Controller's Office

To the Honorable Mayor and City Council of the City of Houston, Texas:

I hereby certify, with respect to the money required for the contract, agreement, obligation or expenditure contemplated by the ordinance set out below that:

( ) **Funds have been encumbered out of funds previously appropriated for such purpose.**

( ) **Funds have been certified and designated to be appropriated by separate ordinance to be approved prior to the approval of the ordinance set out below.**

( ) **Funds will be available out of current or general revenue prior to the maturity of any such obligation.**

( ) **No pecuniary obligation is to be incurred as a result of approving the ordinance set out below.**

( ) **The money required for the expenditure or expenditures specified below is in the treasury, in the fund or funds specified below, and is not appropriated for any other purposes.**

( ) **A certificate with respect to the money required for the expenditure or expenditures specified below is attached hereto and incorporated hereby this reference.**

(✓) **Other – Grant Funds Available.**

Date: 10-22, 20 20

C. B. Brown
City Controller of the City of Houston, Texas

FUND REF: 5430-2000- **AMOUNT:** -0- **ENCUMB. NO.:** GN2039-21

City of Houston, Texas Ordinance No. 2020-916

AN ORDINANCE APPROVING AND AUTHORIZING THE SUBMISSION OF FIVE (5) GRANT APPLICATIONS TO THE TEXAS DEPARTMENT OF TRANSPORTATION'S HIGHWAY SAFETY IMPROVEMENT PROGRAM FOR THE CONSTRUCTION OF VARIOUS ROADWAY AND INTERSECTION SAFETY PROJECTS WITHIN THE CITY OF HOUSTON; DECLARING THE CITY'S ELIGIBILITY FOR SUCH GRANTS; AUTHORIZING THE DIRECTOR OF THE CITY OF HOUSTON PUBLIC WORKS DEPARTMENT ("DIRECTOR") TO APPLY FOR, ACCEPT, AND EXPEND GRANT FUNDS, IF AWARDED, AND TO APPLY FOR, ACCEPT AND EXPEND ALL SUBSEQUENT AWARDS, IF ANY, AND/OR TO PASS THE FUNDS THROUGH TO THE EXTERNAL FUNDING PARTNERS, AS APPROPRIATE; CONTAINING PROVISIONS RELATING TO THE SUBJECT; AND DECLARING AN EMERGENCY.

* * * *

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF HOUSTON, TEXAS:

Section 1. That the City of Houston is certified as eligible to receive the grants from the **TEXAS DEPARTMENT OF TRANSPORTATION'S HIGHWAY SAFETY IMPROVEMENT PROGRAM ("HSIP")**.

Section 2. That the Director of Houston Public Works Department (the "Director") is authorized and directed to represent and act for the City in dealing with the **TEXAS DEPARTMENT OF TRANSPORTATION** for the purpose of the above grant programs and is authorized to execute such documents and all related documents on behalf of the City of Houston.

Section 3. That the official designated is specifically authorized to make applications, in substantially the form attached to this ordinance and incorporated by this reference, to the **TEXAS DEPARTMENT OF TRANSPORTATION** for the above-mentioned grants for the Houston Public Works Department in the amount of **$2,031,144.00** on behalf of the City and certain external funding partners.

Section 4. That the Director is designated as the official authorized person to accept and expend the funds, as awarded, for the purpose of this grant programs and to apply for and accept all subsequent awards, if any, not to exceed five years, pertaining to the operation of the **HSIP**. The Mayor is hereby authorized, without further City Council action, to execute all related contracts, agreements, amendments and documents for the project periods not to exceed five years, in connection with the above-mentioned grant assistance program, with the approval as to form of the City Attorney. The Mayor and the Director are authorized to execute all documents accepting current and future grant funds and to pass them through to the external funding partners. The City Secretary is hereby authorized to attest to all such signatures and to affix the seal of the City to all such documents.

Section 5. There exists a public emergency requiring that this Ordinance be passed finally on the date of its introduction as requested in writing by the Mayor; therefore, this Ordinance shall be passed finally on such date and shall take effect immediately upon its passage and approval by the Mayor; however, in the event that the Mayor fails to sign this Ordinance within five days after its passage and adoption, it shall take effect in accordance with Article VI, Section 6, Houston City Charter.

PASSED AND ADOPTED this 21st **day of** October**, 20**20

APPROVED this _____ day of _____, 20___.

_____
Mayor of the City of Houston, Texas

Pursuant to Article VI, Section 6, Houston City Charter, the effective date of the foregoing Ordinance is OCT 2 7 2020.

Pat J. Daniel
City Secretary

CAPTION PUBLISHED IN DAILY COURT REVIEW
DATE: OCT 2 7 2020

FUNDING SOURCES:

$2,031,144.00 – Fund 5430 – Federal State Local – HPW Pass thru DDSRF
$ 84,095.00 -- Fund 4040- METRO Projects Construction DDSRF
$ 141,588.00 – External Partner Local Share Amount

(Prepared by Legal Dept. _____ for MNB)
(MNB/sjl 10/06/2020) Assistant City Attorney
(Requested by Carol Ellinger Haddock, P.E., Director, Houston Public Works)
(L.D. File No. 0632000437001)

AYE	NO	
✓		**MAYOR TURNER**
....	....	**COUNCIL MEMBERS**
✓		PECK
✓		DAVIS
✓		KAMIN
✓		EVANS-SHABAZZ
✓		MARTIN
✓		THOMAS
✓		TRAVIS
✓		CISNEROS
✓		GALLEGOS
✓		POLLARD
✓		MARTHA CASTEX-TATUM
✓		KNOX
✓		ROBINSON
✓		KUBOSH
✓		PLUMMER
✓		ALCORN
CAPTION	ADOPTED	

Rev. 5/18

HSIP Project Submission

Texas Department of Transportation

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Proposal Information

District	Houston	County	Harris
Comments			
File Name	HOU_HillcroftAve_Houston	Supervised By	Ugonna Ughanze

Roadway Information

Primary Roadway	Hillcroft Ave	Control Section(s)	
Limits From	300' south of Dashwood	DFO*	29.706442, -95.493028
Limits To	300' north of Dashwood	DFO*	29.708091, -95.493102

*Lat/Long pairs for off-system

On or Off System	Off System	Speed Limit	35 mph
Length	0.182 mile	Current AADT	28000

Intersecting Roadway	Dashwood Dr	Speed Limit	30 mph
On or Off System	Off System	Current AADT	1300

Project Information

Targeted or Systemic	Targeted / Hot Spot	Crashes	K	1
Work Code(s)	107 - Install Traffic Signal		A	4
Preferred Letting	10/2021		B	6
			SII	76.42

Estimate

Bid Items (See Guidelines instructions)	$ 210,633
ROW (if required)	$ 0
Mobilization and Barricades (≥ 8%)	$ 30,000
Safety (2-5%)	$ 10,532
Inflation (≥ 10%)	$ 21,063
Total	$ 272,227

Form Rev 11/2019


N
Current: Two-Way Stop-Control
Proposed: Traffic Signal

2020 SII Calculator (2016-2018 Crash Data, 2017 NSC Data)
Enter data in the shaded cells where applicable.

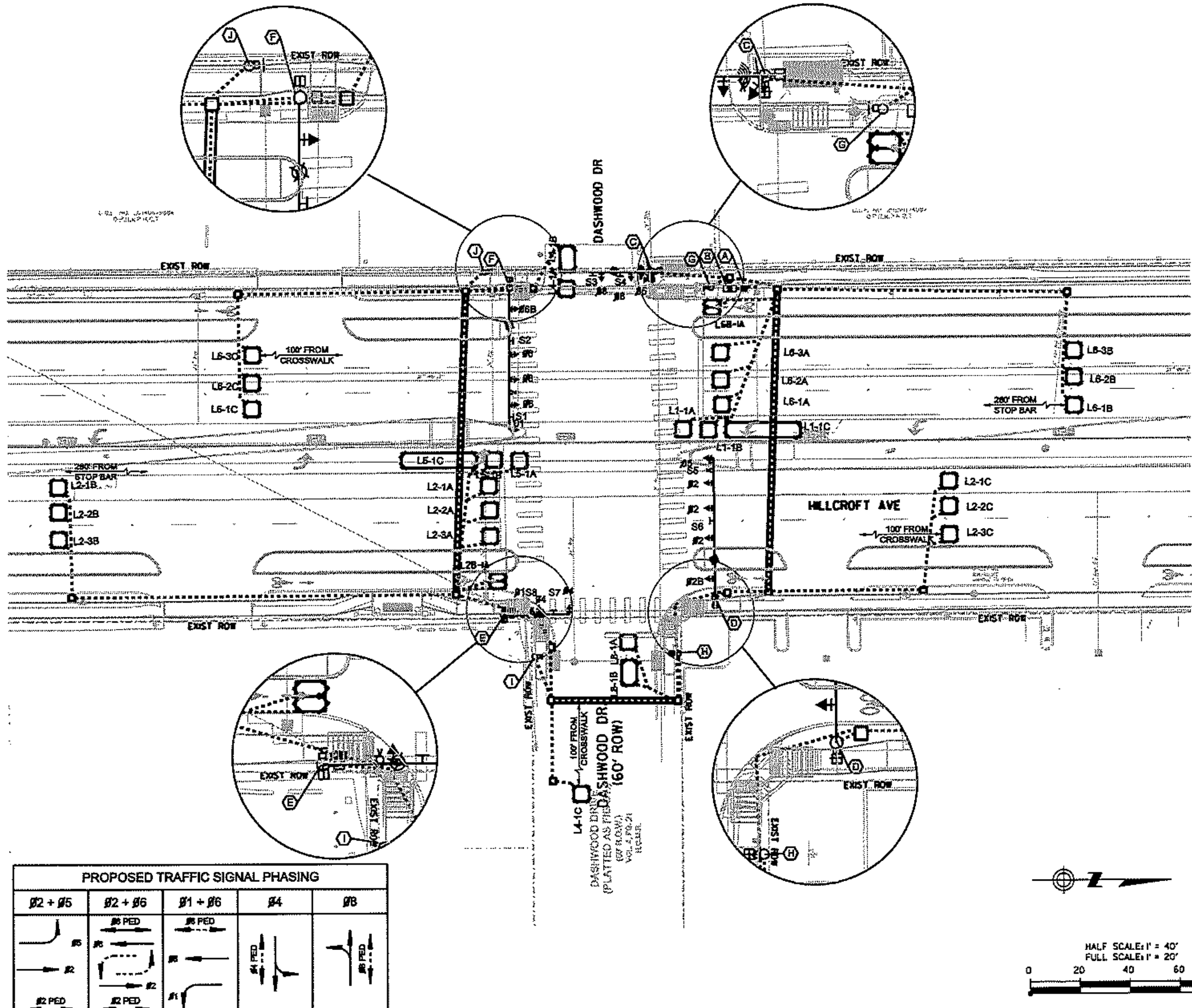
Years of Data
3

	Number of Crashes	Cost
Number of Fatal Crashes (K)	1	$3,600,000
Number of Incapacitating Injury Crashes (A)	4	$3,600,000
Number of Non-Incapactitating Injury Crashes (B)	6	$500,000

Reduction Factor	35%
Service Life	10
Total ROW & Construction Cost	$272,227
Annual Maintenance Cost	$3,900
Present ADT	29297
Future ADT	39373

SII Calculation **76.42**

Item Code	Item Description	Item Unit	Quantity	Unit Price	Total Price
06246001	GROUND BOX TY A (122311)	EA	14	$ 735.95	$10,303.30
06246008	GROUND BOX TY C (162911)W/APRON	EA	1	$ 1,193.56	$1,193.56
06666182	REFL PAV MRK TY II (W) 24" (SLD)	LF	830	$ 2.20	$1,826.00
06786008	PAV SURF PREP FOR MRK (24")	LF	830	$ 0.27	$224.10
06826001	VEH SIG SEC (12")LED(GRN)	EA	10	$ 179.90	$1,799.00
06826002	VEH SIG SEC (12")LED(GRN ARW)	EA	4	$ 177.46	$709.84
06826003	VEH SIG SEC (12")LED(YEL)	EA	10	$ 182.76	$1,827.60
06826004	VEH SIG SEC (12")LED(YEL ARW)	EA	4	$ 178.51	$714.04
06826005	VEH SIG SEC (12")LED(RED)	EA	10	$ 181.95	$1,819.50
06826006	VEH SIG SEC (12")LED(RED ARW)	EA	4	$ 181.25	$725.00
06826018	PED SIG SEC (LED)(COUNTDOWN)	EA	8	$ 405.86	$3,246.88
06826023	BACK PLATE (12")(3 SEC)	EA	14	$ 82.44	$1,154.16
06846029	TRF SIG CBL (TY A)(14 AWG)(3 CONDR)	LF	4200	$ 1.16	$4,872.00
06866079	INS TRF SIG PL AM(S)2 ARM(24-24')LUM	EA	2	$ 8,386.00	$16,772.00
06866204	IN TRF SG PL AM(S)2ARM(55-24')LUM&ILSN	EA	2	$ 21,000.00	$42,000.00
06876001	PED POLE ASSEMBLY	EA	1	$ 1,876.80	$1,876.80
06876002	PEDESTRIAN PUSH BUTTON POLE	EA	3	$ 1,520.15	$4,560.45
06886001	PED DETECT PUSH BUTTON (APS)	EA	8	$ 658.55	$5,268.40
06886004	VEH LP DETECT (SAWCUT)	LF	856	$ 9.56	$8,183.36
06906002	INSTALL OF CONDUIT BY TRENCHING	LF	2320	$ 20.00	$46,400.00
06906020	INSTALL OF ELECTRICAL SERVICE	EA	1	$ 5,244.30	$5,244.30
06906020	INSTALL OF ELECTRICAL SERVICE	EA	1	$ 5,244.30	$5,244.30
06906026	INSTALL OF SIGNAL HEAD ASSM	EA	16	$ 154.00	$2,464.00
06906029	INSTALL OF SIGNAL RELATED SIGNS	EA	10	$ 417.74	$4,177.40
06906032	INSTALL OF PEDESTRIAN PUSH BUTTONS	EA	8	$ 709.09	$5,672.72
06906036	INSTALL OF FND FOR GROUND MNT CABINET	EA	2	$ 5,666.67	$11,333.34
06906040	INSTALL OF CONTROL CABINET(GRND MNT)	EA	1	$ 2,853.85	$2,853.85
06906066	INSTALL OF LUMINAIRE HEAD	EA	4	$ 858.33	$3,433.32
06906069	INSTALL OF LUMINAIRE MAST ARMS	EA	4	$ 1,833.33	$7,333.32
20056001	FILTER FABRIC (TY 2)	SY	400	$ 3.50	$1,400.00
72116104	STORM WATER POLLUTION PREVENTION PLA	LS	1	$ 5,000.00	$5,000.00
72346020	TESTING	LS	1	$ 1,000.00	$1,000.00
				Subtotal	**$210,633**
72256001	MOBILIZATION AND DEMOBILIZATION	LS	1	$20,000.00	$20,000.00
05026001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	1	$10,000.00	$10,000.00
				M&B Subtotal	**$30,000**
				Safety (5%)	$10,532
				Inflation (10%)	$21,063
				TOTAL	$272,227



LEGEND:

SEE HARDWARE LEGEND SHEET FOR LEGEND.

