

Appendix L1 Site Distance Analysis



E-MAIL TRANSMITTED

February 7, 2011

Mr. Patrick Spillane
IDS Real Estate Group
515 S. Figueroa Street, 16th Floor
Los Angeles, California 90071

RE: Sight Distance Analysis for the Proposed Palm Avenue Warehouse Project in the City of San Bernardino

Dear Mr. Spillane,

Crain & Associates has conducted a sight distance analysis at the intersection of Industrial Parkway and the eastern site driveway of the proposed warehouse and distribution center to be located on the north side of Industrial Parkway, east of Palm Avenue, in the City of San Bernardino. The proposed project entails the construction of approximately 693,748 square feet of warehouse and distribution use in a single building. Project site access will be provided via two driveways that intersect the north side of Industrial Parkway. The conceptual project site plan is shown in Attachment 1. At the request of the City of San Bernardino Engineering staff, this sight distance analysis has been prepared. The purpose of this analysis is to determine whether inbound and outbound motorists can safely utilize the project site eastern driveway at Industrial Parkway.

This letter addresses the project driveway location at which potentially adverse sight line conditions were identified. The driveway that could potentially form a connection between the south end of the site and Industrial Parkway was identified as having possible limitations to the available sight distance. No potential adverse sight line conditions or resulting impacts were identified as possibly being created at the main driveway near the north end of the site.

Sight distance measurements were performed at the location of the proposed eastern site driveway intersection on Industrial Parkway in accordance with American Association of State

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Highway and Transportation Officials (AASHTO)¹ requirements. Both stopping sight distance (SSD) and intersection sight distance (ISD) measurements were performed. In brief, SSD is the distance required by a vehicle traveling at the design speed of a roadway, on wet pavement, to stop prior to striking an object in its travel path. SSD is the sum of two distances: (1) the distance traversed by the vehicle from the instant the driver sights an object necessitating a stop to the instant the brakes are applied; and (2) the distance needed to stop the vehicle from the instant brake application begins. ISD, also referred as corner sight distance (CSD) is the sight distance needed for a driver entering or crossing an intersecting roadway to perceive an oncoming vehicle and safely complete a turning or crossing maneuver without unduly interfering with major road traffic operations. In accordance with AASHTO standards, at a minimum, sufficient SSD must be provided at an intersection, with the provision of ISD preferable.

In order to determine the design speed of Industrial Parkway in the vicinity of the proposed eastern site driveway, a spot radar speed survey was conducted on February 18, 2009 for vehicles approaching the proposed driveway location from both the west and east. Different speed profiles were expected for vehicles approaching from each direction, given that Industrial Parkway is constructed on a slight eastbound downgrade. The posted speed limit on this segment of Industrial Parkway is 50 miles per hour (mph), but the radius of the nearby corner only allows for a design speed of 25 mph. In addition, horizontal alignment Reverse Turn (W1-3) warning signs have been installed to advise approaching motorists of the horizontal alignment changes along Industrial Parkway in the vicinity of the proposed driveway location. The spot radar speed survey results showed that the design speed (85th percentile) for eastbound vehicles on Industrial Parkway, approaching the site driveway, was 41 mph. In order to provide a more conservative analysis, sight distance requirements and preferences were calculated based on a 45 mph design speed for vehicles approaching from both directions. The spot radar speed survey data is included in Attachment 2.

In order to determine adequate sight distance, a minimum set-back of 13 feet on the minor roadway from the curb face to the driver position in the approach lane is assumed per Caltrans Highway Design Manual, 6th Edition. Corner sight distance is measured from a 3.5-foot height at the location of the driver on the minor road to a 4.25-foot object height in the center of the approaching lane of the major road.

¹ A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials (AASHTO), 2004.



Looking to the east along Industrial Parkway from the proposed eastern site driveway.



Looking to the west along Industrial Parkway from the proposed eastern site driveway.

The available SSD and ISD were measured in the field on February 11, 2008. The north side of Industrial Parkway is currently lined with shrubs and vegetation. In order to provide adequate SSD and/or ISD at the proposed site driveway, it is recommended that the shrubs and vegetation located within the public right-of-way and situated along the north side of Industrial Parkway, west and east of the site driveway, be trimmed and maintained as necessary to obtain the required minimum lines of sight. For the purposes of this analysis, the measured SSD and ISD were based on the assumption that no vegetation along Industrial Parkway obstructs the available sight distance.

