manual, RMH Software package, by Jack Norris, Version 6.5b, dated November 2000, copyright 1999, serial # 110, was utilized to perform the detailed hydrology analysis (**see below for a certification of this software**).

A unit area hydrograph modeling analysis was not included in the project scope nor analyzed because the total watershed area is less than 640 acres. Thus, per OC guidelines, the Rational Method Analysis is the more appropriate runoff model for the proposed design.

RMH Hydrology Software Certification:

As the Engineer of Record, I certify that I have verified the hydrology submittal using the software named and found the software produced output to be consistent with the standards and procedures set forth in the current version of the Orange County Hydrology Manual.

Randall Berry

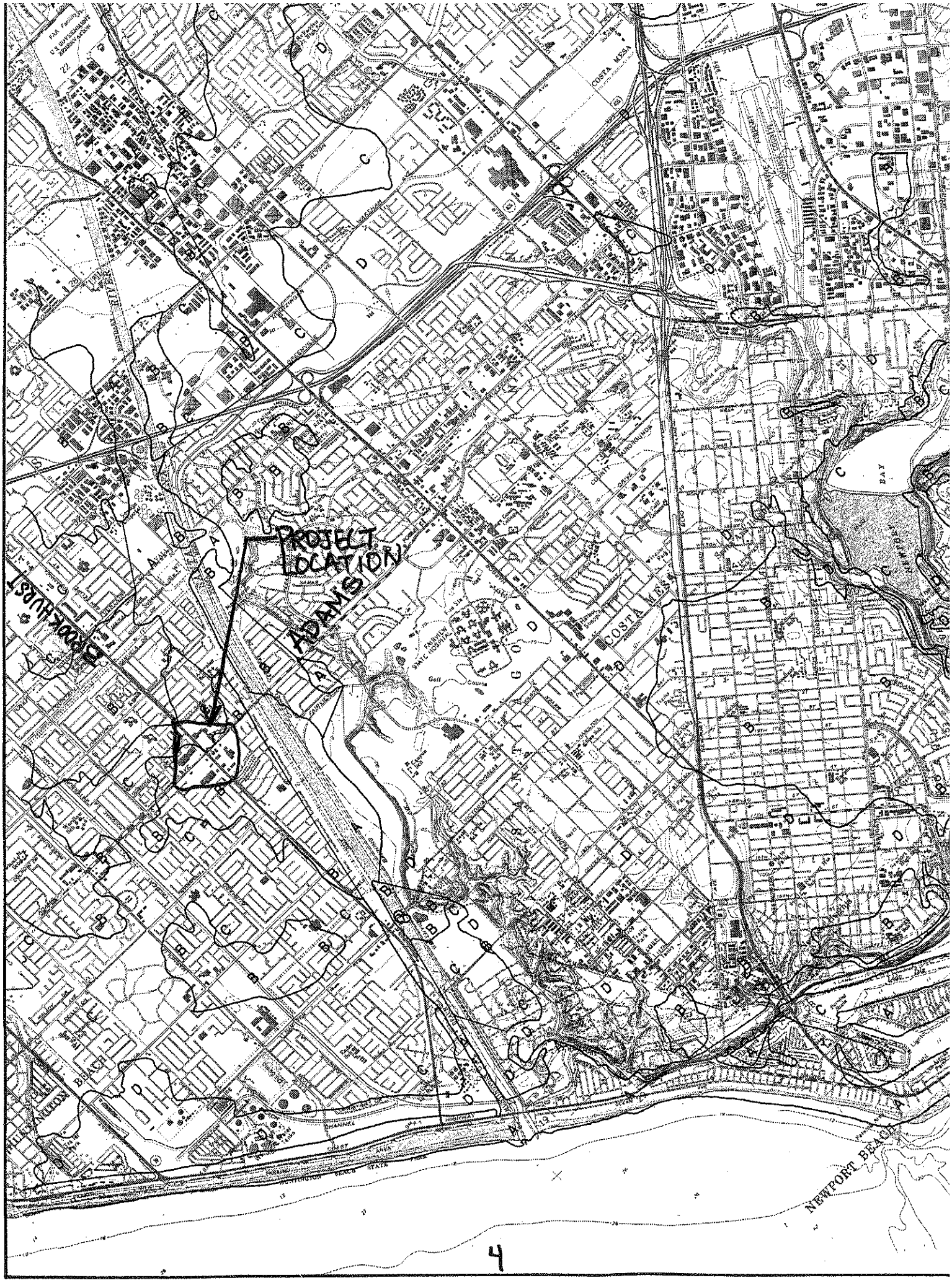
Randall G. Berry, PE RCE # C44642 Exp. 3/31/10

2/11/13

Date

HYDROLOGY AND HYDRAULIC STUDY
FOR
BROOKHURST STREET AND ADAMS AVENUE
INTERSECTION IMPROVEMENTS
CITY OF HUNTINGTON BEACH

SOILS MAP
(Orange County Soil Map B)


PROJECT LOCATION
ADAMS
BROOKHURST
COSTA MESA
NEWPORT BEACH
BAY

HYDROLOGY AND HYDRAULIC STUDY
FOR
BROOKHURST STREET AND ADAMS AVENUE
INTERSECTION IMPROVEMENTS
CITY OF HUNTINGTON BEACH

Q 25
HYDROLOGY CALCULATIONS

City of Huntington Beach
Brookhurst/Adams Intersection Widening
Catch Basin Hydrology

	NAME	AREA (SF)	AREA (AC)	SOIL GROUP	DEVELP.	FROM NODE	TO NODE	SURFACE FLOW FROM ELEV	SURFACE FLOW TO ELEV	SURFACE FLOW LENGTH
AREA A - Q25= 4.12 (SUMP)										
1	A1	14902.24	0.34	C	COM	2	4	13.36	13.05	250
2	A2	37008.61	0.85	C	COM	4	6	13.05	12.95	606
3	A3	58285.11	1.34	C	COM	6	8	12.95	11.86	624
4	A4	31252.58	0.72	B	COM	8	9	11.86	11.03	510
5	A5	16099.08	0.37	B	COM	ADD				
AREA B - Q25= 0.78 (FLOW BY), Q10=0.65										
1	B1	10927.86	0.25	C	COM	10	12	12.93	12.69	175
AREA C - Q25=1.19 (FLOW BY), Q10=1.0										
1	C1	17286.18	0.40	C	COM	20	22	12.70	12.24	248
AREA D - Q25=3.52 (SUMP)										
1	D1	26759.72	0.61	B	COM	30	32	12.24	11.66	322
2	D2	11591.43	0.27	B	COM	32	34	11.66	11.16	193
3	D3	23630.26	0.54	B	COM	ADD				
AREA E - Q25= 13.22 (SUMP)										
1	E1	44332.47	1.02	B	COM	40	41	15.90	14.27	329
2	E2	65437.17	1.50	B	COM	41	42	14.27	10.68	359
3	E3	29888.86	0.69	B	COM	45	46	15.90	15.00	330
4	E4	46076.61	1.06	B	COM	46	47	15.00	14.00	234
5	E5	48519.87	1.11	B	COM	47	42	14.00	10.68	269
6	**CONFLUENCE 42**									
AREA F - Q25= 4.06 (SUMP)										
1	F1	40728.81	0.94	B	COM	50	52	13.70	11.81	330
2	F2	25280.85	0.58	B	COM	52	54	11.81	11.21	256
AREA G - Q25=2.26 (SUMP)										
1	G1	36441.62	0.84	B	COM	60	62	11.62	11.10	347