SIGNS

S4 = STREET NAME "Hillcroft Ave" Block Numbers XXXX and XXXX
S2 = STREET NAME "Dashwood Rd" Block Numbers XXXX and XXXX
S8 = STREET NAME "Hillcroft Ave" Block Numbers XXXX and XXXX
S6 = STREET NAME "Dashwood Rd" Block Numbers XXXX and XXXX
S1, S5, S9, S10 = R10-5L "LEFT ON GREEN ARROW ONLY" 24"X30"

S3, S7 = R10-12 "LEFT TURN YIELD ON GREEN" "30X24"

NOTES:

1. SEE LATEST STANDARD CITY OF HOUSTON TRAFFIC CONTROL DETAILS (0612 SERIES) AND TRAFFIC SIGNAL DETAILS (02893 SERIES), PAVEMENT MARKING DETAILS (0510 SERIES) AND SIGN DETAILS (0509 SERIES) FOR ADDITIONAL INFORMATION. ALL DETAILS ARE AVAILABLE AT THE CITY OF HOUSTON WEBSITE.

POSTED SPEED LIMIT:

HILLCROFT AVE = 35 MPH
DASHWOOD RD = 30 MPH

SP ENGINEERING, INC

PRELIMINARY SUBMITTED FOR PRELIM REVIEW BY SP ENGINEERING, INC
SHAUKAT KHAN
P.E. TX 90195
JUNE 30, 2020

SURVEYED BY: AGS
FB NO. NA

NOT FOR CONSTRUCTION, BIDDING OR PERMITTING

CITY OF HOUSTON

HOUSTON PUBLIC WORKS

HILLCROFT AVENUE
SAFETY IMPROVEMENTS

PROPOSED SIGNAL LAYOUT
HILLCROFT AVE
AT DASHWOOD DR

WBS NUMBER	FOR CITY OF HOUSTON USE ONLY
N-321040-0007-3	
DRAWING SCALE	
AS NOTED	
CITY OF HOUSTON PM	
PATRICK K. CAMPBELL, P.E.	
SHEET NO. OF	

7/1/2020 1:49:57 AM ...\Hillcroft\HE_Hillcroft_Ave_at_Dashwood_Traffic_signal_Design\HILLCROFT_DASHWOOD signallayout.dgn

City of Houston
Traffic Management - Speed Report

Requested Address: 6655 HILLCROFT

CrossStreet 1 : SW FWY

CrossStreet 2 : BELLAIRE

DATE TESTED: 2/18/2020

Tuesday

DAILY COMBINED SPEED

Radar Unit(s) :

R1002 000019f8612c

R1001 000017dd39f3

Starting Hr:min	<15	15 to <20	20 to <25	25 to <30	30 to <35	35 to <40	40 to <45	45 to <50	50 to <55	55 to <60	60 to <65	65 to <70	70 to <75	75 to >100	Total Counts
12:00 AM	0	1	4	15	40	64	64	24	4	0	0	0	0	0	216
1:00 AM	0	0	2	14	25	42	33	13	5	0	0	0	0	0	134
2:00 AM	0	1	2	7	26	61	33	18	6	2	0	0	0	0	156
3:00 AM	0	0	3	11	20	22	30	17	0	1	0	1	0	0	105
4:00 AM	0	1	1	5	23	45	33	10	7	0	0	0	0	0	125
5:00 AM	0	7	10	27	39	110	111	63	7	4	1	0	0	0	379
6:00 AM	1	2	24	59	127	272	260	91	31	10	1	0	0	1	879
7:00 AM	0	5	34	136	388	682	435	145	39	10	1	1	0	0	1876
8:00 AM	0	6	31	129	352	697	484	160	40	6	0	3	1	0	1909
9:00 AM	0	7	29	112	234	439	327	102	14	7	2	0	0	0	1273
10:00 AM	0	5	44	160	319	428	252	87	10	4	1	0	0	0	1310
11:00 AM	0	9	45	199	415	635	251	77	12	3	0	0	0	0	1646
12:00 PM	2	8	62	186	396	576	276	71	16	4	1	0	0	0	1598
1:00 PM	1	7	57	209	354	557	317	82	17	2	0	0	1	0	1604
2:00 PM	0	10	52	212	470	609	318	78	25	4	0	1	0	0	1779
3:00 PM	0	6	56	259	515	805	310	65	15	3	0	1	0	0	2035
4:00 PM	2	10	62	233	503	823	386	88	12	4	0	1	0	0	2124
5:00 PM	0	7	55	221	514	847	383	93	15	1	1	0	0	0	2137
6:00 PM	0	4	50	232	530	767	339	81	18	3	1	0	0	0	2025
7:00 PM	0	6	60	194	381	528	303	79	12	4	0	0	0	0	1567
8:00 PM	1	8	41	129	273	377	213	56	12	2	0	1	0	0	1113
9:00 PM	1	5	30	92	193	332	203	76	13	1	0	0	0	0	946
10:00 PM	0	3	19	65	158	209	159	46	17	3	1	0	0	1	681
11:00 PM	0	1	14	37	73	114	102	20	6	1	0	0	0	0	368
Totals	**8**	**119**	**787**	**2943**	**6368**	**10041**	**5622**	**1642**	**353**	**79**	**10**	**9**	**2**	**2**	**27985**

Percentile Speeds	90%	85%	50%	15%	10%
(mph)	43.5	42.0	36.5	30.0	28.5

Posted Speed: 35

Average (Mean)	Minimum (mph)	Maximum (mph)
36.2	0.0	0.0

Speeds Exceeded	25mph	35mph	45mph	55mph	65mph	75mph
	27071	17760	2097	102	13	4
	96.7%	63.5%	7.5%	0.4%	0.0%	0.0%

REQUESTED ST: 5800 DASHWOOD
CROSS STREET: RENWICK
CROSS STREET: ATWELL

Site: APP T-248 5763 WB

Seven Day Volume, per Channel
Channel: WEST BOUND

Interval Begin	Tue 5/6/2014	Wed 5/7/2014	Thu 5/8/2014	Fri 5/9/2014	Sat 5/10/2014	Sun 5/11/2014	Mon 5/12/2014	Mon - Fri Average	Week Average
12:00 AM	-	4	2	-	-	-	-	3.0	3.0
1:00 AM	-	9	3	-	-	-	-	6.0	6.0
2:00 AM	-	12	1	-	-	-	-	6.5	6.5
3:00 AM	-	5	3	-	-	-	-	4.0	4.0
4:00 AM	-	22	22	-	-	-	-	22.0	22.0
5:00 AM	-	51	49	-	-	-	-	50.0	50.0
6:00 AM	-	89	85	-	-	-	-	87.0	87.0
7:00 AM	-	82	65	-	-	-	-	73.5	73.5
8:00 AM	-	58	-	-	-	-	-	58.0	58.0
9:00 AM	44	51	-	-	-	-	-	47.5	47.5
10:00 AM	75	48	-	-	-	-	-	61.5	61.5
11:00 AM	64	61	-	-	-	-	-	62.5	62.5
12:00 PM	64	46	-	-	-	-	-	55.0	55.0
1:00 PM	72	81	-	-	-	-	-	76.5	76.5
2:00 PM	95	95	-	-	-	-	-	95.0	95.0
3:00 PM	129	106	-	-	-	-	-	117.5	117.5
4:00 PM	117	117	-	-	-	-	-	117.0	117.0
5:00 PM	124	107	-	-	-	-	-	115.5	115.5
6:00 PM	106	98	-	-	-	-	-	102.0	102.0
7:00 PM	73	60	-	-	-	-	-	66.5	66.5
8:00 PM	49	50	-	-	-	-	-	49.5	49.5
9:00 PM	39	28	-	-	-	-	-	33.5	33.5
10:00 PM	14	21	-	-	-	-	-	17.5	17.5
11:00 PM	12	11	-	-	-	-	-	11.5	11.5
Totals	1077	1312	230	-	-	-	-	1338.5	1338.5
Peak Hours									
12:00 AM - 12:00 PM	10:00 AM	6:00 AM	6:00 AM	-	-	-	-	6:00 AM	6:00 AM
Volume	75	89	85	-	-	-	-	87.0	87.0
12:00 PM - 12:00 AM	3:00 PM	4:00 PM	-	-	-	-	-	3:00 PM	3:00 PM
Volume	129	117	-	-	-	-	-	117.5	117.5

HSIP Project Submission

Texas Department of Transportation

Save a Copy | Reset Form

Proposal Information

District	Houston	County	Harris
Comments			
File Name	HOU_RenwickDr_Houston	Supervised By	Ugonna Ughanze

Roadway Information

Primary Roadway	Renwick Dr	Control Section(s)	
Limits From	480' south of Dashwood	DFO*	29.706065, -95.484629
Limits To	480' north of Dashwood	DFO*	29.708693, -95.484712

*Lat/Long pairs for off-system

On or Off System	Off System	Speed Limit	35 mph
Length	0.182 mile	Current AADT	13000

Intersecting Roadway	Dashwood Dr	Speed Limit	30 mph
On or Off System	Off System	Current AADT	3000

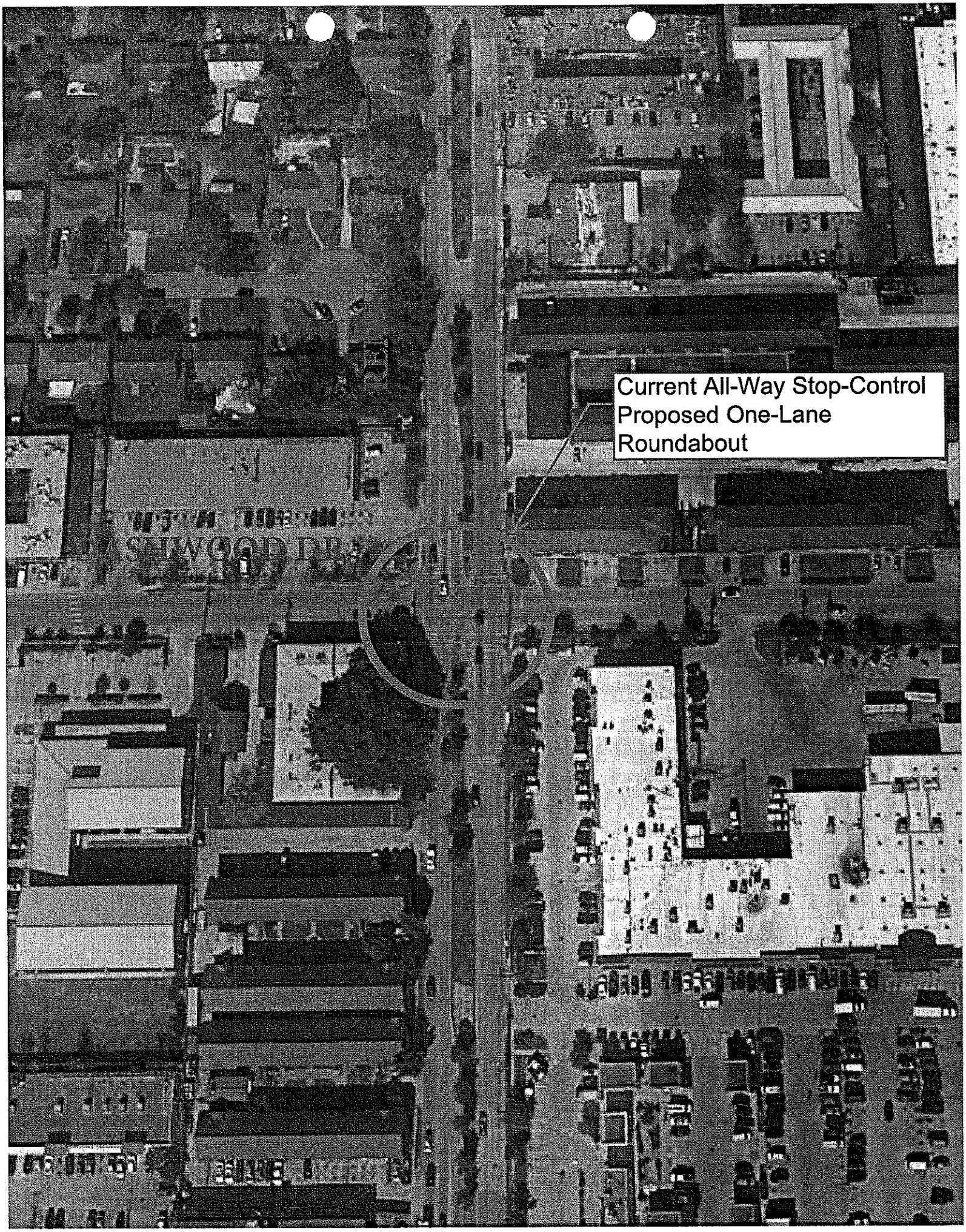
Project Information

Targeted or Systemic	Targeted / Hot Spot	Crashes	K	0
Work Code(s)	547 - Construct a roundabout		A	4
Preferred Letting	10/2021		B	5
			SII	56.78

Estimate

Bid Items (See Guidelines instructions)	$ 299,400
ROW (if required)	$ 0
Mobilization and Barricades (≥ 8%)	$ 45,000
Safety (2-5%)	$ 12,718
Inflation (≥ 10%)	$ 25,435
Total	$ 337,505

Form Rev 11/2019


Current All-Way Stop-Control
Proposed One-Lane
Roundabout
ASHWOOD DR

2020 SII Calculator (2016-2018 Crash Data, 2017 NSC Data)
Enter data in the shaded cells where applicable.

Years of Data
3

	Number of Crashes	Cost
Number of Fatal Crashes (K)	0	$3,600,000
Number of Incapacitating Injury Crashes (A)	4	$3,600,000
Number of Non-Incapactitating Injury Crashes (B)	5	$500,000

Reduction Factor	40%
Service Life	10
Total ROW & Construction Cost	$337,505
Annual Maintenance Cost	$0
Present ADT	15676
Future ADT	21067