In addition, the presence of an eastbound downgrade along Industrial Parkway affects the required stopping sight distance at the proposed eastern site driveway location. Approaching the site driveway from the west, motorists experience a downgrade that varies between approximately 1.5 and 6 percent (calculated based on topographic survey)^[1]. Approaching the site driveway from the east, motorists experience an upgrade that varies between approximately 2 and 4 percent. In order to provide a more conservative analysis, stopping sight distance requirements were calculated based on a 6 percent downgrade along Industrial Parkway, approaching from the west, and a 0 percent upgrade along Industrial Parkway, approaching from the east. Table 1 presents the required, desirable, and measured SSD and ISD at the intersection of Industrial Parkway with the eastern site driveway.

Table 1
Sight Distance Measurements

Intersection/Sight Distance Measurement	Required		
	Minimum (Feet) ^[2]	Desirable (Feet) ^[3]	Measured (Feet) ^[4]
Industrial Parkway at the Eastern Site Driveway			
<i>Intersection Sight Distance for 45 MPH:</i>			
Looking to the west from the site driveway ^[5]	400	500	500 +
Looking to the east from the site driveway ^[6]	360	430	430 +
<i>Intersection Sight Distance for 30 MPH:</i>			
Looking to the west from the site driveway ^[5]	215	335	500 +
Looking to the east from the site driveway ^[6]	200	290	430 +

Notes

- ^[1] The proposed roadway realignment for the Palm Avenue Railroad Overcrossing Project will join the existing pavement north of the Industrial Parkway curve west of the driveway; therefore, will not affect grades or speeds on Industrial Parkway at the driveway, which is southeast of the curve.
- ^[2] Recommended minimum values (Stopping Sight Distance) obtained from A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials (AASHTO), 2004, and based on a 45 mph design speed for motorists on Industrial Parkway approaching the eastern site driveway from the west and east.
- ^[3] Values shown are desirable intersection sight distances (ISD) for vehicles exiting the driveway under STOP control. With ISD, motorists approaching the intersection on the major street should not need to adjust their travel speed to less than 70 percent of their initial approach speed.
- ^[4] Measured SSD/ISD. Measurements assume no obstruction due to vegetation along the north side of Industrial Parkway. Note: Variation in measured distance, if any, due to slight difference in height of observed object (2 feet vs. 3.5 feet) and site-exiting driver location for ISD measurements (approximate 13-foot set-back from the curb face).
- ^[5] Vehicles turning left exiting a driveway under STOP-sign control.
- ^[6] Vehicles turning right exiting a driveway under STOP-sign control.

As can be seen in Table 1, the measured SSD and ISD at the eastern site driveway intersection with Industrial Parkway exceed the recommended minimum requirements based on a 45 mph design speed for eastbound and westbound vehicles approaching the site driveway. As stated previously, the shrubs and vegetation located within the public right-of-way and situated along the north side of Industrial Parkway would have to be trimmed and maintained in order to ensure adequate sight distance continues to be provided. Attachment 3 illustrates the sight distance analysis, with the portion of the conceptual project site plan depicting the eastern site driveway overlaid on an aerial photograph of Industrial Parkway. Lines of sight for motorists approaching the proposed site driveway from the west were found to be limited by a hill that presently occupies the project site. When the proposed warehouse and distribution center is constructed, it is recommended that grading of the site along the northern edge of Industrial Parkway be performed such that lines of sight are maximized to/from the west. Lines of sight for

motorists approaching the proposed site driveway from the east were found to be limited by a newly constructed industrial building (and associated utility facilities) on the south side of Industrial Parkway.



Approaching the proposed eastern site driveway from the west.



Approaching the proposed eastern site Driveway from the east.

While conducting the sight distance field measurements, the presence of recently planted, young trees was noticed along the south side of Industrial Parkway, within the property of the aforementioned industrial building. Currently, these trees are small and present no obstruction to the lines of sight from the proposed site driveway looking east. However, depending upon how large these trees grow in the future, they could become sight distance obstructions. In order to account for this potential tree growth, stopping and intersection sight distances were measured from the eastern site driveway looking to the east, with the southern edge of Industrial Parkway serving as the limit for lines of sight. As shown on Attachment 3, these restricted stopping and intersection sight distances are approximately 360 feet. These measurements satisfy the recommended minimum required stopping sight distance of 360 feet, based on a 45 mph design speed for Industrial Parkway, although are less than the desired intersection sight distance of 430 feet.