Harris & Associates.

```
RMH OC ver OC8 May 2007 RATIONAL METHOD HYDROLOGY Orange County
(C)Copyright 1992-2007 Jack P. Norris, Tel 951-894-6296, Fax 894-6297
S/N 110 Harris and Associates

File CB_A, 5 records, edited 10-29-2010 14:04 Run 10-29-2010
By EREYES  Work code 026  Job# 082-0361.07
+-----------------------------------------------------------------------------+
| HUNTINGTON BEACH-BROOKHURST/ADAMS WIDENING                                  |
| CATCH BASIN IMPACTS-CB A @ NW LEG OF ADAMS -25 YR                           |
| BY EREYES - DATE OCT 29 2010                                                |
+-----------------------------------------------------------------------------+
Frequency: 25 yr, I=11.995Tc^(-.566), for elev < 2000, Pl. B-4 for > 2000
Initial area Tc by Kirpich formula:  Tc = k(Dist^3/deltaH)^.2
=============================================================================
Schematic diagram.  Fields:  Node number
                             Record number + process name

2
 1 Init
4
 2 Stre
6
 3 Stre
8
 4 Stre
9

=============================================================================

Record 1  Node 2 to node 4  Initial subarea
Stream # 1  Subarea # 1  in CB_A edited 10-29-2010 14:04
(AREA A-1)
Elev   13.36 to elev   13.05  Length= 250'  delta H =  0.31'  Slope=0.00124
Subarea: .34 acre
  Soil:     C
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.250"/hr  Fm = 0.025"/hr
------------------------------ Hydrology Results ------------------------------
k =.300 Tc =  10.41 min.    I = 3.184"/hr  Q=.9A(I-Fm)
* Long travel time: Tt = 10.41, Tc = 10.41. See Hydrology Manual D.11.5 *
Fp(avg) = 0.250  ap(avg) =0.100  Fm(avg) = 0.025"/hr  Q(tot) =    0.97 cfs
------------------------------ Stream  1 Summary ------------------------------
At node 4 L=  250' Fm(avg)=0.025"/hr q= 2.84 cfs/ac(tot), 2.84 cfs/ac(eff)
A(eff)=     0.34 acres  A(tot)=     0.34 acres  Tc= 10.41 min  Q=  0.97 cfs
=============================================================================

Record 2  Node 4 to node 6  Street flow
         Subarea Q enters stream uniformly distributed along reach.
Stream # 1  Subarea # 2  in CB_A edited 10-29-2010 14:04
(AREA A-2)
Elev   13.05 to elev   12.95  Length= 606'  delta H =  0.10'  Slope=0.00017
Subarea: .85 acre
Notice: Entered acres < street area.
  Soil:     C
  Land Use: Commercial
  ai = .90  ap = 0.10
```

```
Fp = 0.250"/hr  Fm = 0.025"/hr
Street template 1   Half-width to curb face = 48'
  CF = 8"  Batter= .25 h/v  Gutter width = 24"  Hike = 2.0"   Lip = .00"
  Xfall = .02 '/'  Parkway 10' wide @ .021 '/'
  Flow on 1 side designated.  n = .015
----------------------------- Hydraulics Results -----------------------------
Street capacity to R/W 1 side=   9.1 cfs
Tt=24.89 min. based on Qavg=  1.32 cfs on one side of street.
  Davg=0.48' Aavg=   3.26 s.f. Vavg= 0.41'/sec
At end of reach: Q =   1.7  D = 0.51'  Flow area =  3.91 s.f.
  V =  0.43'/sec.  D*V = 0.22  Flooded width one side = 19.50'  Sf =0.00017
------------------------------ Hydrology Results -----------------------------
Tc = 10.41 + 24.89 =  35.31 min.    I = 1.596"/hr  Q=.9A(I-Fm)
* Long travel time: Tt = 24.89, Tc = 35.31. See Hydrology Manual D.11.5 *
Fp(avg) = 0.250  ap(avg) =0.100  Fm(avg) = 0.025"/hr  Q(tot) =    1.68 cfs
------------------------------ Stream  1 Summary -----------------------------
At node 6 L=  856' Fm(avg)=0.025"/hr q= 1.41 cfs/ac(tot), 1.41 cfs/ac(eff)
A(eff)=     1.19 acres  A(tot)=     1.19 acres  Tc= 35.31 min  Q=  1.68 cfs
================================================================================

Record 3  Node 6 to node 8  Street flow
        Subarea Q enters stream uniformly distributed along reach.
Stream # 1  Subarea # 3  in CB_A edited 10-29-2010 14:04
(AREA A-3)
Elev   12.95 to elev   11.86  Length= 624'  delta H =  1.09'  Slope=0.00175
Subarea: 1.34 acres
Notice: Entered acres < street area.
  Soil:     C
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.250"/hr  Fm = 0.025"/hr
Street template 1   Half-width to curb face = 48'
  CF = 8"  Batter= .25 h/v  Gutter width = 24"  Hike = 2.0"   Lip = .00"
  Xfall = .02 '/'  Parkway 10' wide @ .021 '/'
  Flow on 1 side designated.  n = .015
----------------------------- Hydraulics Results -----------------------------
Street capacity to R/W 1 side=  29.6 cfs
Tt= 9.06 min. based on Qavg=  2.41 cfs on one side of street.
  Davg=0.41' Aavg=   2.10 s.f. Vavg= 1.15'/sec
At end of reach: Q =  . 3.1  D = 0.44'  Flow area =  2.56 s.f.
  V =  1.22'/sec.  D*V = 0.53  Flooded width one side = 15.65'  Sf =0.00175
------------------------------ Hydrology Results -----------------------------
Tc = 35.31 +  9.06 =  44.37 min.    I = 1.402"/hr  Q=.9A(I-Fm)
* Long travel time: Tt =  9.06, Tc = 44.37. See Hydrology Manual D.11.5 *
Fp(avg) = 0.250  ap(avg) =0.100  Fm(avg) = 0.025"/hr  Q(tot) =    3.14 cfs
------------------------------ Stream  1 Summary -----------------------------
At node 8 L= 1480' Fm(avg)=0.025"/hr q= 1.24 cfs/ac(tot), 1.24 cfs/ac(eff)
A(eff)=     2.53 acres  A(tot)=     2.53 acres  Tc= 44.37 min  Q=  3.14 cfs
================================================================================

Record 4  Node 8 to node 9  Street flow
        Subarea Q enters stream uniformly distributed along reach.
Stream # 1  Subarea # 4  in CB_A edited 10-29-2010 14:04
(AREA A-4)
Elev   11.86 to elev   11.03  Length= 510'  delta H =  0.83'  Slope=0.00163
Subarea: .72 acre
Notice: Entered acres < street area.
```

```
  Soil:     B
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.300"/hr  Fm = 0.030"/hr
Street template 2   Half-width to curb face = 50'
  CF = 8"  Batter= .25 h/v  Gutter width = 24"  Hike = 2.0"   Lip = .00"
  Xfall = .02 '/'  Parkway 10' wide @ .021 '/'
  Flow on 1 side designated.  n = .015
----------------------------- Hydraulics Results -----------------------------
Street capacity to R/W 1 side=  28.5 cfs
Tt= 7.00 min. based on Qavg=  3.42 cfs on one side of street.
  Davg=0.45' Aavg=   2.81 s.f. Vavg= 1.21'/sec
At end of reach: Q =   3.7  D = 0.46'  Flow area =  2.99 s.f.
  V =  1.24'/sec.  D*V = 0.57  Flooded width one side = 16.95'  Sf =0.00163
------------------------------ Hydrology Results -----------------------------
Tc = 44.37 +  7.00 =  51.36 min.    I = 1.291"/hr  Q=.9A(I-Fm)
* Long travel time: Tt =  7.00, Tc = 51.36. See Hydrology Manual D.11.5 *
Fp(avg) = 0.261  ap(avg) =0.100  Fm(avg) = 0.026"/hr  Q(tot) =    3.70 cfs
------------------------------ Stream  1 Summary -----------------------------
At node 9 L= 1990' Fm(avg)=0.026"/hr q= 1.14 cfs/ac(tot), 1.14 cfs/ac(eff)
A(eff)=     3.25 acres  A(tot)=     3.25 acres  Tc= 51.36 min  Q=  3.70 cfs
===============================================================================

Record 5  At node 9         Add a subarea at last node
Stream # 1  Subarea # 5  in CB_A edited 10-29-2010 14:04
(AREA A-5)
Subarea: .37 acre
  Soil:     B
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.300"/hr  Fm = 0.030"/hr
------------------------------ Hydrology Results -----------------------------
Tc =  51.36 min.    I = 1.291"/hr  Q=.9A(I-Fm)
Fp(avg) = 0.265  ap(avg) =0.100  Fm(avg) = 0.027"/hr  Q(tot) =    4.12 cfs
------------------------------ Stream  1 Summary -----------------------------
At node 9 L= 1990' Fm(avg)=0.027"/hr q= 1.14 cfs/ac(tot), 1.14 cfs/ac(eff)
A(eff)=     3.62 acres  A(tot)=     3.62 acres  Tc= 51.36 min  Q=  4.12 cfs
===============================================================================
End of RMH run for file CB_A.RMO edited 10-29-2010 14:04
```

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File CB_B, 1 records, edited 10-29-2010 14:04 Run 10-29-2010
By EREYES  Work code 026  Job# 082-0361.07
+------------------------------------------------------------------------------+
| HUNTINGTON BEACH-BROOKHURST/ADAMS WIDENING                                   |
| CATCH BASIN IMPACTS-CB B @ NE LEG OF BROOKHURST - 25 YR                      |
| BY EREYES - DATE OCT 29 2010                                                 |
+------------------------------------------------------------------------------+
Frequency: 25 yr, I=11.995Tc^(-.566), for elev < 2000, Pl. B-4 for > 2000
Initial area Tc by Kirpich formula:  Tc = k(Dist^3/deltaH)^.2
================================================================================
Schematic diagram.  Fields:  Node number
                             Record number + process name