SII Calculation **56.78**

Item Code	Item Description	Item Unit	Quantity	Unit Price	Total Price
01046001	REMOVING CONC (PAV)	SY	150	$3.59	$538.50
01106002	EXCAVATION (CHANNEL)	CY	870	$7.98	$6,942.60
01106003	EXCAVATION (SPECIAL)	CY	200	$7.33	$1,466.00
03606027	CURB (TYPE II)	LF	1600	$7.20	$11,520.00
04006011	SAND BACKFILL	CY	150	$22.77	$3,415.50
04966018	REMOVE STR (CONC)	EA	6	$222.51	$1,335.06
05086001	CONSTRUCTING DETOURS	SY	140	$66.44	$9,301.60
05286011	LANDSCAPE PAVERS (TYPE I)	SY	500	$90.05	$45,025.00
05316042	CONC SIDEWALKS (5") (TYPE 1)	SY	350	$110.00	$38,500.00
06446001	IN SM RD SN SUP&AM TY10BWG(1)SA(P)	EA	20	$464.76	$9,295.20
06446076	REMOVE SM RD SN SUP&AM	EA	10	$81.23	$812.30
06666174	REFL PAV MRK TY II (W) 6" (SLD)	LF	2750	$0.25	$687.50
06666182	REFL PAV MRK TY II (W) 24" (SLD)	LF	130	$2.20	$286.00
06666184	REFL PAV MRK TY II (W) (ARROW)	EA	4	$60.50	$242.00
06666199	REFL PAV MRK TY II (W) 36" (YLD TRI)	EA	22	$16.21	$356.62
06666200	REFL PAV MRK TY II (W) (BIKE ARROW)	EA	8	$52.50	$420.00
06666202	REFL PAV MRK TY II (W) (BIKE SYMBOL)	EA	8	$68.25	$546.00
06666207	REFL PAV MRK TY II (Y) 4" (SLD)	LF	3680	$0.12	$441.60
06786001	PAV SURF PREP FOR MRK (4")	LF	3680	$0.05	$184.00
06786002	PAV SURF PREP FOR MRK (6")	LF	2750	$0.10	$275.00
06786008	PAV SURF PREP FOR MRK (24")	LF	130	$0.27	$35.10
06786009	PAV SURF PREP FOR MRK (ARROW)	EA	4	$1,028.00	$4,112.00
06786023	PAV SURF PREP FOR MRK (36")(YLD TRI)	EA	22	$260.00	$5,720.00
06906059	INSTALL OF PEDESTRIAN RAMPS	EA	10	$5,500.00	$55,000.00
10046001	TREE PROTECTION	EA	5	$449.00	$2,245.00
20056001	FILTER FABRIC (TY 2)	SY	400	$3.50	$1,400.00
40276001	TEMP CONSTRUCTION ACCESS (SIDEWALK)	LS	1	$500.00	$500.00
71996091	HOT MIX ASPHALT CONCRETE PAVEMENT	TON	50	$125.00	$6,250.00
72116104	STORM WATER POLLUTION PREVENTION PLA	LS	1	$25,000.00	$25,000.00
72346020	TESTING	LS	1	$2,500.00	$2,500.00
	METRO BUS SHELTER	LS	1	$20,000.00	$20,000.00
				Subtotal	**$254,353**
72256001	MOBILIZATION AND DEMOBILIZATION	LS	1	$20,000.00	$20,000.00
05026001	BARRICADES, SIGNS AND TRAFFIC HANDLINC	MO	1	$25,000.00	$25,000.00
				M&B Subtotal	**$45,000**
				Safety (5%)	$12,718
				Inflation (10%)	$25,435
				TOTAL	$337,505

REQUESTED ST: 6700 RENWICK
CROSS STREET: DASHWOOD
CROSS STREET: BELLAIRE

Site: APP T-244 5765 NB

Seven Day Volume, per Channel
Channel: NORTH BOUND

Interval Begin	Tue 5/6/2014	Wed 5/7/2014	Thu 5/8/2014	Fri 5/9/2014	Sat 5/10/2014	Sun 5/11/2014	Mon 5/12/2014	Mon - Fri Average	Week Average
12:00 AM	-	34	31	-	-	-	-	32.5	32.5
1:00 AM	-	32	19	-	-	-	-	25.5	25.5
2:00 AM	-	15	18	-	-	-	-	16.5	16.5
3:00 AM	-	14	15	-	-	-	-	14.5	14.5
4:00 AM	-	14	15	-	-	-	-	14.5	14.5
5:00 AM	-	61	61	-	-	-	-	61.0	61.0
6:00 AM	-	160	165	-	-	-	-	162.5	162.5
7:00 AM	-	348	350	-	-	-	-	349.0	349.0
8:00 AM	-	355	372	-	-	-	-	363.5	363.5
9:00 AM	-	226	-	-	-	-	-	226.0	226.0
10:00 AM	95	261	-	-	-	-	-	178.0	178.0
11:00 AM	251	261	-	-	-	-	-	256.0	256.0
12:00 PM	189	290	-	-	-	-	-	239.5	239.5
1:00 PM	234	322	-	-	-	-	-	278.0	278.0
2:00 PM	215	349	-	-	-	-	-	282.0	282.0
3:00 PM	289	424	-	-	-	-	-	356.5	356.5
4:00 PM	394	420	-	-	-	-	-	407.0	407.0
5:00 PM	406	402	-	-	-	-	-	404.0	404.0
6:00 PM	403	476	-	-	-	-	-	439.5	439.5
7:00 PM	394	371	-	-	-	-	-	382.5	382.5
8:00 PM	309	266	-	-	-	-	-	287.5	287.5
9:00 PM	229	256	-	-	-	-	-	242.5	242.5
10:00 PM	139	152	-	-	-	-	-	145.5	145.5
11:00 PM	60	69	-	-	-	-	-	64.5	64.5
Totals	3607	5578	1046	-	-	-	-	5228.5	5228.5
Peak Hours									
12:00 AM - 12:00 PM	11:00 AM	8:00 AM	8:00 AM	-	-	-	-	8:00 AM	8:00 AM
Volume	251	355	372	-	-	-	-	363.5	363.5
12:00 PM - 12:00 AM	5:00 PM	6:00 PM	-	-	-	-	-	6:00 PM	6:00 PM
Volume	406	476	-	-	-	-	-	439.5	439.5

REQUESTED ST: 6700 RENWICK
CROSS STREET: DASHWOOD
CROSS STREET: CLAREWOOD

Site: APP T-253 5766 SB

Seven Day Volume, per Channel
Channel: SOUTH BOUND

Interval Begin	Tue 5/6/2014	Wed 5/7/2014	Thu 5/8/2014	Fri 5/9/2014	Sat 5/10/2014	Sun 5/11/2014	Mon 5/12/2014	Mon - Fri Average	Week Average
12:00 AM	-	24	34	24	-	-	-	27.3	27.3
1:00 AM	-	16	16	25	-	-	-	19.0	19.0
2:00 AM	-	17	16	14	-	-	-	15.7	15.7
3:00 AM	-	22	23	28	-	-	-	24.3	24.3
4:00 AM	-	78	75	71	-	-	-	74.7	74.7
5:00 AM	-	210	224	225	-	-	-	219.7	219.7
6:00 AM	-	497	501	504	-	-	-	500.7	500.7
7:00 AM	-	372	366	256	-	-	-	331.3	331.3
8:00 AM	-	268	308	-	-	-	-	288.0	288.0
9:00 AM	256	304	316	-	-	-	-	292.0	292.0
10:00 AM	320	338	313	-	-	-	-	323.7	323.7
11:00 AM	375	421	408	-	-	-	-	401.3	401.3
12:00 PM	332	367	349	-	-	-	-	349.3	349.3
1:00 PM	380	448	391	-	-	-	-	406.3	406.3
2:00 PM	646	565	587	-	-	-	-	599.3	599.3
3:00 PM	613	575	562	-	-	-	-	583.3	583.3
4:00 PM	647	618	662	-	-	-	-	642.3	642.3
5:00 PM	592	591	566	-	-	-	-	583.0	583.0
6:00 PM	494	481	445	-	-	-	-	473.3	473.3
7:00 PM	318	333	302	-	-	-	-	317.7	317.7
8:00 PM	236	228	233	-	-	-	-	232.3	232.3
9:00 PM	187	170	177	-	-	-	-	178.0	178.0
10:00 PM	97	107	117	-	-	-	-	107.0	107.0
11:00 PM	38	55	45	-	-	-	-	46.0	46.0
Totals	5531	7105	7036	1147	-	-	-	7035.7	7035.7
Peak Hours									
12:00 AM - 12:00 PM	11:00 AM	6:00 AM	6:00 AM	6:00 AM	-	-	-	6:00 AM	6:00 AM
Volume	375	497	501	504	-	-	-	500.7	500.7
12:00 PM - 12:00 AM	4:00 PM	4:00 PM	4:00 PM	-	-	-	-	4:00 PM	4:00 PM
Volume	647	618	662	-	-	-	-	642.3	642.3

REQUESTED ST: 5910 DASHWOOD
CROSS STREET: RENWICK
CROSS STREET: MULLINS

Site: APP T-314 5764 EB

Seven Day Volume, per Channel
Channel: EAST BOUND

Interval Begin	Tue 5/6/2014	Wed 5/7/2014	Thu 5/8/2014	Fri 5/9/2014	Sat 5/10/2014	Sun 5/11/2014	Mon 5/12/2014	Mon - Fri Average	Week Average
12:00 AM	-	9	13	-	-	-	-	11.0	11.0
1:00 AM	-	6	3	-	-	-	-	4.5	4.5
2:00 AM	-	12	5	-	-	-	-	8.5	8.5
3:00 AM	-	8	6	-	-	-	-	7.0	7.0
4:00 AM	-	44	39	-	-	-	-	41.5	41.5
5:00 AM	-	90	95	-	-	-	-	92.5	92.5
6:00 AM	-	109	94	-	-	-	-	101.5	101.5
7:00 AM	-	73	69	-	-	-	-	71.0	71.0
8:00 AM	-	83	-	-	-	-	-	83.0	83.0
9:00 AM	60	73	-	-	-	-	-	66.5	66.5
10:00 AM	86	89	-	-	-	-	-	87.5	87.5
11:00 AM	95	104	-	-	-	-	-	99.5	99.5
12:00 PM	97	104	-	-	-	-	-	100.5	100.5
1:00 PM	105	100	-	-	-	-	-	102.5	102.5
2:00 PM	112	97	-	-	-	-	-	104.5	104.5
3:00 PM	96	121	-	-	-	-	-	108.5	108.5
4:00 PM	111	119	-	-	-	-	-	115.0	115.0
5:00 PM	118	100	-	-	-	-	-	109.0	109.0
6:00 PM	94	101	-	-	-	-	-	97.5	97.5
7:00 PM	91	82	-	-	-	-	-	86.5	86.5
8:00 PM	66	59	-	-	-	-	-	62.5	62.5
9:00 PM	47	45	-	-	-	-	-	46.0	46.0
10:00 PM	29	37	-	-	-	-	-	33.0	33.0
11:00 PM	24	16	-	-	-	-	-	20.0	20.0
Totals	1231	1681	324	-	-	-	-	1659.5	1659.5
Peak Hours									
12:00 AM - 12:00 PM	11:00 AM	6:00 AM	5:00 AM	-	-	-	-	6:00 AM	6:00 AM
Volume	95	109	95	-	-	-	-	101.5	101.5
12:00 PM - 12:00 AM	5:00 PM	3:00 PM	-	-	-	-	-	4:00 PM	4:00 PM
Volume	118	121	-	-	-	-	-	115.0	115.0

REQUESTED ST: 5800 DASHWOOD
CROSS STREET: RENWICK
CROSS STREET: ATWELL

Site: APP T-248 5763 WB

Seven Day Volume, per Channel
Channel: WEST BOUND

Interval Begin	Tue 5/6/2014	Wed 5/7/2014	Thu 5/8/2014	Fri 5/9/2014	Sat 5/10/2014	Sun 5/11/2014	Mon 5/12/2014	Mon - Fri Average	Week Average
12:00 AM	-	4	2	-	-	-	-	3.0	3.0
1:00 AM	-	9	3	-	-	-	-	6.0	6.0
2:00 AM	-	12	1	-	-	-	-	6.5	6.5
3:00 AM	-	5	3	-	-	-	-	4.0	4.0
4:00 AM	-	22	22	-	-	-	-	22.0	22.0
5:00 AM	-	51	49	-	-	-	-	50.0	50.0
6:00 AM	-	89	85	-	-	-	-	87.0	87.0
7:00 AM	-	82	65	-	-	-	-	73.5	73.5
8:00 AM	-	58	-	-	-	-	-	58.0	58.0
9:00 AM	44	51	-	-	-	-	-	47.5	47.5
10:00 AM	75	48	-	-	-	-	-	61.5	61.5
11:00 AM	64	61	-	-	-	-	-	62.5	62.5
12:00 PM	64	46	-	-	-	-	-	55.0	55.0
1:00 PM	72	81	-	-	-	-	-	76.5	76.5
2:00 PM	95	95	-	-	-	-	-	95.0	95.0
3:00 PM	129	106	-	-	-	-	-	117.5	117.5
4:00 PM	117	117	-	-	-	-	-	117.0	117.0
5:00 PM	124	107	-	-	-	-	-	115.5	115.5
6:00 PM	106	98	-	-	-	-	-	102.0	102.0
7:00 PM	73	60	-	-	-	-	-	66.5	66.5
8:00 PM	49	50	-	-	-	-	-	49.5	49.5
9:00 PM	39	28	-	-	-	-	-	33.5	33.5
10:00 PM	14	21	-	-	-	-	-	17.5	17.5
11:00 PM	12	11	-	-	-	-	-	11.5	11.5
Totals	1077	1312	230	-	-	-	-	1338.5	1338.5
Peak Hours									
12:00 AM - 12:00 PM	10:00 AM	6:00 AM	6:00 AM	-	-	-	-	6:00 AM	6:00 AM
Volume	75	89	85	-	-	-	-	87.0	87.0
12:00 PM - 12:00 AM	3:00 PM	4:00 PM	-	-	-	-	-	3:00 PM	3:00 PM
Volume	129	117	-	-	-	-	-	117.5	117.5

HSIP Project Submission

Texas Department of Transportation

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Proposal Information

District	Houston	County	Harris
Comments	This intersection has a lot of type C crashes that would be mitigated by the roundabout.		
File Name	HOU_IrvingtonBlvd_Houston	Supervised By	Ugonna Ughanze

Roadway Information

Primary Roadway	Irvington Blvd	Control Section(s)	
Limits From	350' south of Patton St	DFO*	29.797289, -95.360936
Limits To	350' north of Patton St	DFO*	29.799249, -95.361030

*Lat/Long pairs for off-system

On or Off System	Off System	Speed Limit	35 mph
Length	0.132 mile	Current AADT	13000