To satisfy the desired sight distance of 430 feet based on 45 mph design speed for Industrial Parkway, a minimum of 15 feet clearance between the south edge of Industrial Parkway and the building located on the south side of Industrial Parkway is required. Currently, the clearance between the south edge of Industrial Parkway and the building located south of Industrial Parkway is more than 15 feet.

However, although the speed limit on Industrial Parkway is currently posted at 50 mph, and the spot radar speed survey results showed that the design speed (85th percentile) for eastbound vehicles on Industrial Parkway, approaching the site driveway, was 41 mph, the recommended design speed for the roadway with the curve radius of 220 feet east of the driveway is less than 30 mph per Highway Design Manual Section 203.2. The minimum standard ISD is 335 feet for left-turn vehicles and 290 feet for right-turn vehicles assuming 30 mph design speed. Therefore,

Mr. Patrick Spillane
February 7, 2011
Page Six

the measured restricted sight distances (with the south edge of Industrial Parkway serving as the limit for lines of sight) exceed the minimum standard sight distance requirements for 30 mph design speed.

In addition, the City of San Bernardino is currently planning improvements along this segment of Industrial Parkway. The roadway will be widened slightly to an ultimate curb-to-curb width of 64 feet, with two through travel lanes provided in each direction and a two-way left-turn lane provided along the center of the roadway. It should be noted that the desirable intersection sight distance looking to the west from the proposed site driveway will present a conservative condition once these improvements are implemented, given that the center two-way left-turn lane will be available as an intermediate stop for outbound motorists seeking to enter the eastbound traffic stream.

In conclusion, it is expected that the required SSD can be provided at the eastern site driveway intersection with Industrial Parkway, if the recommendations above (and shown on Attachment 3) are followed. The desired ISD can currently be provided and will be limited in the future only if tree growth along the south side of Industrial Parkway results in line of sight obstructions. It should be noted that if the advisory signs to encourage drivers to reduce their speed to the safe design speed less than 30 mph, the enough sight distances provided at the designed location of the driveway will also meet the desirable ISD.

If you have any questions, please feel free to call either Helen Shi of our office or myself.