10
 1 Init
12

================================================================================

Record 1  Node 10 to node 12                Initial subarea
Stream # 1  Subarea # 1  in CB_B edited 10-29-2010 14:04
(AREA B-1)
Elev   12.93 to elev   12.69  Length= 175'  delta H =  0.24'  Slope=0.00137
Subarea: .25 acre
  Soil:     C
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.250"/hr  Fm = 0.025"/hr
------------------------------ Hydrology Results ------------------------------
k =.300 Tc =   8.85 min.    I = 3.492"/hr  Q=.9A(I-Fm)
* Long travel time: Tt =  8.85, Tc =  8.85. See Hydrology Manual D.11.5 *
Fp(avg) = 0.250  ap(avg) =0.100  Fm(avg) = 0.025"/hr  Q(tot) =    0.78 cfs
------------------------------ Stream  1 Summary ------------------------------
At node 12 L=  175' Fm(avg)=0.025"/hr q= 3.12 cfs/ac(tot), 3.12 cfs/ac(eff)
A(eff)=     0.25 acres  A(tot)=     0.25 acres  Tc=  8.85 min  Q=  0.78 cfs
================================================================================
End of RMH run for file CB_B.RMO edited 10-29-2010 14:04
```

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File CB_C, 1 records, edited 10-29-2010 14:00 Run 10-29-2010
By EREYES  Work code 026  Job# 082-0361.07
+------------------------------------------------------------------------------+
| HUNTINGTON BEACH-BROOKHURST/ADAMS WIDENING                                   |
| CATCH BASIN IMPACTS-CB C @ NE LEG OF BROOKHURST - 25 YR                      |
| BY EREYES - DATE OCT 29 2010                                                 |
+------------------------------------------------------------------------------+
Frequency: 25 yr, I=11.995Tc^(-.566), for elev < 2000, Pl. B-4 for > 2000
Initial area Tc by Kirpich formula:  Tc = k(Dist^3/deltaH)^.2
================================================================================
Schematic diagram.  Fields:  Node number
                             Record number + process name

20
 1 Init
22

================================================================================

Record 1  Node 20 to node 22              Initial subarea
Stream # 1  Subarea # 1  in CB_C edited 10-29-2010 14:00
(AREA C-1)
Elev   12.70 to elev   12.24  Length= 248'  delta H =  0.46'  Slope=0.00185
Subarea: .4 acre
  Soil:     C
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.250"/hr  Fm = 0.025"/hr
------------------------------ Hydrology Results ------------------------------
k =.300 Tc =   9.58 min.    I = 3.339"/hr  Q=.9A(I-Fm)
* Long travel time: Tt =  9.58, Tc =  9.58. See Hydrology Manual D.11.5 *
Fp(avg) = 0.250  ap(avg) =0.100  Fm(avg) = 0.025"/hr  Q(tot) =    1.19 cfs
------------------------------ Stream  1 Summary ------------------------------
At node 22 L=  248' Fm(avg)=0.025"/hr q= 2.98 cfs/ac(tot), 2.98 cfs/ac(eff)
A(eff)=     0.40 acres  A(tot)=     0.40 acres  Tc=  9.58 min  Q=  1.19 cfs
================================================================================
End of RMH run for file CB_C.RMO edited 10-29-2010 14:00
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File CB_D, 3 records, edited 10-29-2010 14:07 Run 10-29-2010
By EREYES  Work code 026  Job# 082-0361.07
+------------------------------------------------------------------------------+
| HUNTINGTON BEACH-BROOKHURST/ADAMS WIDENING                                   |
| CATCH BASIN IMPACTS-CB D @ NE LEG OF ADAMS - 25 YR                           |
| BY EREYES - DATE OCT 29 2010                                                 |
+------------------------------------------------------------------------------+
Frequency: 25 yr, I=11.995Tc^(-.566), for elev < 2000, Pl. B-4 for > 2000
Initial area Tc by Kirpich formula:  Tc = k(Dist^3/deltaH)^.2
================================================================================
Schematic diagram.  Fields:  Node number
                             Record number + process name

30
 1 Init
32
 2 Stre
34

================================================================================

Record 1  Node 30 to node 32                Initial subarea
Stream # 1  Subarea # 1  in CB_D edited 10-29-2010 14:07
(AREA D-1)
Elev   12.24 to elev   11.66  Length= 322'  delta H =  0.58'  Slope=0.00180
Subarea: .61 acre
  Soil:     B
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.300"/hr  Fm = 0.030"/hr
------------------------------ Hydrology Results ------------------------------
k =.300 Tc =  10.69 min.    I = 3.137"/hr  Q=.9A(I-Fm)
* Long travel time: Tt = 10.69, Tc = 10.69. See Hydrology Manual D.11.5 *
Fp(avg) = 0.300  ap(avg) =0.100  Fm(avg) = 0.030"/hr  Q(tot) =    1.71 cfs
------------------------------ Stream  1 Summary ------------------------------
At node 32 L=  322' Fm(avg)=0.030"/hr q= 2.80 cfs/ac(tot), 2.80 cfs/ac(eff)
A(eff)=     0.61 acres  A(tot)=     0.61 acres  Tc= 10.69 min  Q=  1.71 cfs
================================================================================

Record 2  Node 32 to node 34                Street flow
        Subarea Q enters stream uniformly distributed along reach.
Stream # 1  Subarea # 2  in CB_D edited 10-29-2010 14:07
(AREA D-2)
Elev   11.66 to elev   11.16  Length= 193'  delta H =  0.50'  Slope=0.00259
Subarea: .27 acre
Notice: Entered acres < street area.
  Soil:     B
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.300"/hr  Fm = 0.030"/hr
```

```
Street template 2   Half-width to curb face = 50'
  CF = 8"  Batter= .25 h/v  Gutter width = 24"  Hike = 2.0"   Lip = .00"
  Xfall = .02 '/'  Parkway 10' wide @ .021 '/'
  Flow on 1 side designated.  n = .015
----------------------------- Hydraulics Results -----------------------------
Street capacity to R/W 1 side=  36.0 cfs
Tt= 2.54 min. based on Qavg=  1.94 cfs on one side of street.
  Davg=0.36' Aavg=   1.53 s.f. Vavg= 1.27'/sec
At end of reach: Q =   2.2  D = 0.37'  Flow area =  1.67 s.f.
  V =  1.30'/sec.  D*V = 0.49  Flooded width one side = 12.46'  Sf =0.00259
------------------------------ Hydrology Results ------------------------------
Tc = 10.69 +  2.54 =  13.23 min.    I = 2.781"/hr  Q=.9A(I-Fm)
Fp(avg) = 0.300  ap(avg) =0.100  Fm(avg) = 0.030"/hr  Q(tot) =    2.18 cfs
------------------------------ Stream  1 Summary ------------------------------
At node 34 L=  515' Fm(avg)=0.030"/hr q= 2.48 cfs/ac(tot), 2.48 cfs/ac(eff)
A(eff)=     0.88 acres  A(tot)=     0.88 acres  Tc= 13.23 min  Q=  2.18 cfs
================================================================================

Record 3  At node 34        Add a subarea at last node
Stream # 1  Subarea # 3  in CB_D edited 10-29-2010 14:07
(AREA D-3)
Subarea: .54 acre
  Soil:     B
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.300"/hr  Fm = 0.030"/hr
------------------------------ Hydrology Results ------------------------------
Tc =  13.23 min.    I = 2.781"/hr  Q=.9A(I-Fm)
Fp(avg) = 0.300  ap(avg) =0.100  Fm(avg) = 0.030"/hr  Q(tot) =    3.52 cfs
------------------------------ Stream  1 Summary ------------------------------
At node 34 L=  515' Fm(avg)=0.030"/hr q= 2.48 cfs/ac(tot), 2.48 cfs/ac(eff)
A(eff)=     1.42 acres  A(tot)=     1.42 acres  Tc= 13.23 min  Q=  3.52 cfs
================================================================================
End of RMH run for file CB_D.RMO edited 10-29-2010 14:07
```

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File CB_E, 6 records, edited 10-29-2010 14:08 Run 10-29-2010
By EREYES  Work code 026  Job# 082-0361.07
+-------------------------------------------------------------------------+
| HUNTINGTON BEACH-BROOKHURST/ADAMS WIDENING                              |
| CATCH BASIN IMPACTS-CB E @ SE LEG OF ADAMS-25 YR.                       |
| BY EREYES - DATE OCT 29 2010                                            |
+-------------------------------------------------------------------------+
Frequency: 25 yr, I=11.995Tc^(-.566), for elev < 2000, Pl. B-4 for > 2000
Initial area Tc by Kirpich formula:  Tc = k(Dist^3/deltaH)^.2
=========================================================================
Schematic diagram.  Fields:  Node number
                             Record number + process name
Streams  2
-------  -------
40       45
 1 Init   3 Init
41       46
 2 Stre   4 Vall
  |       47
  |        5 Stre
42 <------'

=========================================================================

Record 1  Node 40 to node 41                Initial subarea
Stream # 1  Subarea # 1  in CB_E edited 10-29-2010 14:08
(AREA E-1)
Elev   15.90 to elev   14.27  Length= 329'  delta H =  1.63'  Slope=0.00495
Subarea: 1.02 acres
  Soil:     B
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.300"/hr  Fm = 0.030"/hr
------------------------------ Hydrology Results ----------------------------
k =.300 Tc =   8.81 min.    I = 3.500"/hr  Q=.9A(I-Fm)
* Long travel time: Tt =  8.81, Tc =  8.81. See Hydrology Manual D.11.5 *
Fp(avg) = 0.300  ap(avg) =0.100  Fm(avg) = 0.030"/hr  Q(tot) =    3.19 cfs
------------------------------ Stream  1 Summary ----------------------------
At node 41 L=  329' Fm(avg)=0.030"/hr q= 3.12 cfs/ac(tot), 3.12 cfs/ac(eff)
A(eff)=     1.02 acres  A(tot)=     1.02 acres  Tc=  8.81 min  Q=  3.19 cfs
=========================================================================

Record 2  Node 41 to node 42                Street flow
         Subarea Q enters stream uniformly distributed along reach.
Stream # 1  Subarea # 2  in CB_E edited 10-29-2010 14:08
(AREA E-2)
Elev   14.27 to elev   10.68  Length= 359'  delta H =  3.59'  Slope=0.01000
Subarea: 1.5 acres
  Soil:     B
  Land Use: Commercial
```

```
  ai = .90  ap = 0.10
Fp = 0.300"/hr  Fm = 0.030"/hr
Street template 2   Half-width to curb face = 50'
  CF = 8"  Batter= .25 h/v  Gutter width = 24"  Hike = 2.0"   Lip = .00"
  Xfall = .02 '/'  Parkway 10' wide @ .021 '/'
  Flow on 1 side designated.  n = .015
------------------------------ Hydraulics Results -------------------------------
Street capacity to R/W 1 side=  70.8 cfs
Tt= 2.25 min. based on Qavg=  5.05 cfs on one side of street.
  Davg=0.39' Aavg=   1.90 s.f. Vavg= 2.66'/sec
At end of reach: Q =   6.9  D = 0.43'  Flow area =  2.41 s.f.
  V =  2.87'/sec.  D*V = 1.23  Flooded width one side = 15.14'  Sf =0.01001
------------------------------ Hydrology Results --------------------------------
Tc =  8.81 +  2.25 =  11.06 min.    I = 3.078"/hr  Q=.9A(I-Fm)
Fp(avg) = 0.300  ap(avg) =0.100  Fm(avg) = 0.030"/hr  Q(tot) =    6.91 cfs
------------------------------ Stream  1 Summary --------------------------------
At node 42 L=  688' Fm(avg)=0.030"/hr q= 2.74 cfs/ac(tot), 2.74 cfs/ac(eff)
A(eff)=     2.52 acres  A(tot)=     2.52 acres  Tc= 11.06 min  Q=  6.91 cfs
This stream is designated for confluence with 1 other by record 5
================================================================================

================================================================================ New Stream
Record 3  Node 45 to node 46              Initial subarea
Stream # 2  Subarea # 3  in CB_E edited 10-29-2010 14:08
(AREA E-3)
Elev   15.90 to elev   15.00  Length= 330'  delta H =  0.90'  Slope=0.00273
Subarea: .69 acre
  Soil:     B
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.300"/hr  Fm = 0.030"/hr
------------------------------ Hydrology Results --------------------------------
k =.300 Tc =   9.94 min.    I = 3.270"/hr  Q=.9A(I-Fm)
* Long travel time: Tt =  9.94, Tc =  9.94. See Hydrology Manual D.11.5 *
Fp(avg) = 0.300  ap(avg) =0.100  Fm(avg) = 0.030"/hr  Q(tot) =    2.01 cfs
------------------------------ Stream  2 Summary --------------------------------
At node 46 L=  330' Fm(avg)=0.030"/hr q= 2.92 cfs/ac(tot), 2.92 cfs/ac(eff)
A(eff)=     0.69 acres  A(tot)=     0.69 acres  Tc=  9.94 min  Q=  2.01 cfs
================================================================================

Record 4  Node 46 to node 47              Valley gutter section flow
         Subarea Q enters stream uniformly distributed along reach.
Stream # 2  Subarea # 4  in CB_E edited 10-29-2010 14:08
(AREA E-4)
Elev   15.00 to elev   14.00  Length= 234'  delta H =  1.00'  Slope=0.00427
Subarea: 1.06 acres
  Soil:     B
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.300"/hr  Fm = 0.030"/hr
Section width = 30'   n = .013
  Gutter width = 3'  Hike = 2.0"   Lip = .38"   Pav't X-fall = .02 '/'
------------------------------ Hydraulics Results -------------------------------
At end of reach: D = 0.35'   V =  2.34'/sec.  D*V = 0.82  Sf = .00432
```

```
  Flow area =  1.94 s.f.   Flooded width = 18.11'
------------------------------ Hydrology Results ------------------------------
Tc =  9.94 +  2.31 =  12.25 min.    I = 2.905"/hr  Q=.9A(I-Fm)
Fp(avg) = 0.300  ap(avg) =0.100  Fm(avg) = 0.030"/hr  Q(tot) =    4.53 cfs
------------------------------ Stream  2 Summary ------------------------------
At node 47 L=  564' Fm(avg)=0.030"/hr q= 2.59 cfs/ac(tot), 2.59 cfs/ac(eff)
A(eff)=     1.75 acres  A(tot)=     1.75 acres  Tc= 12.25 min  Q=  4.53 cfs
================================================================================