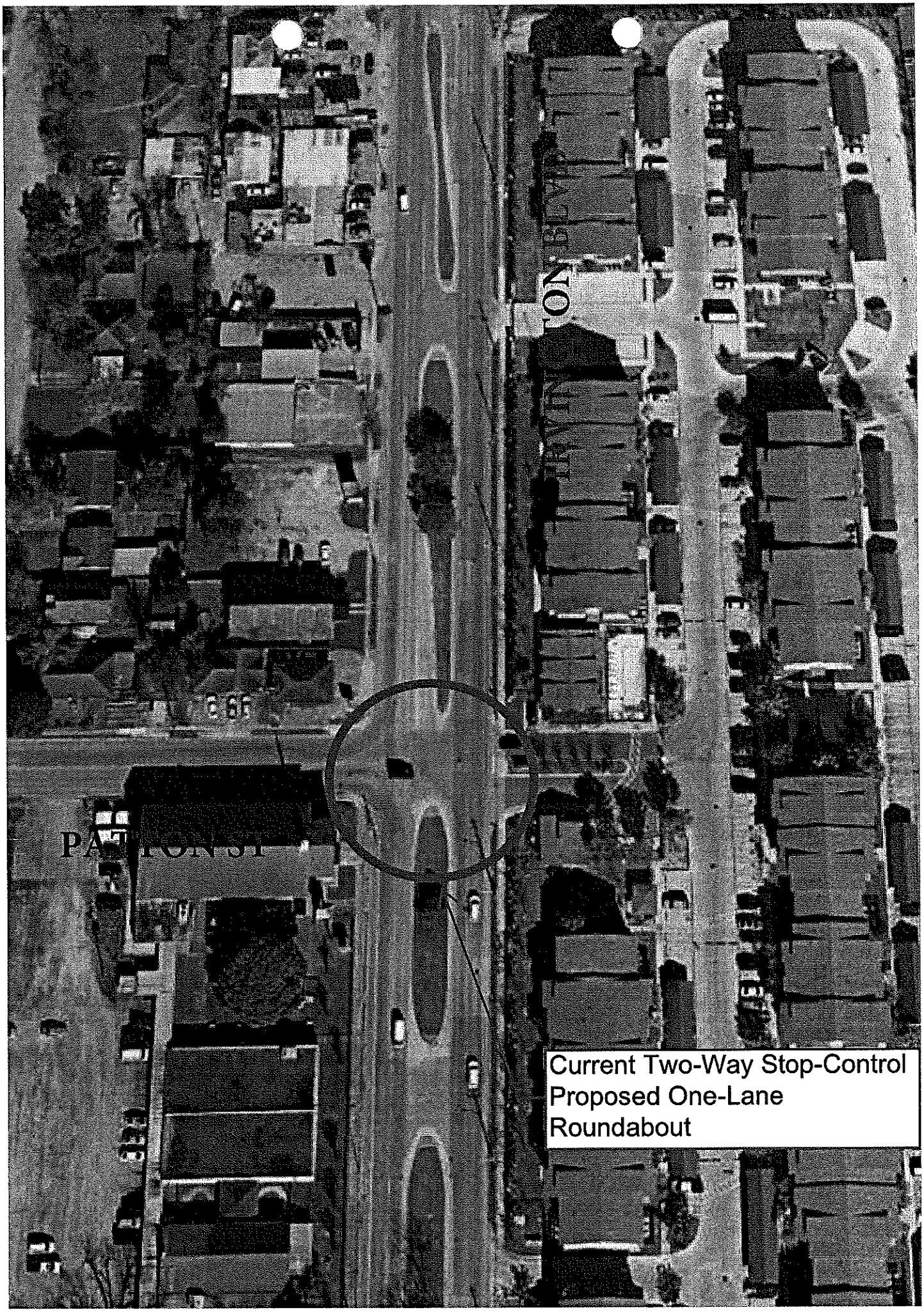
Intersecting Roadway	Patton St	Speed Limit	30 mph
On or Off System	Off System	Current AADT	9000

Project Information

Targeted or Systemic	Targeted / Hot Spot	Crashes	K	0
Work Code(s)	547 - Construct a roundabout		A	0
Preferred Letting	01/2022		B	2
			SII	4.90

Estimate

Bid Items (See Guidelines instructions)	$ 166,269
ROW (if required)	$ 0
Mobilization and Barricades (≥ 8%)	$ 40,000
Safety (2-5%)	$ 8,313
Inflation (≥ 10%)	$ 16,627
Total	$ 231,210


Current Two-Way Stop-Control
Proposed One-Lane
Roundabout

2020 SII Calculator (2016-2018 Crash Data, 2017 NSC Data)
Enter data in the shaded cells where applicable.

Years of Data
3

	Number of Crashes	Cost
Number of Fatal Crashes (K)	0	$3,600,000
Number of Incapacitating Injury Crashes (A)	0	$3,600,000
Number of Non-Incapactitating Injury Crashes (B)	2	$500,000

Reduction Factor	40%
Service Life	10
Total ROW & Construction Cost	$231,210
Annual Maintenance Cost	$0
Present ADT	22626
Future ADT	30407

SII Calculation **4.90**

Item Code	Item Description	Item Unit	Quantity	Unit Price	Total Price
01046001	REMOVING CONC (PAV)	SY	0	$3.59	$0.00
01106002	EXCAVATION (CHANNEL)	CY	0	$7.98	$0.00
01106003	EXCAVATION (SPECIAL)	CY	0	$7.33	$0.00
03606027	CURB (TYPE II)	LF	1600	$7.20	$11,520.00
04006011	SAND BACKFILL	CY	0	$22.77	$0.00
04966018	REMOVE STR (CONC)	EA	0	$222.51	$0.00
05086001	CONSTRUCTING DETOURS	SY	100	$66.44	$6,644.00
05286011	LANDSCAPE PAVERS (TYPE I)	SY	400	$90.05	$36,020.00
05316042	CONC SIDEWALKS (5") (TYPE 1)	SY	100	$110.00	$11,000.00
06446001	IN SM RD SN SUP&AM TY10BWG(1)SA(P)	EA	20	$464.76	$9,295.20
06446076	REMOVE SM RD SN SUP&AM	EA	10	$81.23	$812.30
06666174	REFL PAV MRK TY II (W) 6" (SLD)	LF	1500	$0.25	$375.00
06666182	REFL PAV MRK TY II (W) 24" (SLD)	LF	130	$2.20	$286.00
06666184	REFL PAV MRK TY II (W) (ARROW)	EA	4	$60.50	$242.00
06666199	REFL PAV MRK TY II (W) 36" (YLD TRI)	EA	22	$16.21	$356.62
06666200	REFL PAV MRK TY II (W) (BIKE ARROW)	EA	8	$52.50	$420.00
06666202	REFL PAV MRK TY II (W) (BIKE SYMBOL)	EA	8	$68.25	$546.00
06666207	REFL PAV MRK TY II (Y) 4" (SLD)	LF	2000	$0.12	$240.00
06786001	PAV SURF PREP FOR MRK (4")	LF	2000	$0.05	$100.00
06786002	PAV SURF PREP FOR MRK (6")	LF	1500	$0.10	$150.00
06786008	PAV SURF PREP FOR MRK (24")	LF	130	$0.27	$35.10
06786009	PAV SURF PREP FOR MRK (ARROW)	EA	4	$1,028.00	$4,112.00
06786023	PAV SURF PREP FOR MRK (36")(YLD TRI)	EA	22	$260.00	$5,720.00
06906059	INSTALL OF PEDESTRIAN RAMPS	EA	6	$5,500.00	$33,000.00
10046001	TREE PROTECTION	EA	5	$449.00	$2,245.00
20056001	FILTER FABRIC (TY 2)	SY	400	$3.50	$1,400.00
40276001	TEMP CONSTRUCTION ACCESS (SIDEWALK)	LS	1	$500.00	$500.00
71996091	HOT MIX ASPHALT CONCRETE PAVEMENT	TON	30	$125.00	$3,750.00
72116104	STORM WATER POLLUTION PREVENTION PLAN	LS	1	$15,000.00	$15,000.00
72346020	TESTING	LS	1	$2,500.00	$2,500.00
	METRO BUS SHELTER	LS	1	$20,000.00	$20,000.00
				Subtotal	**$166,269**
72256001	MOBILIZATION AND DEMOBILIZATION	LS	1	$20,000.00	$20,000.00
05026001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	1	$20,000.00	$20,000.00
				M&B Subtotal	**$40,000**
				Safety (5%)	$8,313
				Inflation (10%)	$16,627
				TOTAL	$231,210

Legend
Irvington Blvd & Patton St
Irvington Blvd @ Patton St
Option No. 3
N
Google Earth

PAT

City of Houston
Traffic Count Management

REQUESTED STREET : 4027 IRVINGTON
CROSS STREET: : COLLINGSWORTH
CROSS STREET: : CAVALCADE

Site: SPD T-368

Seven Day Volume, per Channel

NORTH BOUND

Interval Start	Tue 5/9/2017	Wed 5/10/2017	Thu 5/11/2017	Fri 5/12/2017	Sat 5/13/2017	Sun 5/14/2017	Mon 5/15/2017	Mon - Fri Average	7 Day Average
12:00 AM	-	47	63	-	-	-	-	55.0	55.0
1:00 AM	-	30	43	-	-	-	-	36.5	36.5
2:00 AM	-	24	19	-	-	-	-	21.5	21.5
3:00 AM	-	14	31	-	-	-	-	22.5	22.5
4:00 AM	-	31	39	-	-	-	-	35.0	35.0
5:00 AM	-	102	101	-	-	-	-	101.5	101.5
6:00 AM	-	189	177	-	-	-	-	183.0	183.0
7:00 AM	-	481	481	-	-	-	-	481.0	481.0
8:00 AM	-	343	341	-	-	-	-	342.0	342.0
9:00 AM	-	286	300	-	-	-	-	293.0	293.0
10:00 AM	-	298	282	-	-	-	-	290.0	290.0
11:00 AM	-	373	-	-	-	-	-	373.0	373.0
12:00 PM	394	383	-	-	-	-	-	388.5	388.5
1:00 PM	335	366	-	-	-	-	-	350.5	350.5
2:00 PM	353	349	-	-	-	-	-	351.0	351.0
3:00 PM	586	591	-	-	-	-	-	588.5	588.5
4:00 PM	489	520	-	-	-	-	-	504.5	504.5
5:00 PM	545	602	-	-	-	-	-	573.5	573.5
6:00 PM	523	520	-	-	-	-	-	521.5	521.5
7:00 PM	372	456	-	-	-	-	-	414.0	414.0
8:00 PM	322	390	-	-	-	-	-	356.0	356.0
9:00 PM	233	322	-	-	-	-	-	277.5	277.5
10:00 PM	194	189	-	-	-	-	-	191.5	191.5
11:00 PM	99	133	-	-	-	-	-	116.0	116.0
Totals	4445	7039	1877	0	0	0	0	6867.0	6867.0

Peak Hours

12:00 AM - 12:00 PM	-	7:00 AM	7:00 AM	-	-	-	-	7:00 AM	7:00 AM
Volume	-	481	481	-	-	-	-	481.0	481.0
12:00 PM - 12:00 AM	3:00 PM	5:00 PM	-	-	-	-	-	3:00 PM	3:00 PM
Volume	586	602	-	-	-	-	-	588.5	588.5

City of Houston
Traffic Count Management

REQUESTED STREET : 4027 IRVINGTON
CROSS STREET: : COLLINGWORTH
CROSS STREET: : CAVALCADE

Site: SPD T-370

Seven Day Volume, per Channel

SOUTH BOUND

Interval Start	Tue 5/9/2017	Wed 5/10/2017	Thu 5/11/2017	Fri 5/12/2017	Sat 5/13/2017	Sun 5/14/2017	Mon 5/15/2017	Mon - Fri Average	7 Day Average
12:00 AM	-	42	43	-	-	-	-	42.5	42.5
1:00 AM	-	19	19	-	-	-	-	19.0	19.0
2:00 AM	-	16	12	-	-	-	-	14.0	14.0
3:00 AM	-	12	26	-	-	-	-	19.0	19.0
4:00 AM	-	37	30	-	-	-	-	33.5	33.5
5:00 AM	-	95	86	-	-	-	-	90.5	90.5
6:00 AM	-	167	177	-	-	-	-	172.0	172.0
7:00 AM	-	483	464	-	-	-	-	473.5	473.5
8:00 AM	-	298	315	-	-	-	-	306.5	306.5
9:00 AM	-	286	272	-	-	-	-	279.0	279.0
10:00 AM	-	262	220	-	-	-	-	241.0	241.0
11:00 AM	-	316	-	-	-	-	-	316.0	316.0
12:00 PM	333	401	-	-	-	-	-	367.0	367.0
1:00 PM	340	334	-	-	-	-	-	337.0	337.0
2:00 PM	393	351	-	-	-	-	-	372.0	372.0
3:00 PM	472	489	-	-	-	-	-	480.5	480.5
4:00 PM	459	450	-	-	-	-	-	454.5	454.5
5:00 PM	445	464	-	-	-	-	-	454.5	454.5
6:00 PM	448	501	-	-	-	-	-	474.5	474.5
7:00 PM	348	456	-	-	-	-	-	402.0	402.0
8:00 PM	290	333	-	-	-	-	-	311.5	311.5
9:00 PM	223	300	-	-	-	-	-	261.5	261.5
10:00 PM	178	135	-	-	-	-	-	156.5	156.5
11:00 PM	84	89	-	-	-	-	-	86.5	86.5
Totals	4013	6336	1664	0	0	0	0	6164.5	6164.5

Peak Hours

12:00 AM - 12:00 PM	-	7:00 AM	7:00 AM	-	-	-	-	7:00 AM	7:00 AM
Volume	-	483	464	-	-	-	-	473.5	473.5
12:00 PM - 12:00 AM	3:00 PM	6:00 PM	-	-	-	-	-	3:00 PM	3:00 PM
Volume	472	501	-	-	-	-	-	480.5	480.5

City of Houston

Traffic Management - Volume

Requested Address: **400 PATTON** LAT, LONG : **29.7981544, -95.3652145** Incoming Radar Unit : **R1028**