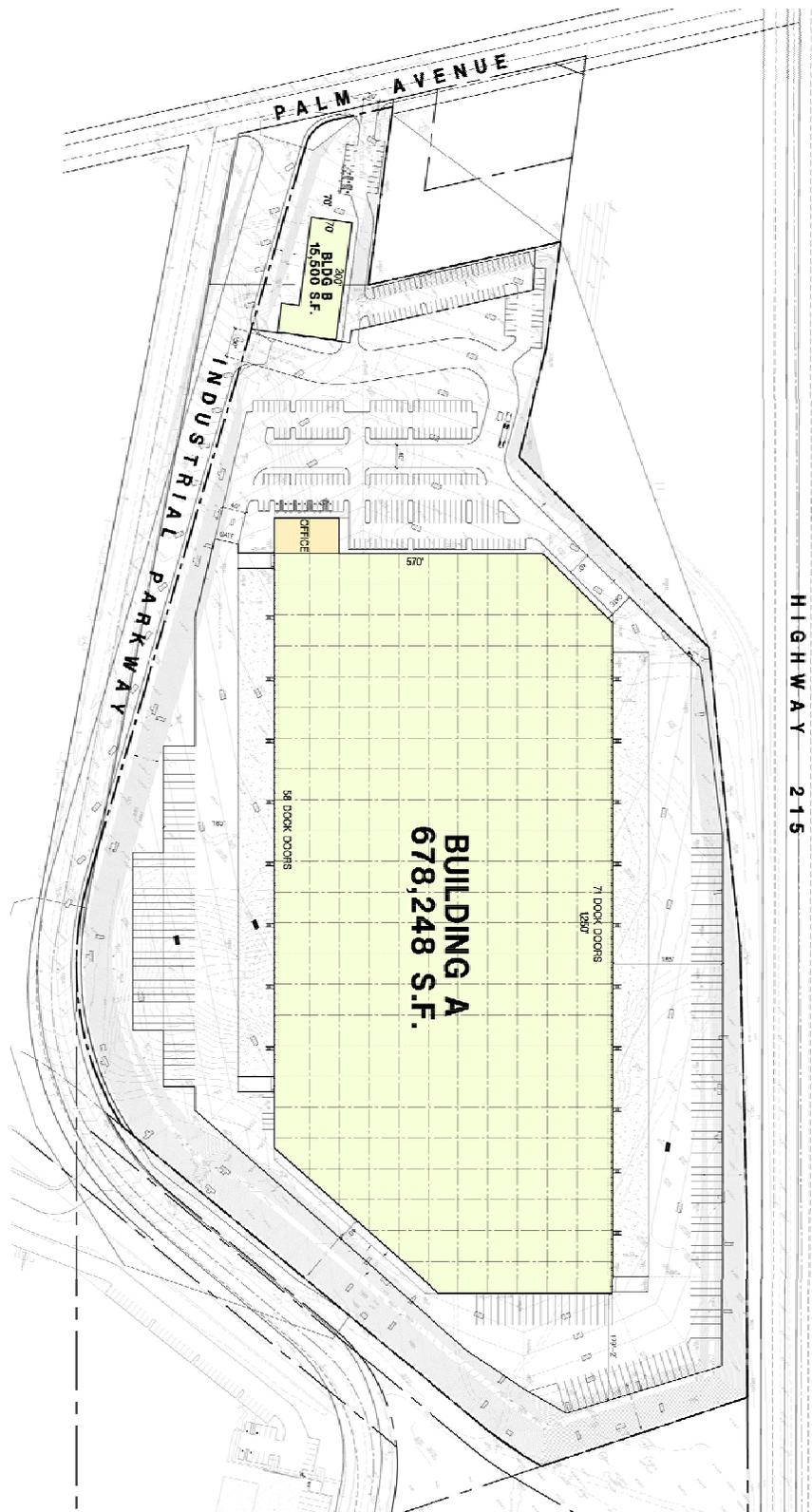
Sincerely,



George Rhyner
Senior Transportation Engineer

GR:hs
C19465
attachments

ATTACHMENT 1
CONCEPTUAL PROJECT SITE PLAN



SCHEME 1

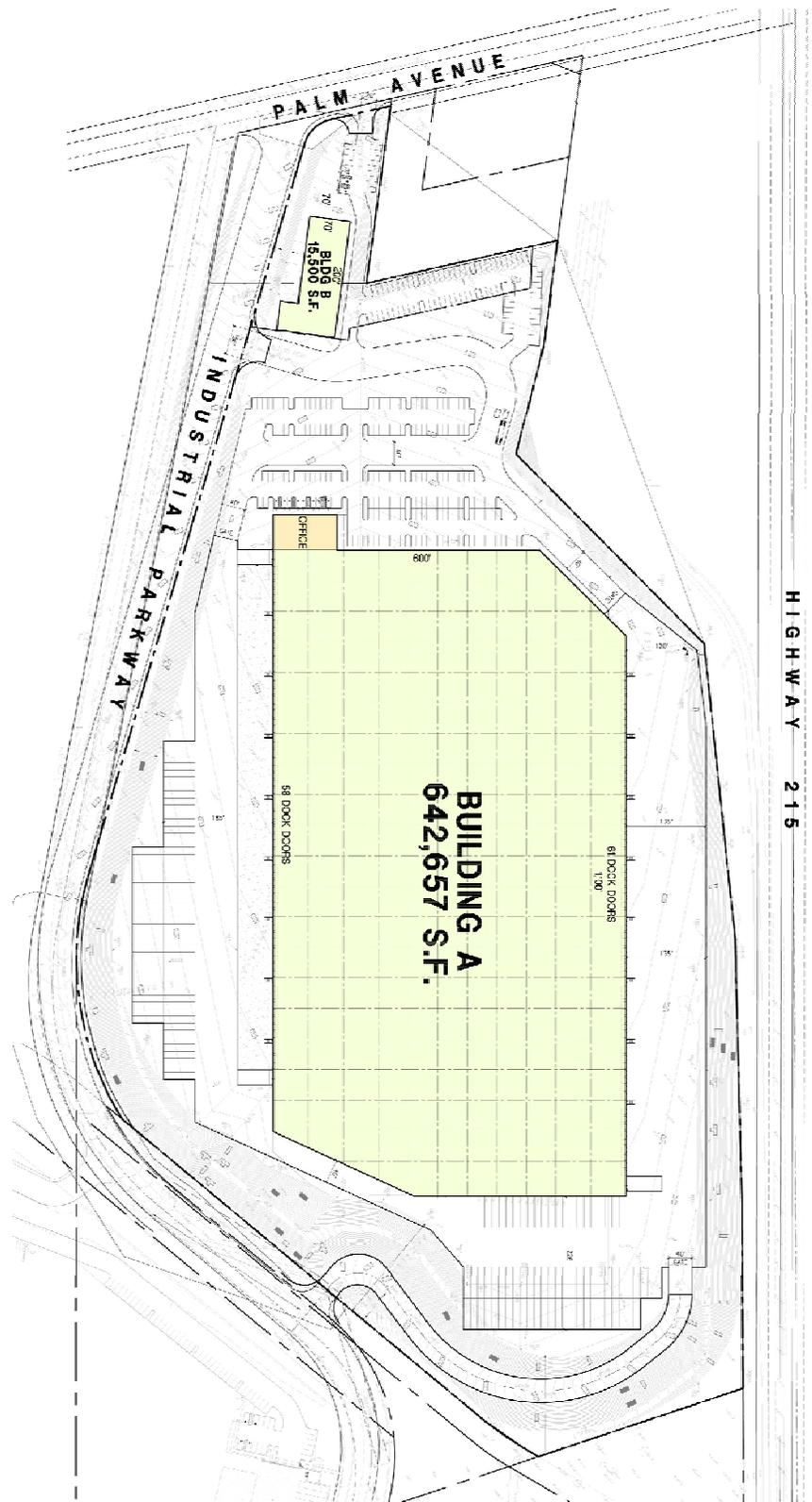
1/12/2011

FN: PALM AVE WAREHOUSE SAN BERNARDINO/SIGHT DISTANCE ANALYSIS 2011/SITEPLAN

PROJECT SITE PLAN



Transportation Planning
Traffic Engineering
300 Corporate Pointe, Suite 470
Culver City, California 90230
PH (310) 473 6508 F (310) 444 9771