Record 5  Node 47 to node 42                Street flow
         Subarea Q enters stream uniformly distributed along reach.
Stream # 2  Subarea # 5  in CB_E edited 10-29-2010 14:08
(AREA E-5)
Elev   14.00 to elev   10.68  Length= 269'  delta H =  3.32'  Slope=0.01234
Subarea: 1.11 acres
  Soil:     B
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.300"/hr  Fm = 0.030"/hr
Street template 2   Half-width to curb face = 50'
  CF = 8"  Batter= .25 h/v  Gutter width = 24"  Hike = 2.0"   Lip = .00"
  Xfall = .02 '/'  Parkway 10' wide @ .021 '/'
  Flow on 1 side designated.  n = .015
------------------------------ Hydraulics Results -----------------------------
Street capacity to R/W 1 side=  78.6 cfs
Tt= 1.51 min. based on Qavg=  5.73 cfs on one side of street.
  Davg=0.39' Aavg=   1.93 s.f. Vavg= 2.97'/sec
At end of reach: Q =   6.9  D = 0.42'  Flow area =  2.23 s.f.
  V =  3.11'/sec.  D*V = 1.29  Flooded width one side = 14.53'  Sf =0.01235
------------------------------ Hydrology Results ------------------------------
Tc = 12.25 +  1.51 =  13.76 min.    I = 2.720"/hr  Q=.9A(I-Fm)
Fp(avg) = 0.300  ap(avg) =0.100  Fm(avg) = 0.030"/hr  Q(tot) =    6.92 cfs
------------------------------ Stream  2 Summary ------------------------------
At node 42 L=  833' Fm(avg)=0.030"/hr q= 2.42 cfs/ac(tot), 2.42 cfs/ac(eff)
A(eff)=     2.86 acres  A(tot)=     2.86 acres  Tc= 13.76 min  Q=  6.92 cfs
This stream is designated for confluence with 1 other by record 2
================================================================================

Record 6
Confluencing 2 streams at node 42

 @ Tc      Stream 1 +  Stream 2 =   Confluenced
------     --------    --------    ------------
 11.06 Q=      6.91 +      6.31 =     13.22 cfs *
       A=      2.52 +      2.30 =      4.82 ac.

 13.76 Q=      6.10 +      6.92 =     13.03 cfs
       A=      2.52 +      2.86 =      5.38 ac.

Qpeak =   13.22 cfs at Tc = 11.06 minutes  A(contributing) =   4.82 ac
  I = 3.078"/hr.  Fm(avg) = 0.030"/hr.  A(total) =   5.38 ac

Confluenced streams become stream # 1
------------------------------ Stream  1 Summary ------------------------------
```

```
At node 42 L=  688' Fm(avg)=0.030"/hr q= 2.46 cfs/ac(tot), 2.74 cfs/ac(eff)
A(eff)=     4.82 acres  A(tot)=     5.38 acres  Tc= 11.06 min  Q= 13.22 cfs
================================================================================
End of RMH run for file CB_E.RMO edited 10-29-2010 14:08
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File CB_F, 2 records, edited 10-29-2010 14:09 Run 10-29-2010
By EREYES  Work code 026  Job# 082-0361.07
+------------------------------------------------------------------------------+
| HUNTINGTON BEACH-BROOKHURST/ADAMS WIDENING                                   |
| CATCH BASIN IMPACTS-CB F @ SW LEG OF ADAMS-25 YR                             |
| BY EREYES - DATE OCT 29 2010                                                 |
+------------------------------------------------------------------------------+
Frequency: 25 yr, I=11.995Tc^(-.566), for elev < 2000, Pl. B-4 for > 2000
Initial area Tc by Kirpich formula:  Tc = k(Dist^3/deltaH)^.2
================================================================================
Schematic diagram.  Fields:  Node number
                             Record number + process name

50
 1 Init
52
 2 Stre
54

================================================================================

Record 1  Node 50 to node 52                Initial subarea
Stream # 1  Subarea # 1  in CB_F edited 10-29-2010 14:09
(AREA F-1)
Elev   13.70 to elev   11.81  Length= 330'  delta H =  1.89'  Slope=0.00573
Subarea: .94 acre
  Soil:     B
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.300"/hr  Fm = 0.030"/hr
------------------------------ Hydrology Results ------------------------------
k =.300 Tc =   8.57 min.    I = 3.556"/hr  Q=.9A(I-Fm)
* Long travel time: Tt =  8.57, Tc =  8.57. See Hydrology Manual D.11.5 *
Fp(avg) = 0.300  ap(avg) =0.100  Fm(avg) = 0.030"/hr  Q(tot) =    2.98 cfs
------------------------------ Stream  1 Summary ------------------------------
At node 52 L=  330' Fm(avg)=0.030"/hr q= 3.17 cfs/ac(tot), 3.17 cfs/ac(eff)
A(eff)=     0.94 acres  A(tot)=     0.94 acres  Tc=  8.57 min  Q=  2.98 cfs
================================================================================

Record 2  Node 52 to node 54                Street flow
        Subarea Q enters stream uniformly distributed along reach.
Stream # 1  Subarea # 2  in CB_F edited 10-29-2010 14:09
(AREA F-2)
Elev   11.81 to elev   11.21  Length= 256'  delta H =  0.60'  Slope=0.00234
Subarea: .58 acre
Notice: Entered acres < street area.
  Soil:     B
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.300"/hr  Fm = 0.030"/hr
```

```
Street template 2   Half-width to curb face = 50'
  CF = 8"  Batter= .25 h/v  Gutter width = 24"  Hike = 2.0"   Lip = .00"
  Xfall = .02 '/'  Parkway 10' wide @ .021 '/'
  Flow on 1 side designated.  n = .015
----------------------------- Hydraulics Results -----------------------------
Street capacity to R/W 1 side=  34.3 cfs
Tt= 3.03 min. based on Qavg=  3.52 cfs on one side of street.
  Davg=0.43' Aavg=   2.51 s.f. Vavg= 1.41'/sec
At end of reach: Q =   4.1  D = 0.45'  Flow area =  2.79 s.f.
  V =  1.45'/sec.  D*V = 0.66  Flooded width one side = 16.35'  Sf =0.00235
------------------------------ Hydrology Results ------------------------------
Tc =  8.57 +  3.03 =  11.60 min.    I = 2.995"/hr  Q=.9A(I-Fm)
* Long travel time: Tt =  3.03, Tc = 11.60. See Hydrology Manual D.11.5 *
Fp(avg) = 0.300  ap(avg) =0.100  Fm(avg) = 0.030"/hr  Q(tot) =    4.06 cfs
------------------------------ Stream  1 Summary ------------------------------
At node 54 L=  586' Fm(avg)=0.030"/hr q= 2.67 cfs/ac(tot), 2.67 cfs/ac(eff)
A(eff)=     1.52 acres  A(tot)=     1.52 acres  Tc= 11.60 min  Q=  4.06 cfs
================================================================================
End of RMH run for file CB_F.RMO edited 10-29-2010 14:09
```

```
RMH OC ver OC8 May 2007 RATIONAL METHOD HYDROLOGY Orange County
(C)Copyright 1992-2007 Jack P. Norris, Tel 951-894-6296, Fax 894-6297
S/N 110 Harris and Associates

File CB_G, 1 records, edited 10-29-2010 14:09 Run 10-29-2010
By EREYES  Work code 026  Job# 082-0361.07
+------------------------------------------------------------------------------+
| HUNTINGTON BEACH-BROOKHURST/ADAMS WIDENING                                   |
| CATCH BASIN IMPACTS-CB G @ SW LEG OF ADAMS-25 YR                             |
| BY EREYES - DATE OCT 29 2010                                                 |
+------------------------------------------------------------------------------+
Frequency: 25 yr, I=11.995Tc^(-.566), for elev < 2000, Pl. B-4 for > 2000
Initial area Tc by Kirpich formula:  Tc = k(Dist^3/deltaH)^.2
================================================================================
Schematic diagram.  Fields:  Node number
                             Record number + process name

60
 1 Init
62

================================================================================

Record 1  Node 60 to node 62                Initial subarea
Stream # 1  Subarea # 1  in CB_G edited 10-29-2010 14:09
(AREA G-1)
Elev   11.62 to elev   11.10  Length= 347'  delta H =  0.52'  Slope=0.00150
* Warning: Hydrology Manual recommends against exceeding 330' *
Subarea: .84 acre
  Soil:     B
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.300"/hr  Fm = 0.030"/hr
------------------------------ Hydrology Results ------------------------------
k =.300 Tc =  11.43 min.    I = 3.021"/hr  Q=.9A(I-Fm)
* Long travel time: Tt = 11.43, Tc = 11.43. See Hydrology Manual D.11.5 *
Fp(avg) = 0.300  ap(avg) =0.100  Fm(avg) = 0.030"/hr  Q(tot) =    2.26 cfs
------------------------------ Stream  1 Summary ------------------------------
At node 62 L=  347' Fm(avg)=0.030"/hr q= 2.69 cfs/ac(tot), 2.69 cfs/ac(eff)
A(eff)=     0.84 acres  A(tot)=     0.84 acres  Tc= 11.43 min  Q=  2.26 cfs
================================================================================
End of RMH run for file CB_G.RMO edited 10-29-2010 14:09
```

HYDROLOGY AND HYDRAULIC STUDY
FOR
BROOKHURST STREET AND ADAMS AVENUE
INTERSECTION IMPROVEMENTS
CITY OF HUNTINGTON BEACH

Q 10
HYDROLOGY CALCULATIONS

```
RMH OC ver OC8 May 2007 RATIONAL METHOD HYDROLOGY Orange County
(C)Copyright 1992-2007 Jack P. Norris, Tel 951-894-6296, Fax 894-6297
S/N 110 Harris and Associates

File CB_C, 1 records, edited 11-01-2010 09:13 Run 11-01-2010
By EREYES  Work code 026  Job# 082-0361.07
+------------------------------------------------------------------------------+
| HUNTINGTON BEACH-BROOKHURST/ADAMS WIDENING                                   |
| CATCH BASIN IMPACTS-CB C @ NE LEG OF BROOKHURST- 10 YR                       |
| BY EREYES - DATE OCT 29 2010                                                 |
+------------------------------------------------------------------------------+
Frequency: 10 yr, I=10.209Tc^(-.573), for elev < 2000, Pl. B-4 for > 2000
Initial area Tc by Kirpich formula:  Tc = k(Dist^3/deltaH)^.2
================================================================================
Schematic diagram.  Fields:  Node number
                             Record number + process name