Segment **FULTON TO IRVINGTON** Outgoing Radar Unit : **R1028**

hr:mm	Monday 11/12/2018		Tuesday 11/13/2018		Wednesday 11/14/2018		Thursday 11/15/2018		Friday 11/16/2018		Saturday 11/17/2018		Sunday 11/18/2018		Mon-Fri Average		7 Day Average	
	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST	WEST
12:00 AM	0	0	0	0	0	0	52	33	64	51	0	0	0	0	58.0	42.0	58.0	42.0
1:00 AM	0	0	0	0	0	0	30	23	49	37	0	0	0	0	39.5	30.0	39.5	30.0
2:00 AM	0	0	0	0	0	0	9	12	25	17	0	0	0	0	17.0	14.5	17.0	14.5
3:00 AM	0	0	0	0	0	0	31	15	19	10	0	0	0	0	25.0	12.5	25.0	12.5
4:00 AM	0	0	0	0	0	0	14	20	11	22	0	0	0	0	12.5	21.0	12.5	21.0
5:00 AM	0	0	0	0	0	0	18	41	16	41	0	0	0	0	17.0	41.0	17.0	41.0
6:00 AM	0	0	0	0	0	0	42	106	38	78	0	0	0	0	40.0	92.0	40.0	92.0
7:00 AM	0	0	0	0	0	0	75	307	65	313	0	0	0	0	70.0	310.0	70.0	310.0
8:00 AM	0	0	0	0	0	0	179	693	185	664	0	0	0	0	182.0	678.5	182.0	678.5
9:00 AM	0	0	0	0	0	0	163	534	160	437	0	0	0	0	161.5	485.5	161.5	485.5
10:00 AM	0	0	0	0	0	0	155	288	190	266	0	0	0	0	172.5	277.0	172.5	277.0
11:00 AM	0	0	0	0	50	64	158	260	60	84	0	0	0	0	89.3	136.0	89.3	136.0
12:00 PM	0	0	0	0	226	263	217	250	0	0	0	0	0	0	221.5	256.5	221.5	256.5
1:00 PM	0	0	0	0	238	229	246	248	0	0	0	0	0	0	242.0	238.5	242.0	238.5
2:00 PM	0	0	0	0	218	216	235	203	0	0	0	0	0	0	226.5	209.5	226.5	209.5
3:00 PM	0	0	0	0	285	269	279	255	0	0	0	0	0	0	282.0	262.0	282.0	262.0
4:00 PM	0	0	0	0	292	280	295	317	0	0	0	0	0	0	293.5	298.5	293.5	298.5
5:00 PM	0	0	0	0	393	301	334	285	0	0	0	0	0	0	363.5	293.0	363.5	293.0
6:00 PM	0	0	0	0	390	395	363	365	0	0	0	0	0	0	376.5	380.0	376.5	380.0
7:00 PM	0	0	0	0	351	303	382	335	0	0	0	0	0	0	366.5	319.0	366.5	319.0
8:00 PM	0	0	0	0	299	211	285	235	0	0	0	0	0	0	292.0	223.0	292.0	223.0
9:00 PM	0	0	0	0	178	153	236	168	0	0	0	0	0	0	207.0	160.5	207.0	160.5
10:00 PM	0	0	0	0	168	126	138	109	0	0	0	0	0	0	153.0	117.5	153.0	117.5
11:00 PM	0	0	0	0	108	83	130	83	0	0	0	0	0	0	119.0	83.0	119.0	83.0
TOTALS	-	-	-	-	3196	2893	4066	5185	882	2020	0	0	0	0	4027.3	4981.0	4027.3	4981.0
COMBINED	0		0		6089		9251		2902		0		0		9008.3		9008.3	
SPLIT (%)	0.0%	0.0%	0.0%	0.0%	52.5%	47.5%	44.0%	56.0%	30.4%	69.6%	0.0%	0.0%	0.0%	0.0%	44.7%	55.3%	44.7%	55.3%
PEAK HOURS																		
12:00:00 AM - 12:00:00 PM	-	-	-	-	11:00 AM	11:00 AM	8:00 AM	8:00 AM	10:00 AM	8:00 AM	-	-	-	-	8:00 AM	8:00 AM	8:00 AM	8:00 AM
Volume	-	-	-	-	50	64	179	693	190	664	-	-	-	-	182	679	182	679
12:00:00 PM - 12:00:00 AM	-	-	-	-	5:00 PM	6:00 PM	7:00 PM	6:00 PM	-	-	-	-	-	-	6:00 PM	6:00 PM	6:00 PM	6:00 PM
Volume	-	-	-	-	393	395	382	365	-	-	-	-	-	-	377	380	377	380

HSIP Project Submission

Texas Department of Transportation

Save a Copy | Reset Form

Proposal Information

District	Houston	County	Harris
Comments	Non-Incapacitating Crash IDs:17397902,16437842,15559985,15650758,15842125		
File Name	HOU_YaleSt&CenterSt_Houston	Supervised By	Sherry Weesner

Roadway Information

Primary Roadway	YALE ST	Control Section(s)	B71457,B13377
Limits From	Intersection of Yale St and Center St	DFO*	29.771,-95.399
Limits To	Intersection of Yale St and Center St	DFO*	29.770,-95.398

*Lat/Long pairs for off-system

On or Off System	Off	Speed Limit	30
Length	0.015	Current AADT	25,515

Intersecting Roadway	CENTER ST	Speed Limit	30
On or Off System	Off	Current AADT	2,261

Project Information

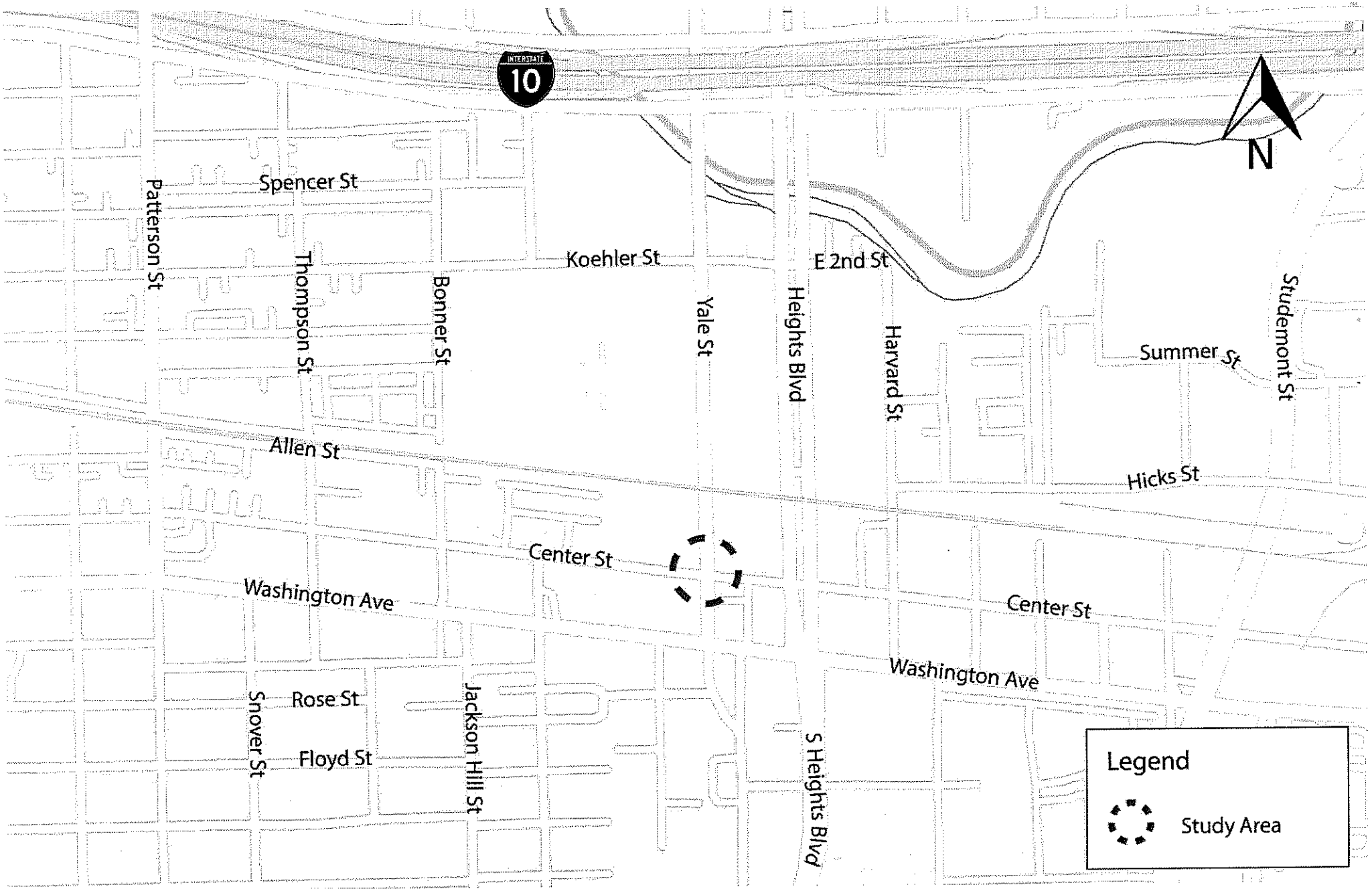
Targeted or Systemic	Systemic	Crashes	K	0
Work Code(s)	108		A	0
Preferred Letting	02/2022		B	5
			SII	1.93

Estimate

Bid Items (See Guidelines instructions)	$ 704,908
ROW (if required)	
Mobilization and Barricades (≥ 8%)	$ 70,491
Safety (2-5%)	$ 35,245
Inflation (≥ 10%)	$ 70,491
Total	$ 881,134

Form Rev 11/2019

HOU_YaleSt&CenterSt_Houston
Location Map



2020 SII Calculator (2016-2018 Crash Data, 2017 NSC Data)
Enter data in the shaded cells where applicable.

Years of Data
3

	Number of Crashes	Cost
Number of Fatal Crashes (K)	0	$3,600,000
Number of Incapacitating Injury Crashes (A)	0	$3,600,000
Number of Non-Incapactitating Injury Crashes (B)	5	$500,000

Reduction Factor	24%
Service Life	10
Total ROW & Construction Cost	$881,134
Annual Maintenance Cost	
Present ADT	25515
Future ADT	34290

SII Calculation **1.93**

MHRA - YALE ST AT CENTER STREET

ITEM NO	DESCRIPTION	UNITS	QUANTITY	UNIT COST	TOTAL
2221-202	REMOVE AND DISPOSE OF MISCELLANEOUS CONCRETE AND MASONRY	CY	230	$ 60.00	$ 13,800.00
2893-300	REMOVING TRAFFIC SIGNALS	EA	4	$ 15,000.00	$ 60,000.00
2221-251	REMOVE AND DISPOSE OF EXISTING SIDEWALK AND DRIVEWAYS (ALL THICKNESS)	SY	62	$ 25.00	$ 1,555.56
2221-250	REMOVE AND DISPOSE OF EXISTING CURB OR CURB AND GUTTER	LF	120	$ 6.00	$ 720.00
2221-301	REMOVE EXISTING POLE FOUNDATION	EA	11	$ 1,500.00	$ 16,500.00
2221-201	REMOVE AND DISPOSE OF EXISTING INLETS	EA	6	$ 1,000.00	$ 6,000.00
2221-203	REMOVE AND DISPOSE OF PIPE CULVERTS, SEWERS, AND SEWER LEADS	LF	100	$ 20.00	$ 2,000.00
2633-300	TYPE C-1 INLET (PRE CAST)	EA	6	$ 4,000.00	$ 24,000.00
2633-900	JUNCTION BOX WITH LID OR GRATE TOP FOR STORM SEWER (PRE CAST)	EA	2	$ 8,000.00	$ 16,000.00
351 6025	FLEX PAVEMENT STRUCTURE REPAIR (8"-15")	SY	267	$ 120.00	$ 32,000.00
6000 6004	REMOVE UNDERGROUND CONDUIT	LF	600	$ 340.00	$ 204,000.00
6076 6001	REMOVE EXISTING COMMUNICATION CABINET	EA	1	$ 5,000.00	$ 5,000.00
6141 6005	REMOVE EXISTING LANE CONTROL SYSTEM	EA	1	$ 4,500.00	$ 4,500.00
6268 6001	REMOVE EXIST LN CONTROL SIGNAL HEAD	EA	8	$ 1,500.00	$ 12,000.00
2631-105	24-INCH DIAMETER STORM SEWER BY OPEN CUT	LF	100	$ 70.00	$ 7,000.00
2775-105	4-1/2-INCH CONCRETE SIDEWALK	SF	198	$ 10.00	$ 1,980.00
2775-400	WHEEL CHAIR RAMP	SF	320	$ 20.00	$ 6,400.00
2771-100	6-INCH CONCREE CURB	LF	120	$ 80.00	$ 9,600.00
	RELOCATE UTILITY MISC.	LS	1	$ 15,000.00	$ 15,000.00
2582-105	4-INCH POLE, ALL STYLES, WITH FOUNDATION	EA	4	$ 4,000.00	$ 16,000.00
2582-200	GALVANIZED MAST ARM POLE WITH FOUNDATION (30-FT MAST ARM, INLCUDING LUMINAIRE ARM ASSEMBLY)	EA	4	$ 20,000.00	$ 80,000.00
2893-100	ELECTRICAL SERVICE POLE ASSEMBLY	EA	1	$ 6,000.00	$ 6,000.00
2893-200	OVERHEAD STREET NAME SIGNS	EA	8	$ 800.00	$ 6,400.00
2765-xxx	REFL PAV MRK (VARIOUS)	LS	1	$ 10,000.00	$ 10,000.00
16710-xxx	PULLBOX WITH APRON, GRAVEL AND GROUND ROD	EA	4	$ 2,000.00	$ 8,000.00
16711-205	2-INCH PVC SCH 80, UNDERGROUND, EARTH	LF	320	$ 12.00	$ 3,840.00
16711-305	3-INCH PVC SCH 80, UNDER PAVEMENT, BORE	LF	320	$ 21.00	$ 6,720.00
16711-405	4-INCH PVC SCH 80, UNDER PAVEMENT, BORE	LF	320	$ 25.00	$ 8,000.00
16715-300	3 SECTION VEHICLE SIGNAL HEAD ASSEMBLY	EA	6	$ 1,100.00	$ 6,600.00
16716-100	LED PEDESTRIAN SIGNAL HEAD ASSEMBLY (SYMBOLIC) (COUNTDOWN)	EA	8	$ 550.00	$ 4,400.00
16720-xxx	TRAFFIC SIGNAL CABLES, DETECTOR LEAD-IN CABLE	LF	460	$ 1.70	$ 782.00
16720-xxx	TRAFFIC SIGNAL CABLES, 3/C-#14 AWG SOLID CABLE	LF	1200	$ 1.80	$ 2,160.00
16720-505	TRAFFIC SIGNAL CABLES, 5/C-#14 AWG SOLID CABLE	LF	1000	$ 2.00	$ 2,000.00
16720-705	TRAFFIC SIGNAL CABLES, 7/C-#14 AWG SOLID CABLE	LF	1800	$ 2.50	$ 4,500.00

MHRA - YALE ST AT CENTER STREET

ITEM NO	DESCRIPTION	UNITS	QUANTITY	UNIT COST	TOTAL
16720-xxx	#4 THIN SERVICE WIRE	LF	200	$ 2.50	$ 500.00
16720-xxx	LUMINAIRE WIRE	LF	800	$ 1.50	$ 1,200.00
16724-100	EMERGENCY RESPONSE MANAGEMENT SYSTEM	EA	1	$ 10,000.00	$ 10,000.00
16730-xxx	ITS CONTROLLER CABINET ASSEMBLY	EA	1	$ 33,000.00	$ 33,000.00
02893-xxx	CONTROLLER CABINET FOUNDATION WITH APRON	EA	1	$ 2,000.00	$ 2,000.00
16732-xxx	UNINTERRUPTIBLE POWER SUPPLY	EA	1	$ 8,000.00	$ 8,000.00
16750-xxx	ACCESSIBLE PEDESTRIAN PUSH BUTTON STATION	EA	8	$ 1,200.00	$ 9,600.00
16785-xxx	GPS SERIAL COMMUNICATION MODULE	EA	1	$ 700.00	$ 700.00
16733-100	FIELD HARDENED ETHERNET SWITCH	EA	1	$ 2,500.00	$ 2,500.00
16734-100	WIMAX	EA	1	$ 2,700.00	$ 2,700.00
6001-681	TEMP TRAF SIGNALS	EA	1	$ 15,000.00	$ 15,000.00
1580-100	PROJECT SIGN	EA	1	$ 1,250.00	$ 1,250.00
1570-000	SWPPP	LS	1	$ 15,000.00	$ 15,000.00

SUB-TOTAL	$	704,908
ROW	**$**	**-**
MOBILIZATION AND BARRICADES (10%)	**$**	**70,491**
SAFETY (5%)	**$**	**35,245**
INFLATION (10%)	**$**	**70,491**
TOTAL	**$**	**176,227**
HSIP TOTAL ESTIMATE COST	**$**	**881,134**

September 17, 2020

Ms. Carol Ellinger Haddock, P.E.
Director
Houston Public Works

Re: Funding Commitment for 2020 HSIP Submittal of the Intersection of Yale and Center Streets Safety Project

Dear Ms. Haddock,

The intersection of Yale and Center Street has a history of collisions that makes this location a candidate project for the 2020 Off-System Highway Safety Improvement Program (HSIP). The proposed project will replace existing traffic signals with new traffic signals, per current City of Houston design standards. This countermeasure will modernize the intersection and provide clear visibility to allow sufficient stopping sight distance. The new traffic signal will have mast arms, three (3) signal heads, including one (1) left turn light, with an overhead street name sign. The signal pole will also feature a countdown pedestrian signal and pedestrian push button stations for pedestrian purposes.