www.crainandassociates.com



SCHEME 2

1/12/2011

FN PALM AVE WAREHOUSE SAN BERNARDINO/SIGHT DISTANCE ANALYSIS 2011/SITEPLAN

PROJECT SITE PLAN



CRAIN Transportation Planning
 Traffic Engineering
 &
ASSOCIATES
 300 Corporate Pointe, Suite 470
 Culver City, California 90230
 PH (310) 473 6508 F (310) 444 9771
 www.crainandassociates.com

ATTACHMENT 2
SPOT RADAR SPEED SURVEY DATA

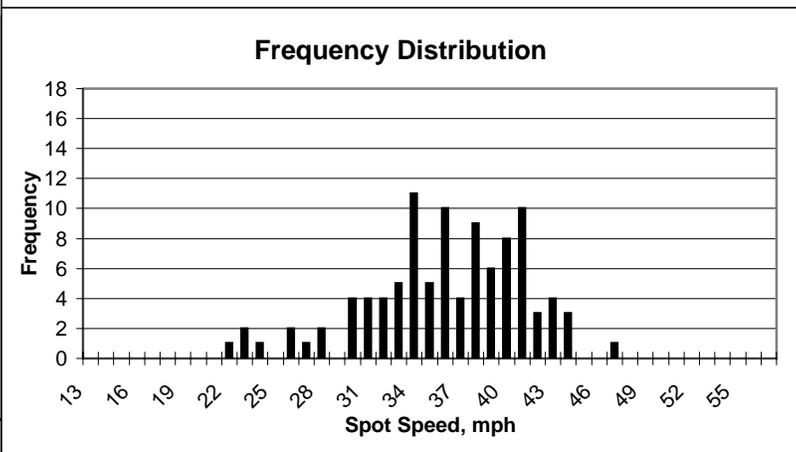
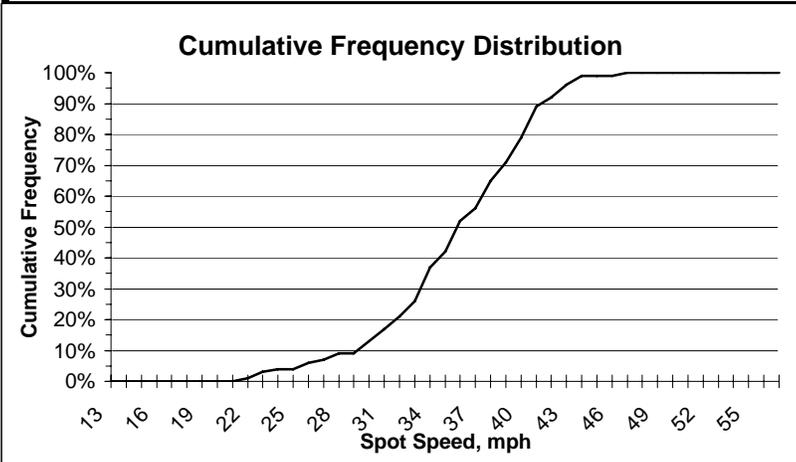
CITY OF SAN BERNARDINO SPEED STUDY