20
 1 Init
22

================================================================================

Record 1  Node 20 to node 22              Initial subarea
Stream # 1  Subarea # 1  in CB_C edited 11-01-2010 09:13
(AREA C-1)
Elev   12.70 to elev   12.24  Length= 248'  delta H =  0.46'  Slope=0.00185
Subarea: .4 acre
  Soil:     C
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.250"/hr  Fm = 0.025"/hr
------------------------------ Hydrology Results ------------------------------
k =.300 Tc =   9.58 min.    I = 2.797"/hr  Q=.9A(I-Fm)
* Long travel time: Tt =  9.58, Tc =  9.58. See Hydrology Manual D.11.5 *
Fp(avg) = 0.250  ap(avg) =0.100  Fm(avg) = 0.025"/hr  Q(tot) =    1.00 cfs
------------------------------ Stream  1 Summary ------------------------------
At node 22 L=  248' Fm(avg)=0.025"/hr q= 2.50 cfs/ac(tot), 2.50 cfs/ac(eff)
A(eff)=     0.40 acres  A(tot)=     0.40 acres  Tc=  9.58 min  Q=  1.00 cfs
================================================================================
End of RMH run for file CB_C.RMO edited 11-01-2010 09:13
```

```
RMH OC ver OC8 May 2007 RATIONAL METHOD HYDROLOGY Orange County
(C)Copyright 1992-2007 Jack P. Norris, Tel 951-894-6296, Fax 894-6297
S/N 110 Harris and Associates

File CB_B, 1 records, edited 11-01-2010 09:12 Run 11-01-2010
By EREYES  Work code 026  Job# 082-0361.07
+-----------------------------------------------------------------------------+
| HUNTINGTON BEACH-BROOKHURST/ADAMS WIDENING                                  |
| CATCH BASIN IMPACTS-CB B @ NE LEG OF BROOKHURST - 10 YR                     |
| BY EREYES - DATE OCT 29 2010                                                |
+-----------------------------------------------------------------------------+
Frequency: 10 yr, I=10.209Tc^(-.573), for elev < 2000, Pl. B-4 for > 2000
Initial area Tc by Kirpich formula:  Tc = k(Dist^3/deltaH)^.2
=============================================================================
Schematic diagram.  Fields:  Node number
                             Record number + process name