The Memorial Heights Redevelopment Authority (MHRA) is committed to providing the 10% local match commitment for the project, per program requirements. MHRA will also provide the costs required for any project design and development activities and will be responsible for cost overruns associated with said improvements.

Thank you for submitting this project for funding on behalf of the Memorial Heights Redevelopment Authority.

Sincerely,

Ann Lents
Board Chair
Memorial Heights Redevelopment Authority (MHRA)

cc: Sherry Weesner, PE – MHRA President

THE GOODMAN CORPORATION
TBPE NO. F-19990

HOUSTON:
3200 Travis Street
Suite 200
Houston, TX 77006

AUSTIN:
911 W. Anderson Lane
Suite 200
Austin, TX 78757

PHONE: (713) 951-7951

CREATIVE MOBILITY SOLUTIONS

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Memorial Heights Redevelopment Authority (MHRA)
Intersection of Yale Street and Center Street
Highway Safety Improvement Program (HSIP) Candidate Project
August 2020

The intersection of Yale and Center Street (See Figure 1) has a history of collisions that make this location a candidate project for the 2020 Highway Safety Improvement Program (HSIP). The HSIP aims to reduce fatalities, incapacitating injuries and non-incapacitating injuries on all public roads. Using the required data from Crash Records Information System (CRIS), this intersection has been evaluated to determine project eligibility.

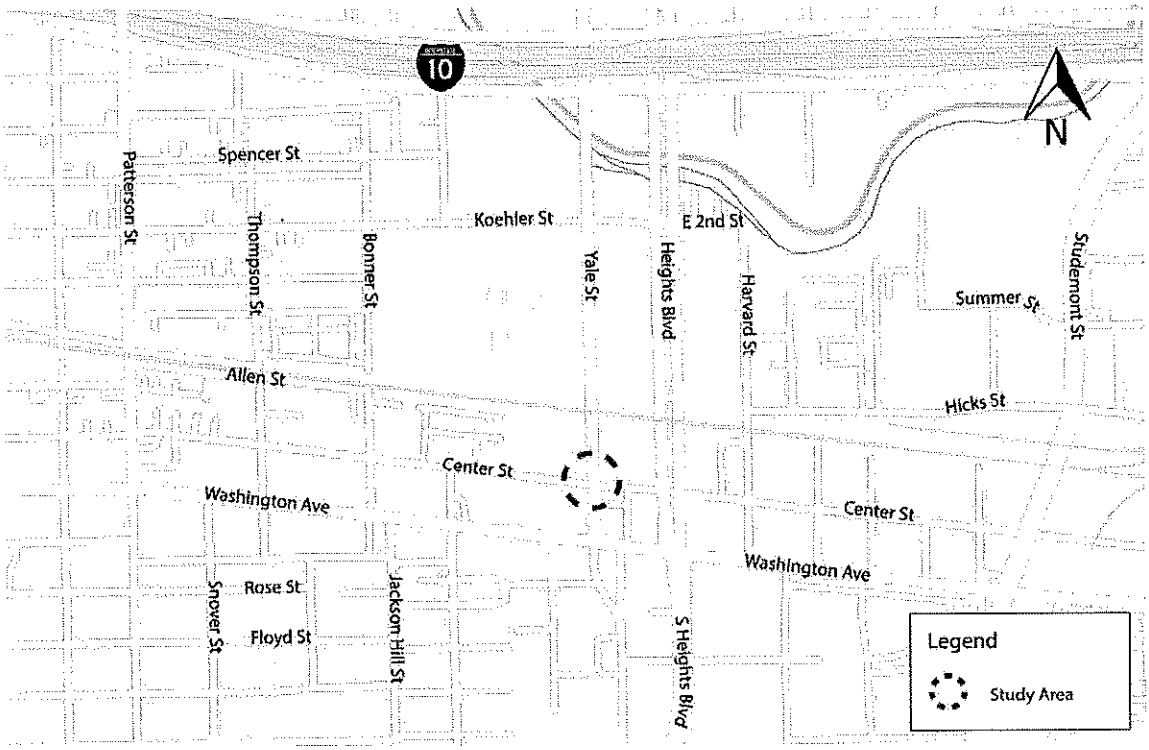


Figure 1. Study area location map

CRIS data from 2017 to 2019 indicates there were a total of 27 intersection related crashes at the intersection of Yale Street and Center Street. Of these 27 crashes, 9 (33.3%) of them were red-light related crashes.[1] Among the 9 red light related crashes, one of them involved a cyclist who experienced a non-incapacitating injury in 2017. The high crash frequency of red-light related crashes are understandable given current site conditions. On Yale Street, drivers traveling southbound experience grade changes and then encounter an underpass, which creates visibility issues with the immediate signal. The signals can be easily obstructed by vehicles and overlooked by distracted drivers (See Figure 2).

Figure 2. Southbound traffic signals at Yale St. and Center St. Intersection

Drivers traveling on the single north bound lanes experience signal visibility issues as well and are unable to determine vehicles approaching the intersection (See Figure 3). Poor signal visibility at this intersection is thought to be a major contributor for crashes.

[1] Red-light related crashes: crashes that disregard stop and go signal; crashes that disregard stop sign or light; crashes failed to yield right of way -turn on red; crashes failed to yield right of way- turning left.

Figure 3. Northbound traffic signals at Yale St. and Center St. intersection

Proposed Solution

Due to the difficulty in seeing the existing signals, new traffic signals, per current City of Houston design standards, are proposed. This countermeasure will modernize the intersection and provide clear visibility for sufficient stopping sight distance. The new traffic signal will be at least 20 feet tall with a mast arm length of a least 25 feet. It will have 3 signal heads, including 1 left turn light, with an overhead street name sign. The signal pole will feature a countdown pedestrian signal and pedestrian push button stations for pedestrian and cyclist safety purposes (see Figure 4).

According to the HSIP function codes, improving traffic signals (Work Code 108) has a reduction factor of 24% on eligible crashes with 10 years of service life.

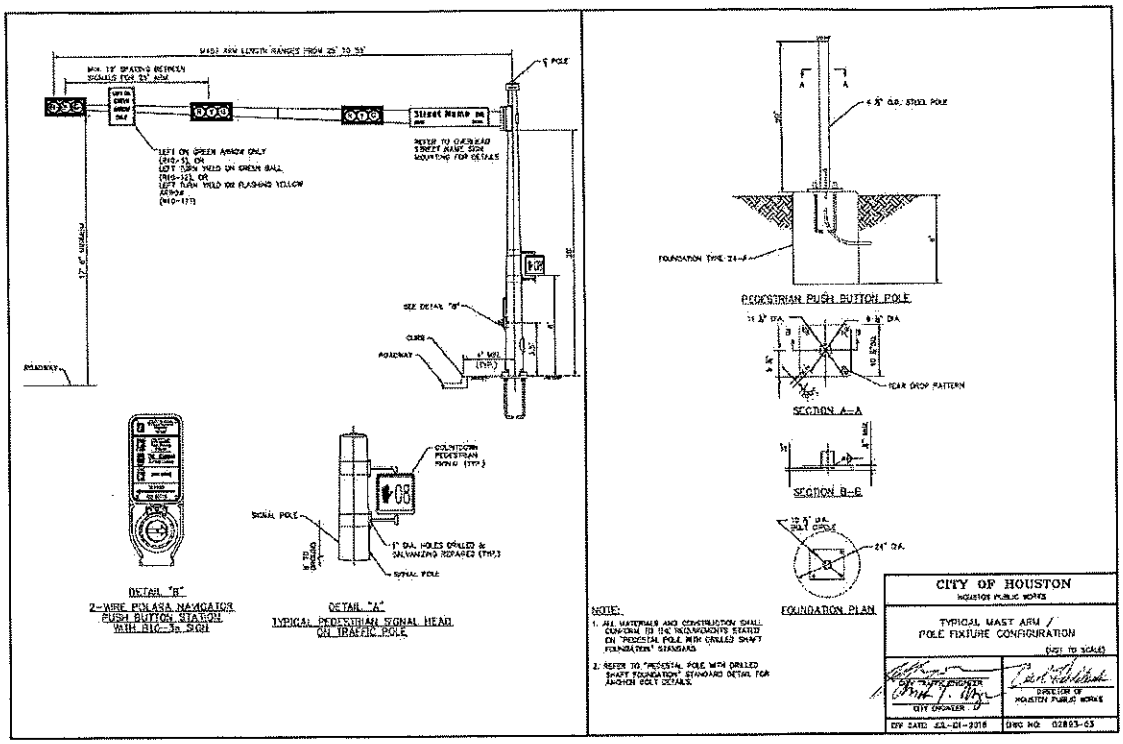


Figure 4. Typical Mast/Arm Pole Fixture Configuration

Project Cost

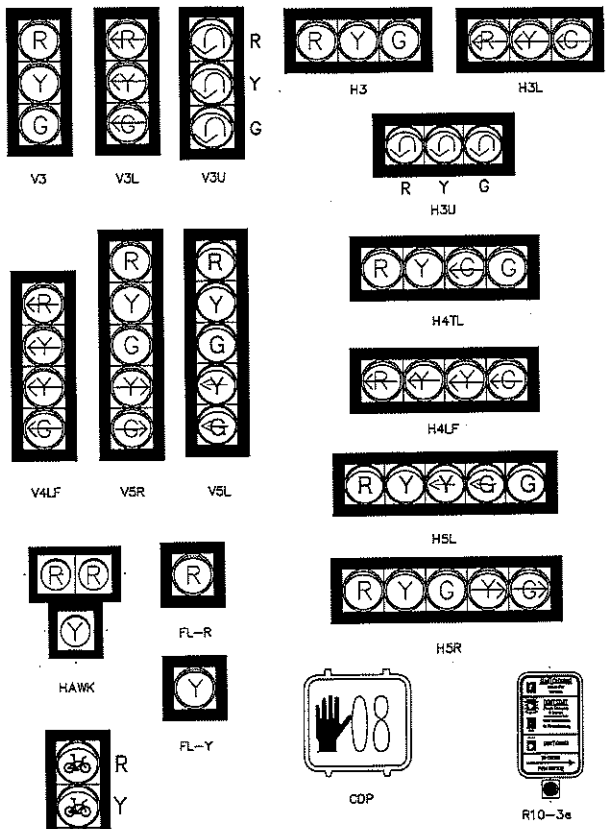
The project is anticipated to have a construction cost of approximately $881,000. These costs would be pursued on a 90/10 basis through the TxDOT HSIP program. The cost to design the project and the 10% match would be provided by the MHRA.

Project Benefit per HSIP Criteria

The analysis was conducted from 2017 to 2019. There was a total of 27 eligible crashes with no fatal or incapacitating crashes and 5 non-capacitating crashes. The cost benefit ratio for 2017 to 2019 is 1.93. This project is eligible for the HSIP off-system call for projects and can be implemented per the program timeline requirements.

	NEW	EXISTING
TRAFFIC SIGNAL POLE		
PEDESTAL POLE		
POLE W/MAST ARM		
VEHICLE SIGNAL HEAD		
VEHICLE SIGNAL HEAD W/BACK PLATE		
PEDESTRIAN SIGNAL HEAD		
PEDESTRIAN PUSH BUTTON		
PULL BOX – TYPE A		
PULL BOX – TYPE B		
PULL BOX – TYPE C		
PULL BOX – TYPE B W/EXTENSION		
CONDUIT		
VIDEO DETECTION CAMERA		
PRE-EMPT SENSOR		
LUMINAIRE		
LUMINAIRE W/PHOTO CELL		
CONTROLLER CABINET		
METERED POWER PEDESTAL		
POLE MOUNTED METER		
FIBER OPTIC CONDUIT	—FO—	—FO—
MAST ARM SIGN		

SIGNAL TYPES



NOTE:

ALL TRAFFIC SIGNAL HEAD TYPES HAVE 12-INCH LENSES.