Client: CRAIN & ASSOCIATES
Street: INDUSTRIAL PARKWAY
Spt.Sp. Location: PROPOSED SITE DRIVEWAY

Ref. # 01 EB

Speed	Frequency	Percent	Cumulative Percent
13	0	0.00%	0.00%
14	0	0.00%	0.00%
15	0	0.00%	0.00%
16	0	0.00%	0.00%
17	0	0.00%	0.00%
18	0	0.00%	0.00%
19	0	0.00%	0.00%
20	0	0.00%	0.00%
21	0	0.00%	0.00%
22	1	1.00%	1.00%
23	2	2.00%	3.00%
24	1	1.00%	4.00%
25	0	0.00%	4.00%
26	2	2.00%	6.00%
27	1	1.00%	7.00%
28	2	2.00%	9.00%
29	0	0.00%	9.00%
30	4	4.00%	13.00%
31	4	4.00%	17.00%
32	4	4.00%	21.00%
33	5	5.00%	26.00%
34	11	11.00%	37.00%
35	5	5.00%	42.00%
36	10	10.00%	52.00%
37	4	4.00%	56.00%
38	9	9.00%	65.00%
39	6	6.00%	71.00%
40	8	8.00%	79.00%
41	10	10.00%	89.00%
42	3	3.00%	92.00%
43	4	4.00%	96.00%
44	3	3.00%	99.00%
45	0	0.00%	99.00%
46	0	0.00%	99.00%
47	1	1.00%	100.00%
48	0	0.00%	100.00%
49	0	0.00%	100.00%
50	0	0.00%	100.00%
51	0	0.00%	100.00%
52	0	0.00%	100.00%
53	0	0.00%	100.00%
54	0	0.00%	100.00%
55	0	0.00%	100.00%
56	0	0.00%	100.00%
57	0	0.00%	100.00%

Date:	<u>2/18/2009</u>	Day:	<u>Wednesday</u>
Weather:	<u>Dry, clear</u>		
Hours:	<u>10:30 AM</u>	To	<u>12:10 PM</u>
Recorder:	<u>Counts Unlimited, Inc.</u>		
Posted Speed:	<u>50 MPH</u>		
Channelization:			
Street Width:			
Comm./Resid.:	<u>Commercial</u>		
DIRECTION:	<u>Eastbound</u>		
DATA ANALYSIS:			
Mean Speed:			<u>36</u>
Standard Deviation:			<u>5</u>
Standard error of the mean:			<u>0.5</u>
50th Percentile:			<u>36</u>
85th Percentile:			<u>41</u>
97th Percentile:			<u>44</u>
10 Mile Pace:	<u>32</u>	to	<u>41</u>
% of Samples in 10-Mile Pace:	<u>72.00%</u>		
Comments:			



Total: 100 100%

CITY OF SAN BERNARDINO SPEED STUDY

Client: CRAIN & ASSOCIATES
Street: INDUSTRIAL PARKWAY
Spt.Sp. Location: PROPOSED SITE DRIVEWAY