10
 1 Init
12

=============================================================================

Record 1  Node 10 to node 12              Initial subarea
Stream # 1  Subarea # 1  in CB_B edited 11-01-2010 09:12
(AREA B-1)
Elev   12.93 to elev   12.69  Length= 175'  delta H =  0.24'  Slope=0.00137
Subarea: .25 acre
  Soil:     C
  Land Use: Commercial
  ai = .90  ap = 0.10
Fp = 0.250"/hr  Fm = 0.025"/hr
------------------------------ Hydrology Results ------------------------------
k =.300 Tc =   8.85 min.    I = 2.927"/hr  Q=.9A(I-Fm)
* Long travel time: Tt =  8.85, Tc =  8.85. See Hydrology Manual D.11.5 *
Fp(avg) = 0.250  ap(avg) =0.100  Fm(avg) = 0.025"/hr  Q(tot) =    0.65 cfs
------------------------------ Stream  1 Summary ------------------------------
At node 12 L=  175' Fm(avg)=0.025"/hr q= 2.61 cfs/ac(tot), 2.61 cfs/ac(eff)
A(eff)=     0.25 acres  A(tot)=     0.25 acres  Tc=  8.85 min  Q=  0.65 cfs
=============================================================================
End of RMH run for file CB_B.RMO edited 11-01-2010 09:12
```

HYDROLOGY AND HYDRAULIC STUDY
FOR
BROOKHURST STREET AND ADAMS AVENUE
INTERSECTION IMPROVEMENTS
CITY OF HUNTINGTON BEACH

PROPOSED CATCH BASIN CALCULATIONS

City of Huntington Beach
Brookhurst/Adams Intersection Widening
Catch Basin Sizing

BROOKHURST/ADAMS - CATCH BASIN SIZING SUMMARY - "SUMP" CASE										
LOCATION	**CB #**	Peak to CB	Local Depression	**(h)**	Available Ponding Depth **(H)**	**H / h**	Resulting Q/L Factor From Figure 5-13 using H/h	Resulting Catch Basin Size for 100% Intercept		Comment Numbers (Relates to list below)
								L=Q/(Q/L) (Ft)	**L Existing**	
CB on NW leg of Adams	**A**	4.1	3"	9"	8.2"	0.91	1.8	2.3	**7**	ok -1
CB on NE leg of Adams	**D**	3.6	3"	9"	10"	1.11	2.24	1.6	**3.5**	ok
CB on SE leg of Adams combination grate/curb inlet (assume 100% clogged)	**E**	13.2	1"	7"	8"	1.14	1.6	8.3	**3.5**	Need 10'
CB on SW leg of Adams	**F**	4.1	2"	8"	9.4"	1.18	2	2.0	**3.5**	ok
CB on SW leg of Adams	**G**	2.3	3"	9"	8.4"	0.93	1.8	1.3	**7**	ok

Notes:
1. 0.12 CFS added to CB D from CB C

BROOKHURST/ADAMS WIDENING - CATCH BASIN SIZING SUMMARY - "CONTINUOUS GRADE" CASE											
LOCATION	**CB #**	Q10 Runoff (CFS)	Existing Approach St. Grade (S)	Q/S**1/2 For Use In St. Flow Table A	Flow Depth From Table A (Ft)	Width of Flooding From Table A (Ft)	Resulting Q/L Factor From Figure 5-10 using Depth of Flow	Resulting Catch Basin Size for 100% Intercept		Flow-by Q25 (if any)	Comment Numbers (Relates to list below)
								L=Q/(Q/L) (Ft)	**Existing L**		
CB on NE leg of Brookhurst	**B**	0.65	0.15%	16.8	0.32	9.2	0.21	3.1	**3.5**	0	ok-2
CB on NE leg of Brookhurst	**C**	1.0	0.10%	31.6	0.37	12.1	0.23	4.3	**3.5**	0.12	2

Notes:
1. A 2" PCC local depression
2. A 2" PCC local depression, Flow by goes to CB D

OCEMA

STREET FLOW TABLES

Street Half Width = 51'

Curb Type = A2-8"

Flow Depth ft	Flow Area sqft	Flooded Widths Street ft	Parkway ft	Maximum S for Y*V=6	Conveyance Q/S**.5