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

HARDWARE LEGENDS

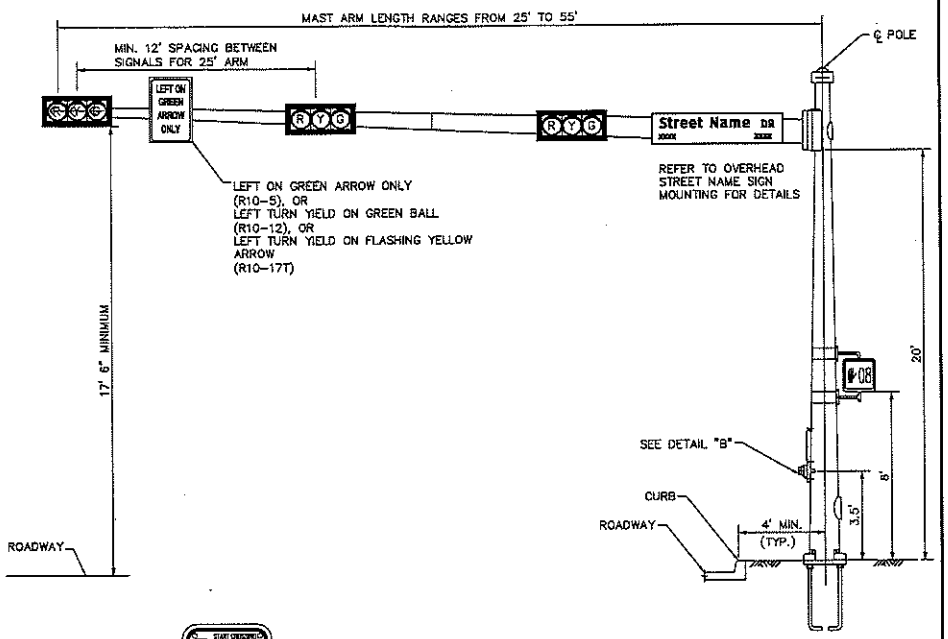
(NOT TO SCALE)

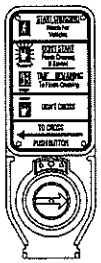
CITY TRAFFIC ENGINEER
CITY ENGINEER

DIRECTOR OF
HOUSTON PUBLIC WORKS

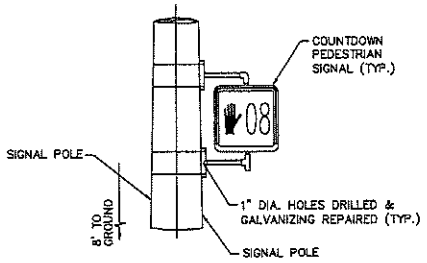
EFF DATE: JUL-01-2018

DWG NO: 02893-02

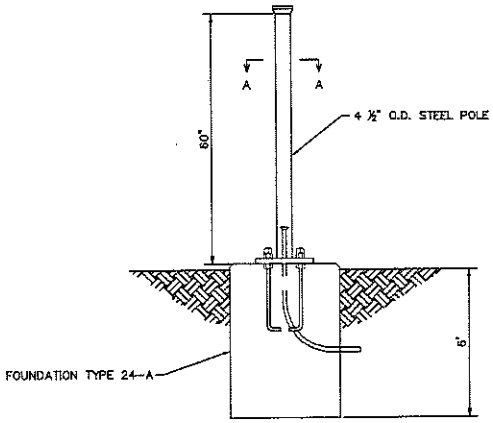




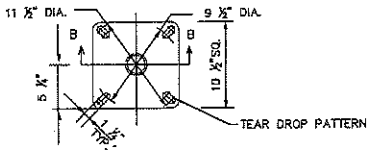
DETAIL "B"
2-WIRE POLARA NAVIGATOR PUSH BUTTON STATION WITH R10-3e SIGN



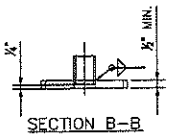
DETAIL "A"
TYPICAL PEDESTRIAN SIGNAL HEAD ON TRAFFIC POLE



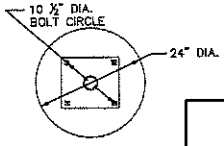
PEDESTRIAN PUSH BUTTON POLE



SECTION A-A



SECTION B-B



FOUNDATION PLAN

NOTE:

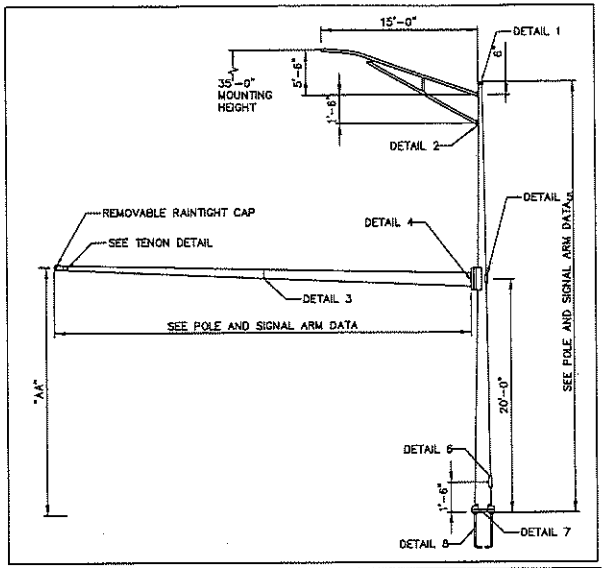
1. ALL MATERIALS AND CONSTRUCTION SHALL CONFORM TO THE REQUIREMENTS STATED ON "PEDESTAL POLE WITH DRILLED SHAFT FOUNDATION" STANDARD.
2. REFER TO "PEDESTAL POLE WITH DRILLED SHAFT FOUNDATION" STANDARD DETAIL FOR ANCHOR BOLT DETAILS.

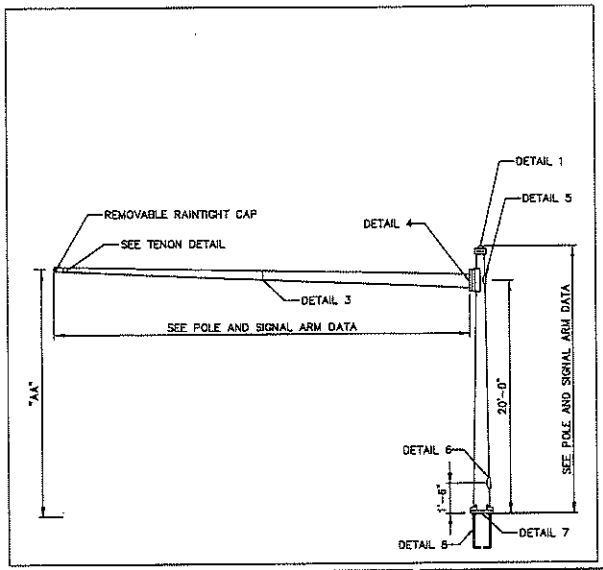
CITY OF HOUSTON
HOUSTON PUBLIC WORKS

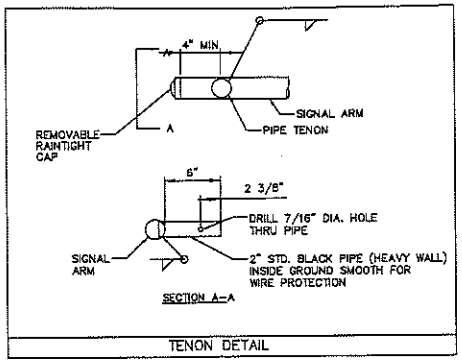
TYPICAL MAST ARM / POLE FIXTURE CONFIGURATION
(NOT TO SCALE)

CITY TRAFFIC ENGINEER
CITY ENGINEER
DIRECTOR OF HOUSTON PUBLIC WORKS

EFF DATE: JUL-01-2018
DWG NO: 02893-03





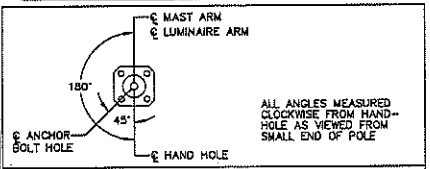


TENON DETAIL

MATERIAL DATA

COMPONENT	ASTM DESIGNATION	MIN. YIELD (KSI)	COMPONENT	ASTM DESIGNATION	MIN. YIELD (KSI)
POLE SHAFT – 3 GAUGE	A595 GR.A	55	MAST ARM CONN. BOLTS	A325*	
POLE SHAFT – 0.375"	A572 GR.55	55	LUM. ARM CONN. BOLTS	SAE GR.5	36
MAST ARM SHAFT	A595 GR.A	55	ANCHOR BOLTS	F1554 GR.55	55
LUMINAIRE ARM SHAFT	2" SCH.80 PIPE		GALVANIZING	A123 & A153	
ARM ATTACHMENT PLATE	A36	36			
BASEPLATE	A36	36			

*LUBRICATE IN FIELD IF NECESSARY IN LIEU OF THE REQUIREMENTS IN A325.



RADIAL INDEX

ALTHOUGH RARE, VIBRATIONS SEVERE ENOUGH TO CAUSE DAMAGE CAN OCCASIONALLY OCCUR IN STRUCTURES OF ALL TYPES. BECAUSE THEY ARE INFLUENCED BY MANY INTERACTING VARIABLES, VIBRATIONS ARE GENERALLY UNPREDICTABLE. THE USER'S MAINTENANCE PROGRAM SHOULD INCLUDE OBSERVATION FOR EXCESSIVE VIBRATION AND EXAMINATION FOR ANY STRUCTURAL DAMAGE OR BOLT LOOSENING. ARMS SHALL BE VISUALLY INSPECTED IN 5 TO 20 MPH WIND CONDITIONS AFTER SIGNAL HEAD INSTALLATION AND, IF VERTICAL MOVEMENTS WITH A TOTAL EXCURSION (MAXIMUM POSITIVE TO MAXIMUM NEGATIVE) OF MORE THAN APPROXIMATELY 8 INCHES ARE OBSERVED AT ARM TIP, DAMPING DEVICES OR OTHER MEANS SHALL BE FITTED TO THE ARM (S). THE NECESSARY DAMPING DEVICE (S) OR OTHER REMEDIAL MEASURES SHALL BE AS RECOMMENDED BY THE CONTRACTOR. EXCESSIVE VIBRATIONS SHALL NOT BE ALLOWED TO CONTINUE FOR MORE THAN 2 DAYS.

VIBRATION DISCLAIMER

POLE AND MAST ARM DATA

DESIGNATION KEY			POLE TUBE						POLE BASE				ANCHOR BOLT				SIGNAL ARM TUBE				
POLE SERIES	POLE TYPE	SIGNAL ARM SPAN (FT)	BASE DIA. (IN)	TOP DIA. (IN) WITH LUM. ARM	TOP DIA. (IN) WITHOUT LUM. ARM	LENGTH (FT) WITH LUM. ARM	LENGTH (FT) WITHOUT LUM. ARM	GAUGE OR THK. (IN)	SQUARE "S" (IN)	BOLT CIRCLE "Y" (IN)	THK. "M" (IN)	HOLE / SLOT "Z" (IN)	DIA. "K" (IN)	LENGTH "J" (IN)	HOOK "H" (IN)	THREAD LENGTH "U" (IN)	FIXED END DIA. (IN)	FREE END DIA. (IN)	GAUGE OR THICK (IN)	SPAN (FT)	TIP HEIGHT "AA" (FT)
HOU	1	25	13.00	8.80	10.00	30.00	21.50	3									8.00	3.50	7	25.00	20.2
		30															9.00	4.80	7	30.00	20.3
		35															10.00	5.10	7	35.00	20.3
HOU	2	40	13.00	8.80	10.00	30.00	21.50	0.375	19.00	18.00	2.25	2.50	2.25	59.00	7.00	12.00	10.50	4.90	7	40.00	20.3
		45															10.14	3.84	3	45.00	20.4
		50															11.00	4.00	3	50.00	20.4
		55															11.50	4.16	DET 3	55.00	20.5

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

TRAFFIC SIGNAL STRUCTURES
(SHEET 1 OF 2)

(NOT TO SCALE)

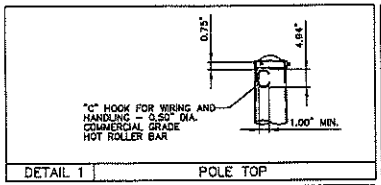
CITY TRAFFIC ENGINEER

CITY ENGINEER

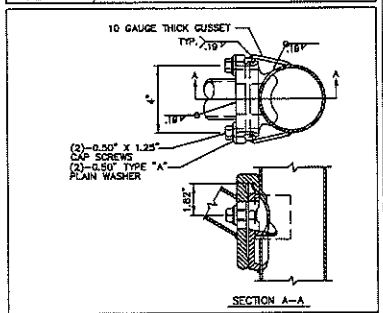
DIRECTOR OF HOUSTON PUBLIC WORKS

EFF DATE: JUL-01-2018

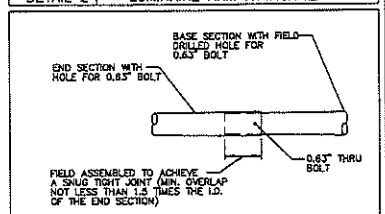
DWG NO: 02693-04A



DETAIL 1 | POLE TOP

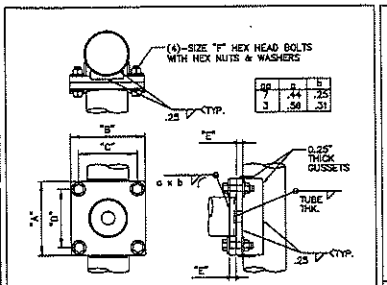


DETAIL 2 | LUMINAIRE ARM ATTACHMENT



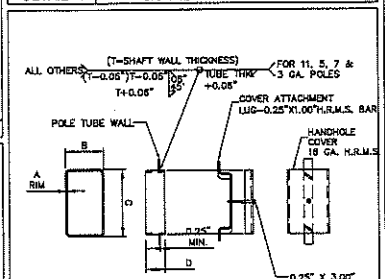
ITEM	BASE SECTION		END SECTION	
	LENGTH	GAUGE	LENGTH	GAUGE
55.00'	28.42'	3	30.71'	7

DETAIL 3 | SIGNAL ARM SLIP JOINT



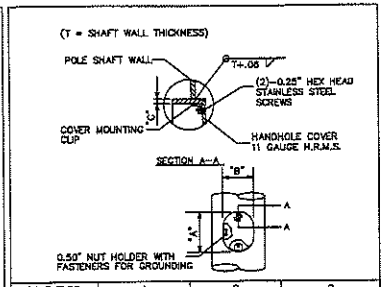
POLE TYPE	"A"	"B"	"C"	"D"	"E"	"F"
1	17.75"	17.75"	14.50"	14.50"	1.50"	1.25" X 4.50"
2	18.75"	18.75"	15.00"	15.00"	1.75"	1.50" X 5.25"

DETAIL 4 | SIGNAL ARM ATTACHMENT



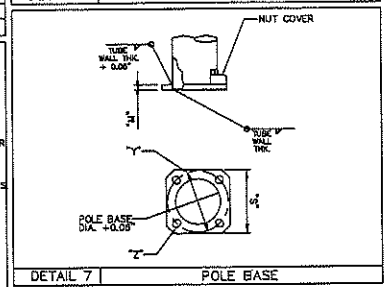
POLE TYPE	A	B	C	D
1	7 GA.	3.00"	5.00"	1.50"
2	0.50"	4.00"	6.00"	2.50"

DETAIL 5 | HANDHOLE

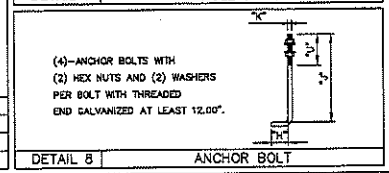


POLE TYPE	A	B	C
1	7.56"	5.19"	0.280"
2	7.31"	5.63"	0.432"

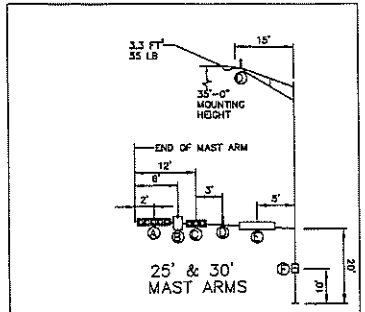
DETAIL 6 | HANDHOLE



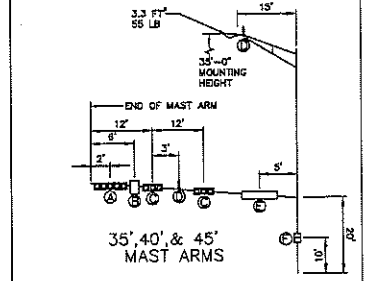
DETAIL 7 | POLE BASE



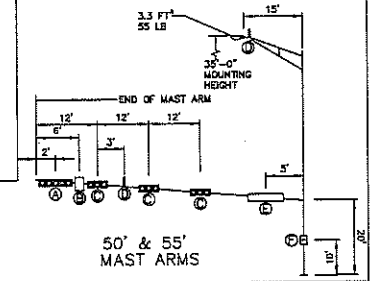
DETAIL 8 | ANCHOR BOLT



25' & 30' MAST ARMS



35',40',& 45' MAST ARMS



50' & 55' MAST ARMS

DESIGN NOTE:

DESIGNS ARE BASED ON THE LOADING CHART SHOWN ON THIS DRAWING AND ARE IN ACCORDANCE WITH MATERIALS AND ALLOWABLE STRESS REQUIREMENTS OF THE 1994 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS,LUMINAIRES AND TRAFFIC SIGNALS" FOR A 90 MPH WIND ZONE WITH A 1.3 GUST FACTOR.