Ref. # 01 WB

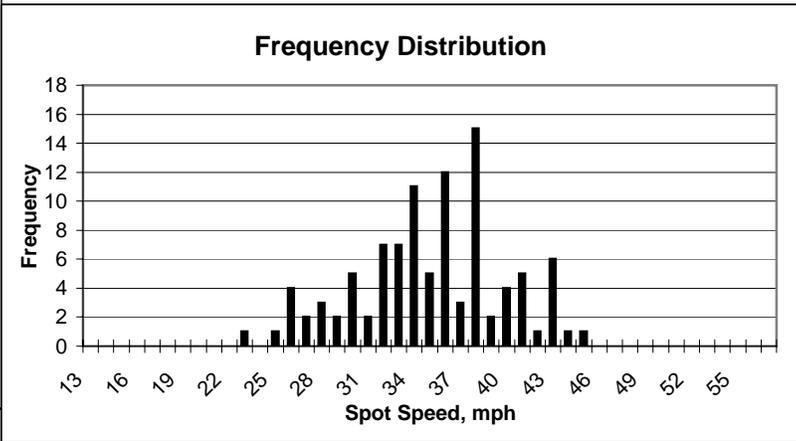
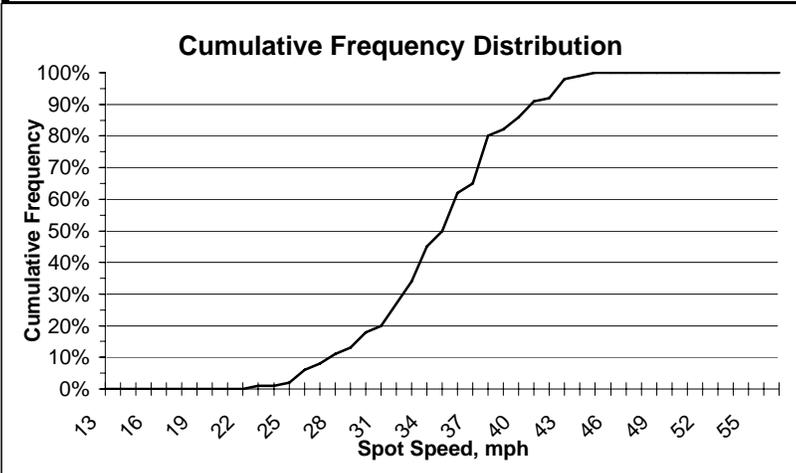
Speed	Frequency	Percent	Cumulative Percent
13	0	0.00%	0.00%
14	0	0.00%	0.00%
15	0	0.00%	0.00%
16	0	0.00%	0.00%
17	0	0.00%	0.00%
18	0	0.00%	0.00%
19	0	0.00%	0.00%
20	0	0.00%	0.00%
21	0	0.00%	0.00%
22	0	0.00%	0.00%
23	1	1.00%	1.00%
24	0	0.00%	1.00%
25	1	1.00%	2.00%
26	4	4.00%	6.00%
27	2	2.00%	8.00%
28	3	3.00%	11.00%
29	2	2.00%	13.00%
30	5	5.00%	18.00%
31	2	2.00%	20.00%
32	7	7.00%	27.00%
33	7	7.00%	34.00%
34	11	11.00%	45.00%
35	5	5.00%	50.00%
36	12	12.00%	62.00%
37	3	3.00%	65.00%
38	15	15.00%	80.00%
39	2	2.00%	82.00%
40	4	4.00%	86.00%
41	5	5.00%	91.00%
42	1	1.00%	92.00%
43	6	6.00%	98.00%
44	1	1.00%	99.00%
45	1	1.00%	100.00%
46	0	0.00%	100.00%
47	0	0.00%	100.00%
48	0	0.00%	100.00%
49	0	0.00%	100.00%
50	0	0.00%	100.00%
51	0	0.00%	100.00%
52	0	0.00%	100.00%
53	0	0.00%	100.00%
54	0	0.00%	100.00%
55	0	0.00%	100.00%
56	0	0.00%	100.00%
57	0	0.00%	100.00%

Date: 2/18/2009 **Day:** Wednesday
Weather: Dry, clear
Hours: 10:30 AM **To** 12:10 PM
Recorder: Counts Unlimited, Inc.
Posted Speed: 50 MPH
Channelization: _____
Street Width: _____
Comm./Resid.: Commercial
DIRECTION: Westbound

DATA ANALYSIS:

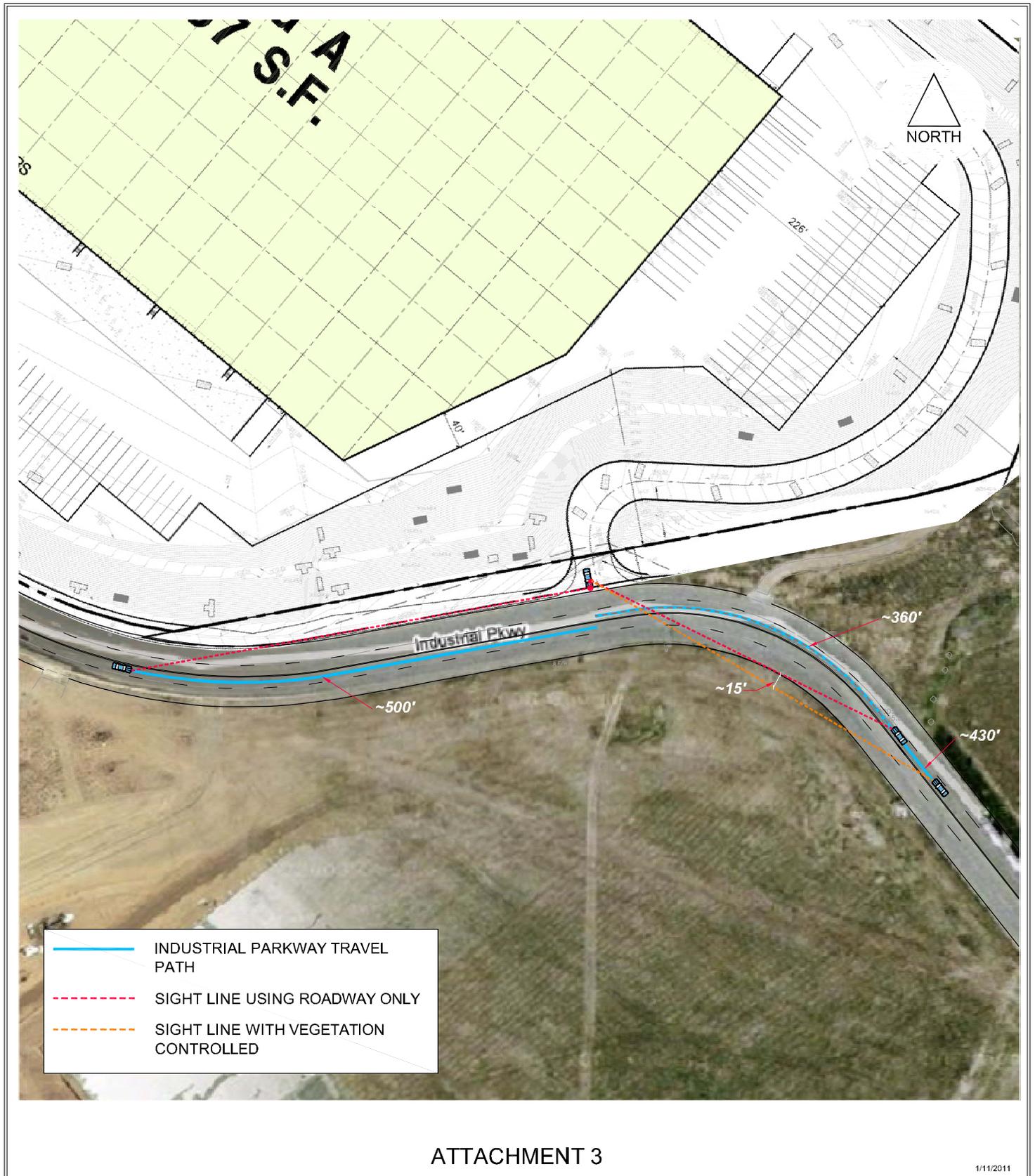
Mean Speed:	35
Standard Deviation:	5
Standard error of the mean:	0.5
50th Percentile:	35
85th Percentile:	40
97th Percentile:	43
10 Mile Pace:	32 to 41
% of Samples in 10-Mile Pace:	71.00%

Comments: _____



Total: 100 100%

ATTACHMENT 3
PROPOSED EASTERN SITE DRIVEWAY
STOPPING SIGHT DISTANCE ANALYSIS



1/11/2011

FN: PALM AVE WAREHOUSE SAN BERNARDINO SIGHT DISTANCE ANALYSIS 2011 STOPPING SIGHT-DISTANCE

**PALM AVENUE WAREHOUSE PROJECT
 PROPOSED EASTERN SITE DRIVEWAY
 SIGHT DISTANCE ANALYSIS**



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