0.20	0.2	2.1	0.0	2.055	4.6
0.21	0.2	2.7	0.0	2.223	4.7
0.22	0.3	3.3	0.0	2.239	5.0
0.23	0.3	3.8	0.0	2.153	5.5
0.24	0.3	4.4	0.0	2.007	6.2
0.25	0.4	5.0	0.0	1.835	7.0
0.26	0.5	5.6	0.0	1.656	8.1
0.27	0.5	6.2	0.0	1.484	9.3
0.28	0.6	6.8	0.0	1.323	10.7
0.29	0.6	7.4	0.0	1.177	12.3
0.30	0.7	8.0	0.0	1.047	14.1
0.31	0.8	8.6	0.0	0.931	16.1
0.32	0.9	9.2	0.0	0.830	18.4
0.33	1.0	9.8	0.0	0.740	20.9
0.34	1.1	10.3	0.0	0.662	23.6
0.35	1.2	10.9	0.0	0.594	26.6
0.36	1.3	11.5	0.0	0.533	29.8
0.37	1.4	12.1	0.0	0.480	33.4
0.38	1.5	12.7	0.0	0.434	37.2
0.39	1.7	13.3	0.0	0.393	41.2
0.40	1.8	13.9	0.0	0.356	45.6
0.41	2.0	14.5	0.0	0.324	50.3
0.42	2.1	15.1	0.0	0.296	55.3
0.43	2.3	15.7	0.0	0.270	60.7
0.44	2.4	16.3	0.0	0.247	66.3
0.45	2.6	16.8	0.0	0.227	72.3
0.46	2.8	17.4	0.0	0.209	78.7
0.47	2.9	18.0	0.0	0.192	85.4
0.48	3.1	18.6	0.0	0.177	92.5
0.49	3.3	19.2	0.0	0.164	99.9
0.50	3.5	19.8	0.0	0.152	107.8
0.51	3.7	20.4	0.0	0.141	116.0
0.52	3.9	21.0	0.0	0.131	124.6
0.53	4.1	21.6	0.0	0.122	133.7
0.54	4.3	22.2	0.0	0.114	143.1
0.55	4.6	22.8	0.0	0.106	153.0
0.56	4.8	23.3	0.0	0.099	163.3
0.57	5.0	23.9	0.0	0.093	174.0
0.58	5.3	24.5	0.0	0.087	185.2
0.59	5.5	25.1	0.0	0.081	196.8
0.60	5.8	25.7	0.0	0.076	208.9
0.61	6.0	26.3	0.0	0.072	221.4
0.62	6.3	26.9	0.0	0.068	234.5
0.63	6.6	27.5	0.0	0.064	248.0
0.64	6.9	28.1	0.0	0.060	261.9
0.65	7.1	28.7	0.0	0.057	276.4
0.66	7.4	29.3	0.0	0.054	291.4
0.67	7.7	29.8	0.0	0.051	306.9

E X C E E D S T O P O F C U R B

OCEMA

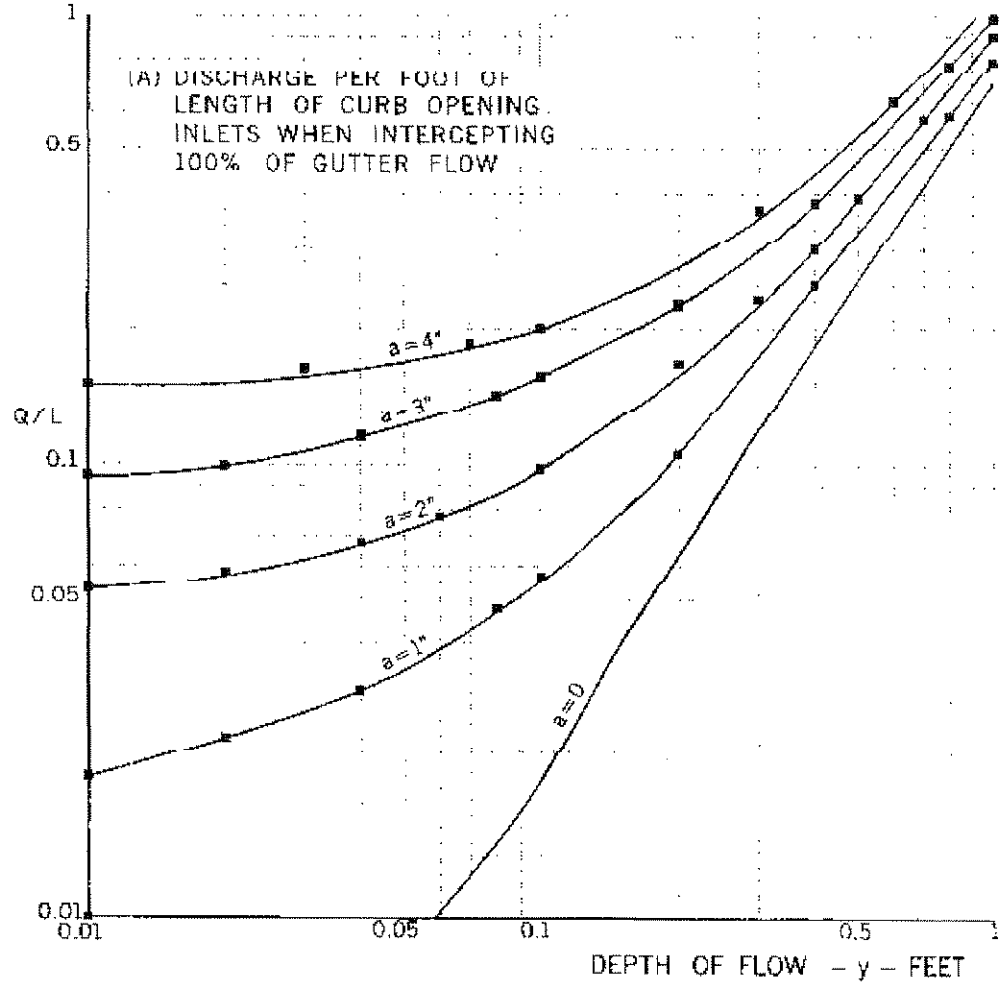
STREET FLOW TABLES

Street Half Width = 51'

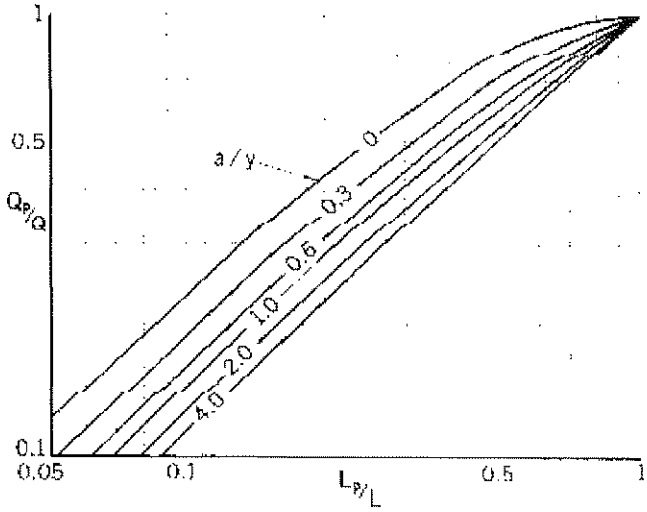
Curb Type = A2-8"

Flow Depth ft	Flow Area sqft	Flooded Widths Street ft	Flooded Widths Parkway ft	Maximum S for Y*V=6	Conveyance Q/S**.5
E X C E E D S	T O P	O F	C U R B		
0.68	8.0	30.4	0.5	0.049	319.8
0.69	8.3	31.0	1.0	0.047	333.5
0.70	8.7	31.6	1.4	0.046	347.8
0.71	9.0	32.2	1.9	0.044	362.9
0.72	9.3	32.8	2.4	0.042	378.8
0.73	9.7	33.4	2.9	0.041	395.4
0.74	10.1	34.0	3.4	0.039	412.7
0.75	10.4	34.5	3.8	0.038	430.8
0.76	10.8	35.1	4.3	0.036	449.7
0.77	11.2	35.7	4.8	0.035	469.4
0.78	11.6	36.3	5.3	0.033	489.8
0.79	12.1	36.9	5.8	0.032	511.1
0.80	12.5	37.5	6.2	0.031	533.2
0.81	12.9	38.1	6.7	0.030	556.1
0.82	13.4	38.7	7.2	0.029	579.9
0.83	13.9	39.3	7.7	0.027	604.5
0.84	14.3	39.8	8.2	0.026	630.0
0.85	14.8	40.4	8.6	0.025	656.3
0.86	15.3	41.0	9.1	0.024	683.6

E X C E E D S R I G H T - O F - W A Y

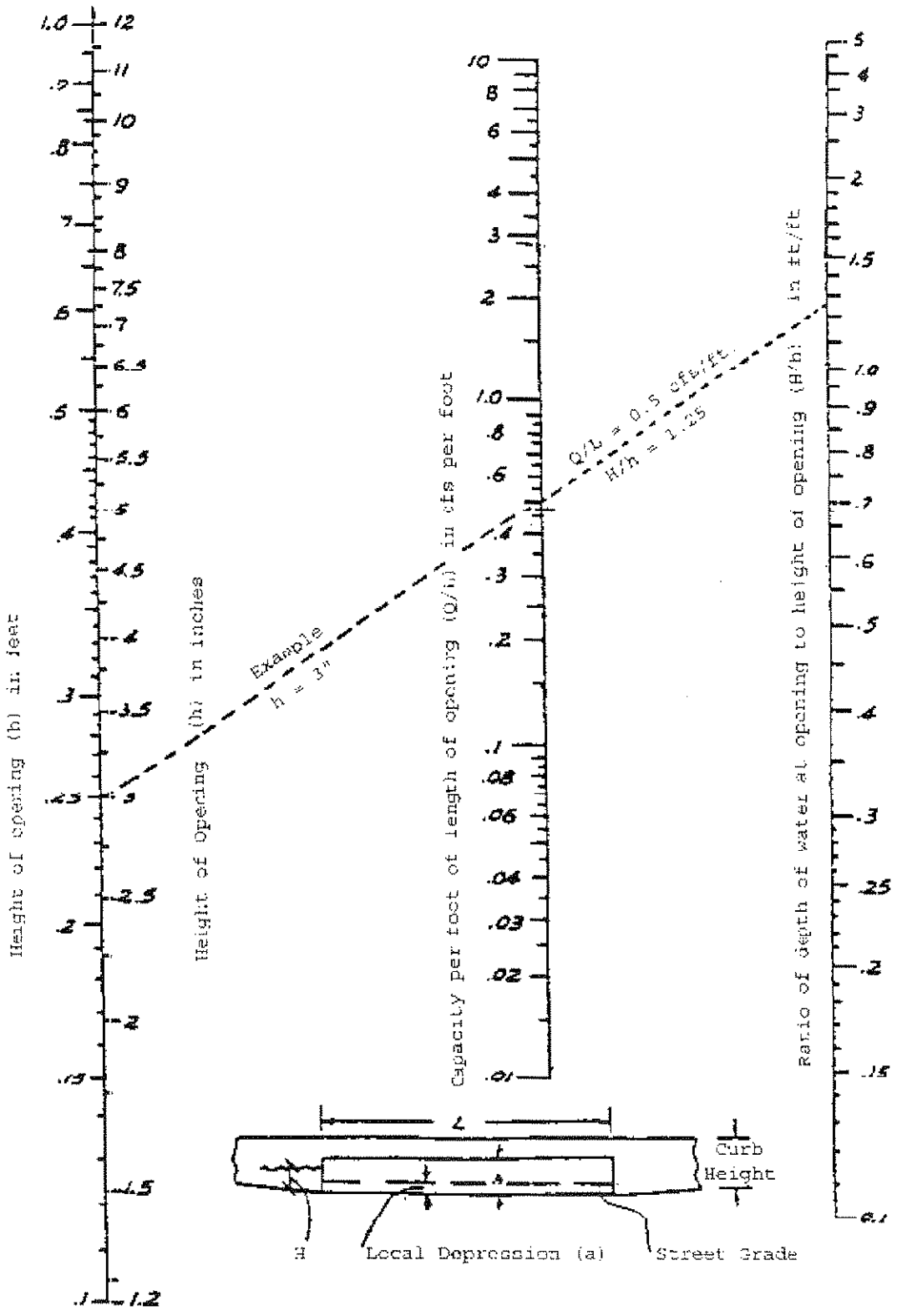


(B) PARTIAL INTERCEPTION RATIO FOR INLETS OF LENGTH LESS THAN L



CAPACITY OF INLETS

FIGURE 5-10



Bureau of Public Roads
Division Two, Wash., D.C.

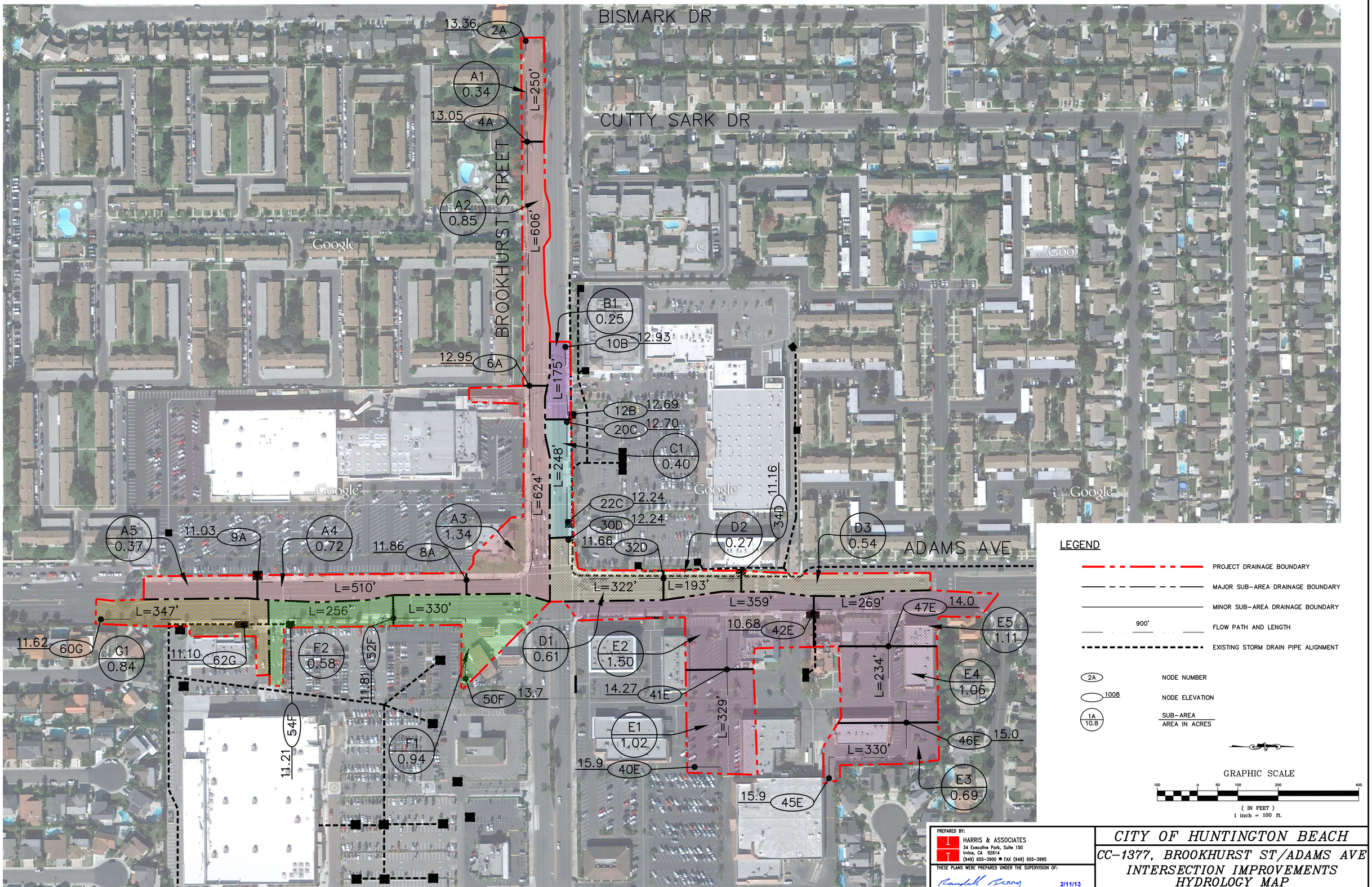
Nomograph for capacity at curb opening inlets at low points

Figure 5-13

HYDROLOGY AND HYDRAULIC STUDY
FOR
BROOKHURST STREET AND ADAMS AVENUE
INTERSECTION IMPROVEMENTS
CITY OF HUNTINGTON BEACH

HYDROLOGY MAP

(See Back Pocket)



LEGEND

- PROJECT DRAINAGE BOUNDARY
- MAJOR SUB-AREA DRAINAGE BOUNDARY
- MINOR SUB-AREA DRAINAGE BOUNDARY
- 900' — FLOW PATH AND LENGTH
- EXISTING STORM DRAIN PIPE ALIGNMENT
- 2A — NODE NUMBER
- 1008 — NODE ELEVATION
- 1A / 10.8 — SUB-AREA / AREA IN ACRES

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

PREPARED BY:
HARRIS & ASSOCIATES
34 Executive Park, Suite 150
Irvine, CA 92614
(949) 655-3900 • FAX (949) 655-3995

THESE PLANS WERE PREPARED UNDER THE SUPERVISION OF:

RANDALL G. BERRY, PE RCE 44642 DATE 2/11/13

CITY OF HUNTINGTON BEACH

CC-1377, BROOKHURST ST/ADAMS AVE INTERSECTION IMPROVEMENTS HYDROLOGY MAP

DATE: NOVEMBER 2010
SCALE: 1"=100'

SHEET 1 OF 1 SHEET

ATTACHMENT J

Applicable Excerpts from

City of Huntington Beach

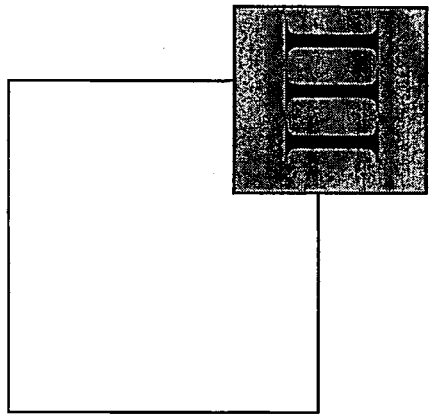
General Plan Circulation Elements

- Designation of Brookhurst Street and Adams Avenue as Major Arterial Streets (per the Existing Network of Arterial Street and Highways
- Typical Cross Section of Major Arterial Street

III

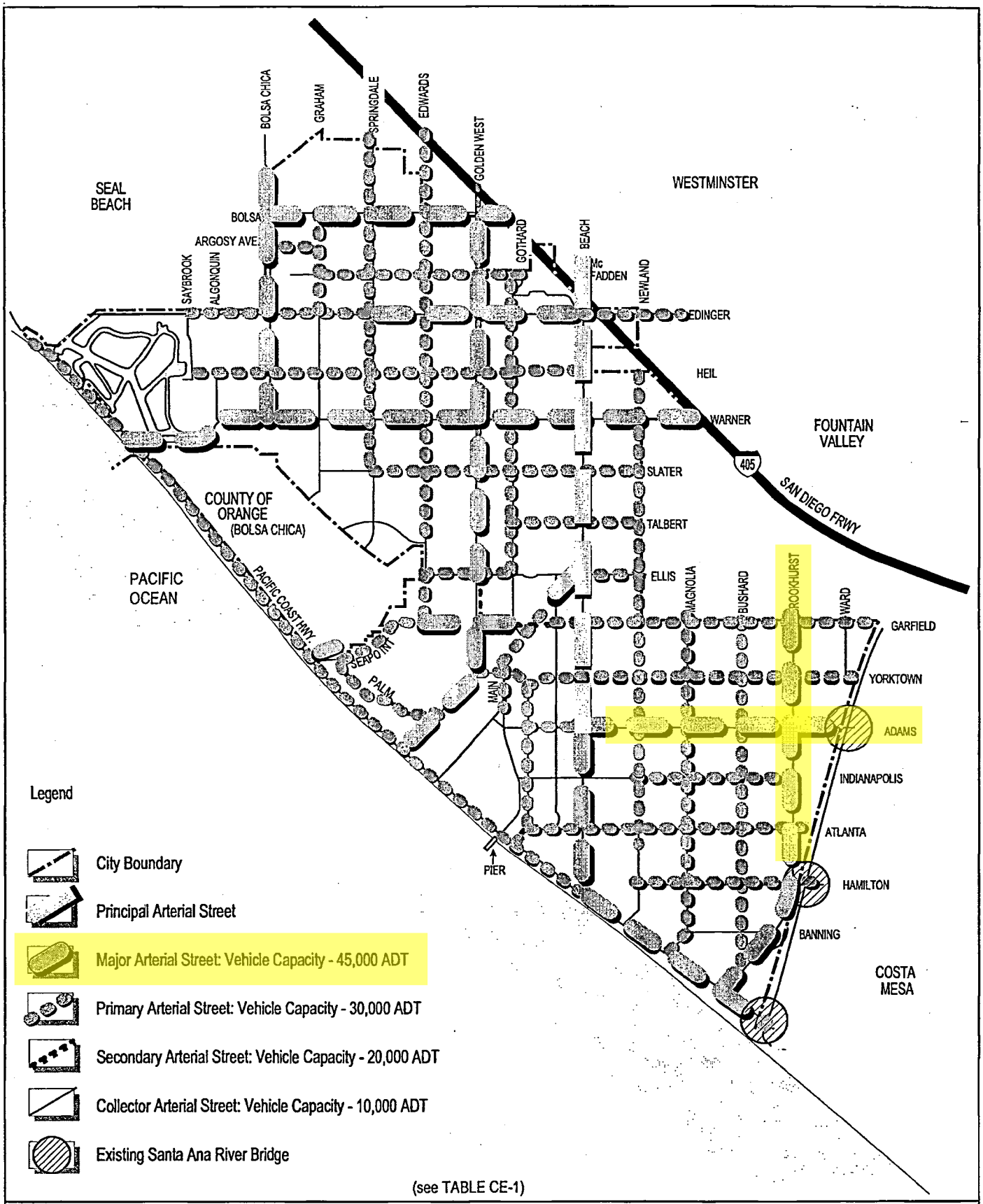
Infrastructure and Community Services Chapter

GENERAL PLAN
HUNTINGTON BEACH



CIRCULATION ELEMENT

HUNTINGTON BEACH

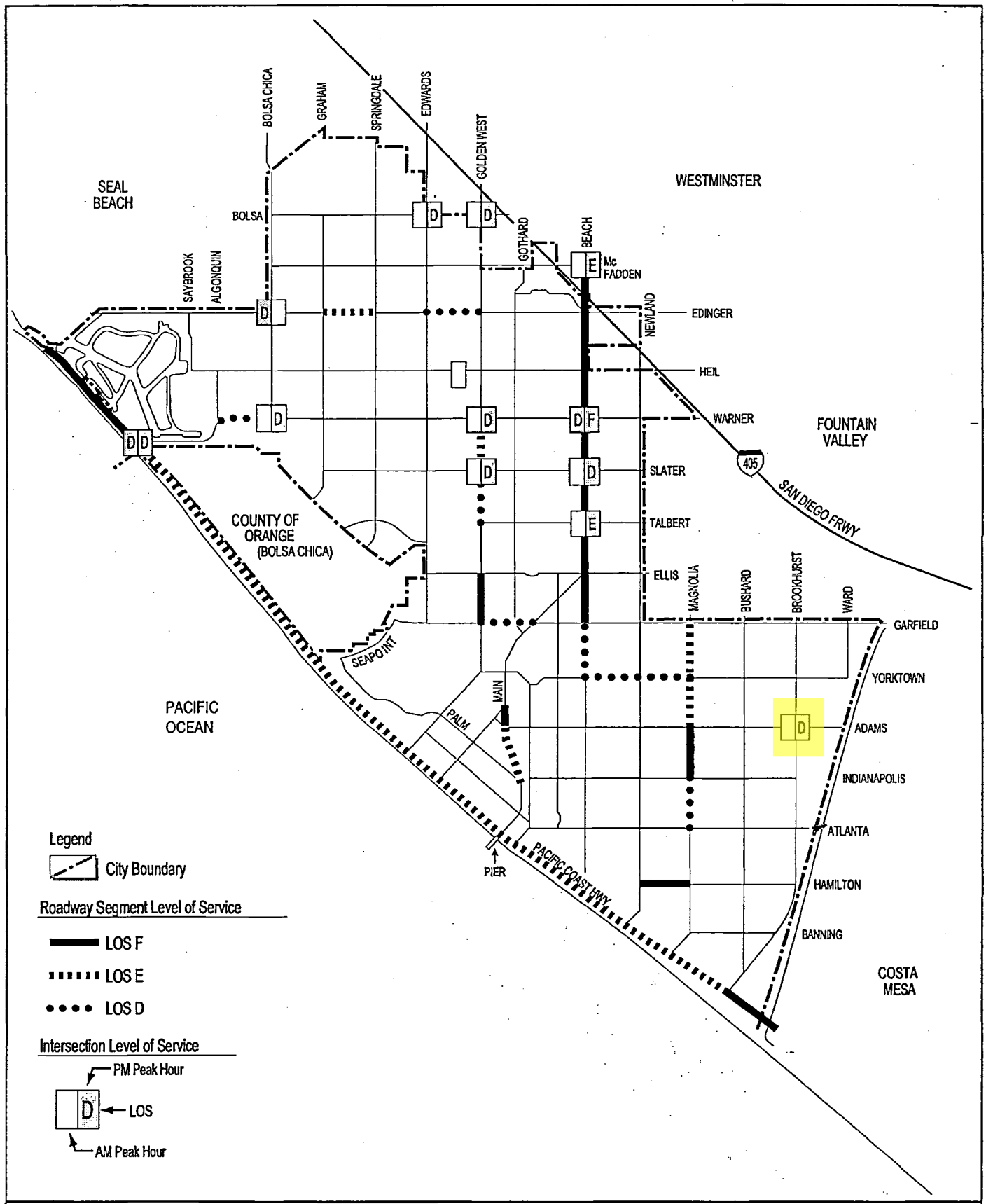


EXISTING NETWORK OF ARTERIAL STREETS AND HIGHWAYS

CITY OF HUNTINGTON BEACH GENERAL PLAN

MILES 0 0.5 1.0 NORTH

FIGURE CE-1

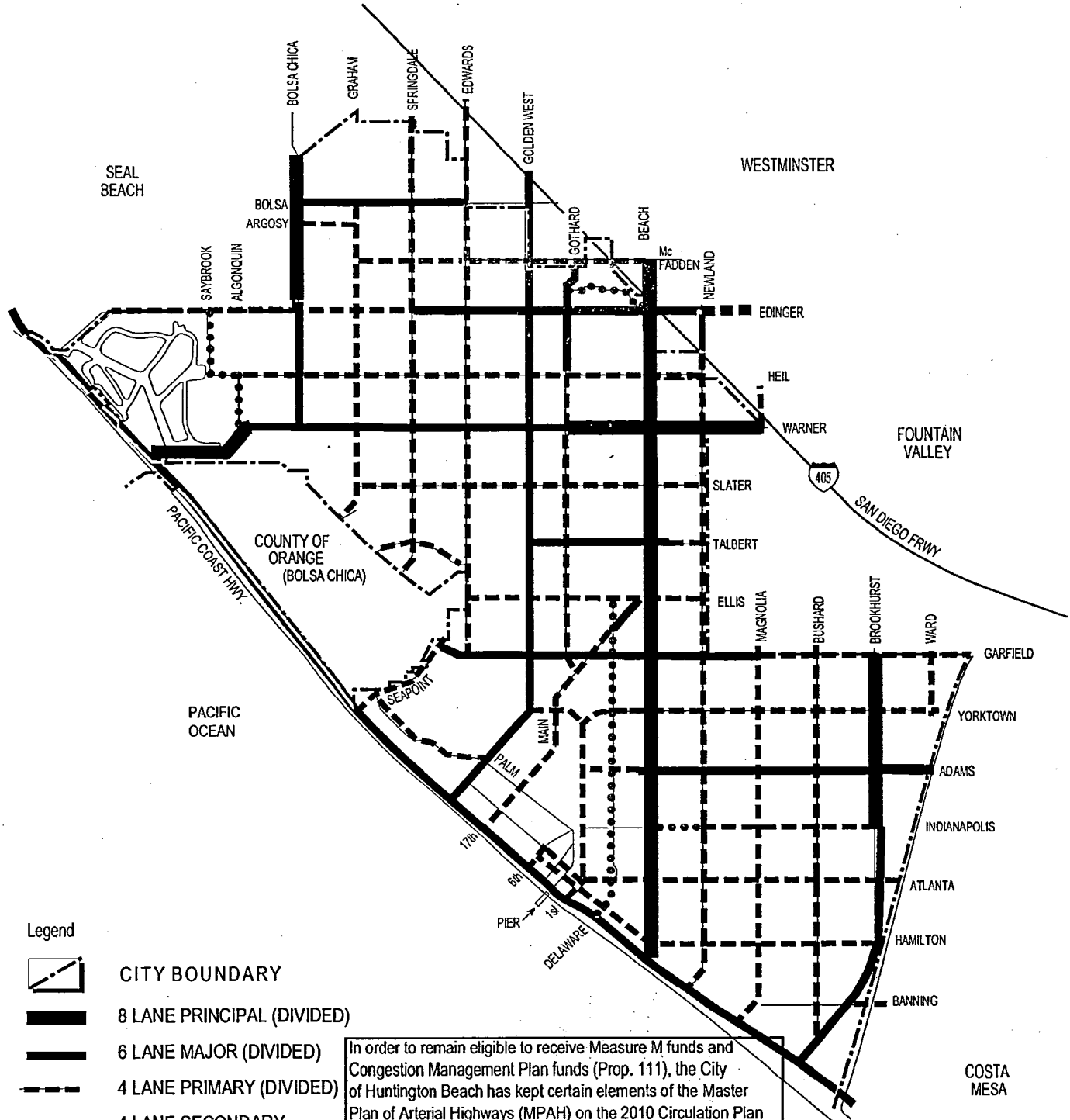


EXISTING INTERSECTIONS AND ROADWAY SEGMENTS OPERATING BELOW LEVEL OF SERVICE C

CITY OF HUNTINGTON BEACH GENERAL PLAN

MILES 0 0.5 1.0 NORTH

FIGURE CE-2



Legend

- CITY BOUNDARY
- 8 LANE PRINCIPAL (DIVIDED)
- 6 LANE MAJOR (DIVIDED)
- 4 LANE PRIMARY (DIVIDED)
- 4 LANE SECONDARY
- 2 LANE COLLECTOR

In order to remain eligible to receive Measure M funds and Congestion Management Plan funds (Prop. 111), the City of Huntington Beach has kept certain elements of the Master Plan of Arterial Highways (MPAH) on the 2010 Circulation Plan of Arterial Highways. These items include the proposed Santa Ana River Bridge crossings. In addition, the Orange County Transportation Authority and surrounding cities are currently discussing the appropriateness of elements, such as the Santa Ana River Bridges, of the OCMPAH. Therefore, future land use planning and transportation planning were based upon the possiblity that these road segments may never be constructed. Please see dicsussion under Technical Synopsis Section F. (see CE 1.1.3)

*The designated street network network may only be implemented following appropriate amendment of the MPAH. Refer to Figure CE-13 for minimum circulation network.

DKS Associates, 1994
Amended June 1998
Amended October 2002

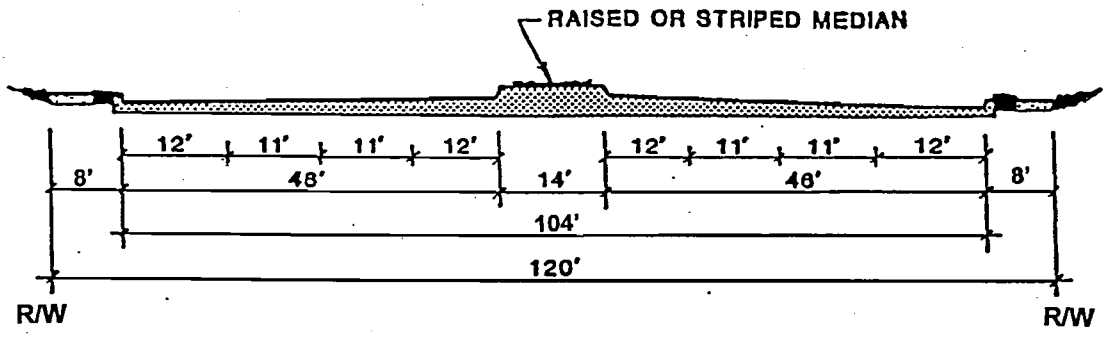
(See TABLE CE-3)

POTENTIAL FOR 2010 CIRCULATION PLAN OF ARTERIAL HIGHWAYS*

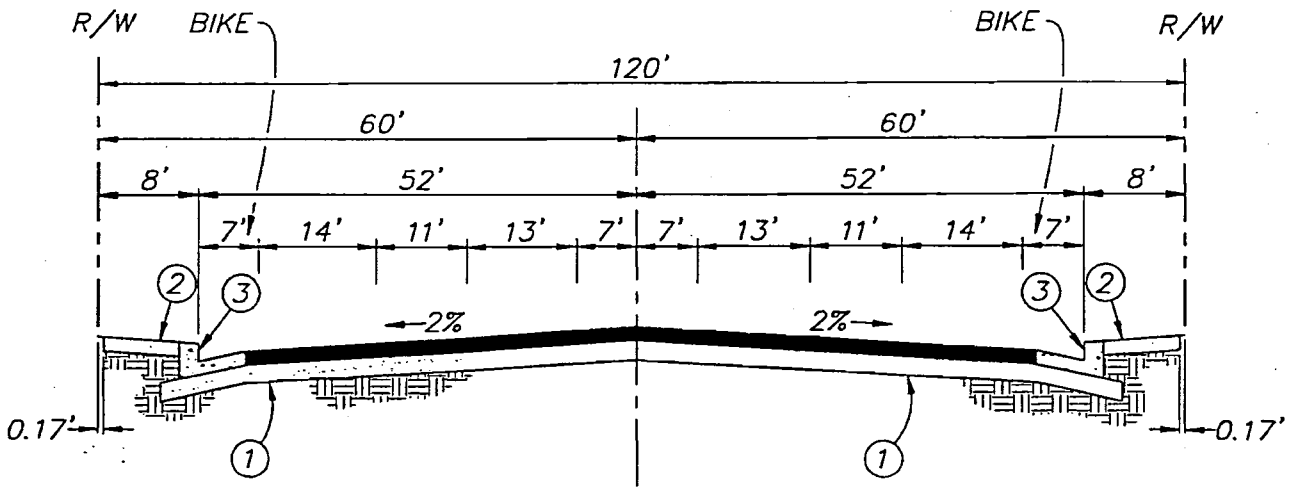
CITY OF HUNTINGTON BEACH GENERAL PLAN

NORTH

FIGURE CE-3



PRINCIPAL ARTERIAL STREET



MAJOR ARTERIAL STREET

(see CE1.2.1)

TYPICAL ROADWAY SECTIONS

CITY OF HUNTINGTON BEACH GENERAL PLAN

FIGURE CE-6b