DEVICE	DESCRIPTION	PROJ. AREA (FT²)	WEIGHT (LBS)
A	12"–3 SEC. SIGNAL WITH BACKPLATES	13.33	98
B	30" X 36" SIGNAL ARM MOUNTED SIGN	7.50	15
C	12"–3 SEC. SIGNAL WITH BACKPLATES	8.67	53
D	VIVOS CAMERA	1.00	15
E	24" X 72" STREET NAME SIGN	12.00	30
F	PEDESTRIAN SIGNAL	4.00	40

MAXIMUM LOADING INFORMATION

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

TRAFFIC SIGNAL STRUCTURES (SHEET 2 OF 2)

(NOT TO SCALE)

CITY TRAFFIC ENGINEER
CITY ENGINEER

DIRECTOR OF HOUSTON PUBLIC WORKS

EFF DATE: JUL–01–2018

DWG NO: 02893–048

FOUNDATION DESIGN TABLE

POLE MARK	DRILLED SHAFT DIA.	REINFORCING STEEL		DRILLED SHAFT LENGTH –feet	BOLT CIRCLE DIA.	FOUNDATION DESIGN LOADS (1)			TYPICAL APPLICATION
		VERT. BARS	SPIRAL & PITCH			MOMENT K–ft.	SHEAR KIPS	TORQUE K–ft.	
HOU 1	30"	8–#9	#3 @ 9"	14'–0"	18"	72.2	3.4	51.9	MAST ARM ASSEMBLY (25'–35') IN COHESIVE SOILS
HOU 2	30"	8–#9	#3 @ 9"	18'–0"	18"	89.9	4.0	98.0	MAST ARM ASSEMBLY (40'–55') IN COHESIVE SOILS MAST ARM ASSEMBLY (25'–55') IN NON–COHESIVE SOILS

FOUNDATION DESIGN TABLE NOTES:

(1) FOUNDATION DESIGN LOADS ARE THE ALLOWABLE MOMENTS, SHEARS AND TORQUES AT THE TOP OF THE FOUNDATION.

(2) CONSTRUCT IN ACCORDANCE WITH CITY OF HOUSTON SPECIFICATION SECTION 02465, "DRILLED SHAFT FOUNDATIONS".

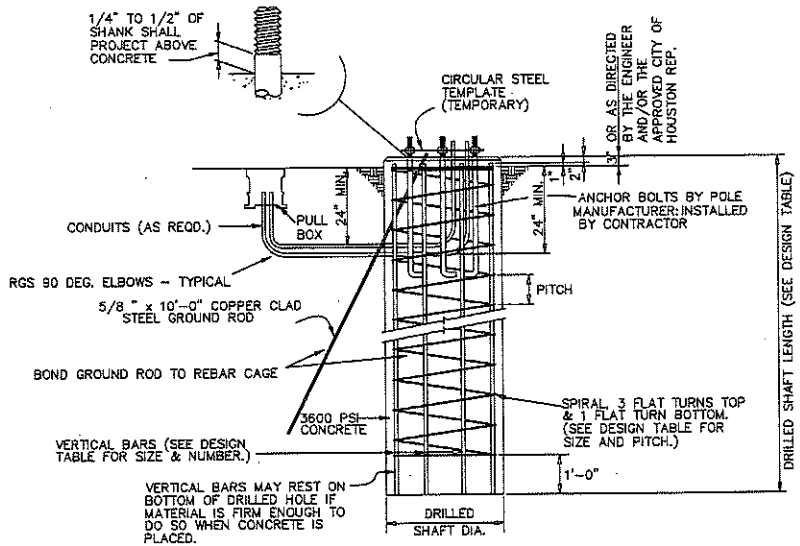
(3) FOUNDATION DESIGN IS BASED UPON AN UNDRAINED SHEAR STRENGTH OF 1500 PSF FOR COHESIVE SOILS AND A TEXAS CONE PENETROMETER MINIMUM OF 10 BLOWS/FOOT IN NON–COHESIVE SOILS. WHERE COHESIVE AND NON–COHESIVE LAYERS EXIST WITHIN THE SPECIFIED SHAFT LENGTH, THE NON–COHESIVE SOILS SHALL GOVERN. LOWER SOIL PARAMETERS WILL REQUIRE A SPECIAL DESIGN.

GENERAL NOTES:

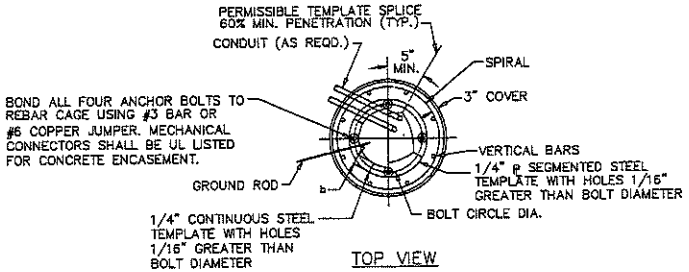
1. DESIGN IS FOR CITY OF HOUSTON STANDARD TRAFFIC SIGNAL MAST ARM SUPPORT STRUCTURES BY VALMONT INDUSTRIES, INC.
2. DESIGN CONFORMS TO 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS" AND INTERIM REVISIONS THERETO FOR A 90 MPH WIND ZONE WITH A 1.3 GUST FACTOR AND ACI "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE (ACI 318–02)".
3. REINFORCING STEEL SHALL CONFORM TO ASTM A615, GRADE 60.
4. CONCRETE SHALL BE 6 SACK, 3600 PSI.
5. ALL ANCHOR BOLTS SHALL BE GALVANIZED THE ENTIRE LENGTH OF BOLT. EXPOSED NUTS AND WASHERS SHALL ALSO BE GALVANIZED.

INSTALLATION PROCEDURE

THREADS OF ANCHOR BOLTS SHALL BE COATED WITH PIPE JOINT COMPOUND PRIOR TO INSTALLATION OF UPPER NUTS WHEN ERECTING POLE. AFTER POLE IS PLUMBED AND IN PERMANENT ALIGNMENT, THE EXPOSED THREADS OF PAINTED BOLTS SHALL BE CLEANED AND AN ADDITIONAL COATING OF ZINC–RICH PAINT APPLIED TO SEAL THE BOLT THREAD–NUT JOINT.



FOUNDATION DETAILS



TOP VIEW

NOTE:

1. b = MINIMUM STEEL TEMPLATE WIDTH EQUAL TO TWO TIMES ANCHOR BOLT DIAMETER.
2. STEEL TEMPLATE MAY BE OF CONTINUOUS WIDTH OR SEGMENTED WIDTH.
3. SEE FOUNDATION DESIGN TABLE FOR BOLT CIRCLE DIAMETER.
4. BOLTS SHOULD BE CHECKED FOR PLUMB AFTER CONCRETE IS POURED AND BEFORE INITIAL SET.

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

POLE FOUNDATION DETAILS

(NOT TO SCALE)

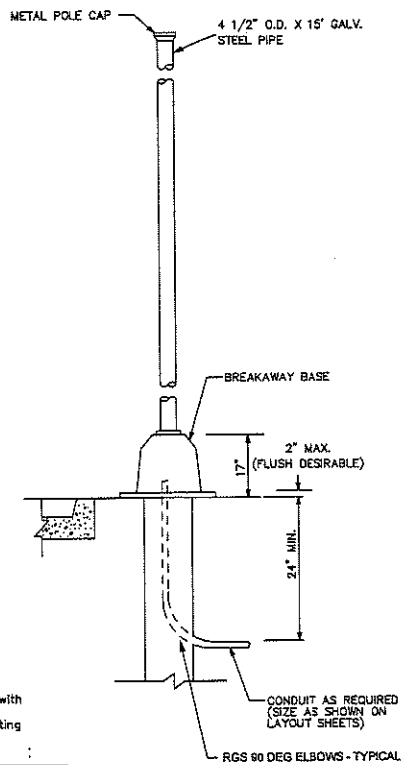
CITY TRAFFIC ENGINEER
CITY ENGINEER
DIRECTOR OF HOUSTON PUBLIC WORKS

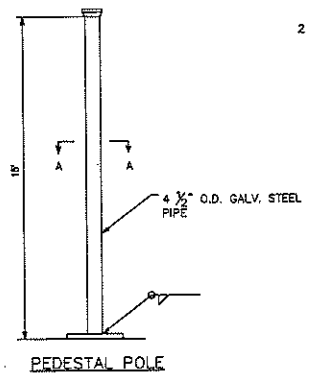
EFF DATE: JUL–01–2018

DWG NO: 02893–05

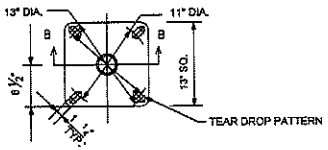
NOTES:

1. DETAILS DEPICTED ON THIS SHEET SHOW A TYPICAL PEDESTAL POLE ASSEMBLY WITH SCREW-IN ANCHOR FOUNDATION TO BE UTILIZED FOR SCHOOL ZONE FLASHERS ONLY.
2. THE PEDESTAL POLE ASSEMBLY DEPICTED ON THIS SHEET IS DESIGNED FOR SIGNAL HEADS WHERE ELECTRICAL POWER IS NEEDED WITH A BREAKAWAY POLE.
3. PROVIDE BREAKAWAY FUSE HOLDER WITH DOUBLE-POLE HOUSING. ENSURE FUSE HOLDER IS POLARIZED, WATER-RESISTANT, UL RECOGNIZED, AND RATED FOR 30A MAXIMUM CURRENT CAPACITY AT 600V OR LESS. PROVIDE BREAKAWAY FUSE HOLDER FROM MANUFACTURERS PRE-QUALIFIED BY THE TRAFFIC OPERATIONS DIVISION. SEE HTTP://WWW.DOT.STATE.TX.US/BUSINESS/PRODUCER LIST.HTM FOR LIST OF PRE-QUALIFIED MANUFACTURERS, CATEGORY IS "ROADWAY ILLUMINATION AND ELECTRICAL SUPPLIES." PROVIDE 10 AMP TIME DELAY FUSES.
4. UNLESS OTHERWISE SHOWN ON THE PLANS, PROVIDE POLE SHAFT AND BREAKAWAY BASE IN ACCORDANCE WITH THE REQUIREMENTS LISTED IN TEXAS DEPARTMENT OF TRANSPORTATION (TxDOT) STANDARD SPECIFICATION ITEM "PEDESTAL POLE ASSEMBLIES".
5. SEE TxDOT SPECIAL SPECIFICATION 4923 (SS 4923),"SCREW-IN TYPE ANCHOR FOUNDATIONS" FOR FURTHER REQUIREMENTS.
6. PROVIDE SIGNAL HEADS AND MOUNTING AS SHOWN ELSEWHERE ON THE PLANS.
7. CONDUIT IN FOUNDATION AND WITHIN 6 IN. OF FOUNDATION IS SUBSIDIARY TO STANDARD SPECIFICATION ITEM, "PEDESTAL POLE ASSEMBLIES".
8. POLE SHAFT SHALL BE ONE PIECE. ALUMINUM CONDUIT WILL NOT DEVELOP THE NECESSARY STRENGTH AND WILL NOT BE ALLOWED. IN HIGH WINDS, USE A POLE AND BASE COLLAR ASSEMBLY TO ADD STRENGTH AND PREVENT LOOSENING ON CONNECTION.
9. PER MANUFACTURER'S RECOMMENDATIONS, ENGAGE ALL THREADS ON THE PEDESTAL POLE BASE AND PIPE UNLESS THE PIPE IS FULLY SEATED INTO BASE.
10. PROVIDE NON-FUSED WATERTIGHT BREAKAWAY ELECTRICAL CONNECTORS FOR BREAKAWAY POLES.(BUSSMANN HET, LITTELFUSE LET, FERRAZ-SHAWMUT FEBN, OR APPROVED EQUAL).

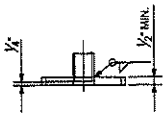




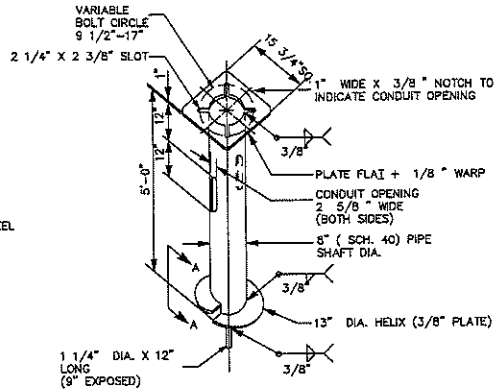
PEDESTAL POLE



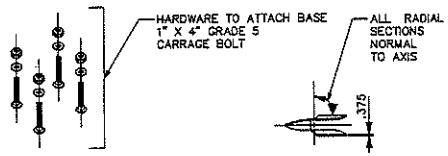
SECTION A-A



SECTION B-B

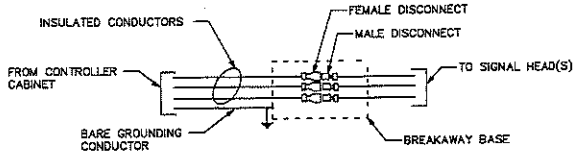


SCREW ANCHOR FOUNDATION DETAIL

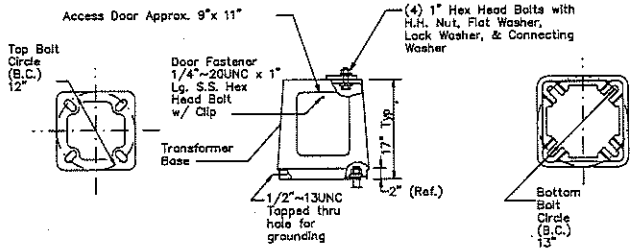


HARDWARE DETAIL

VIEW A-A



BREAKAWAY IN-LINE FUSE HOLDERS



BREAKAWAY BASE DETAILS

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

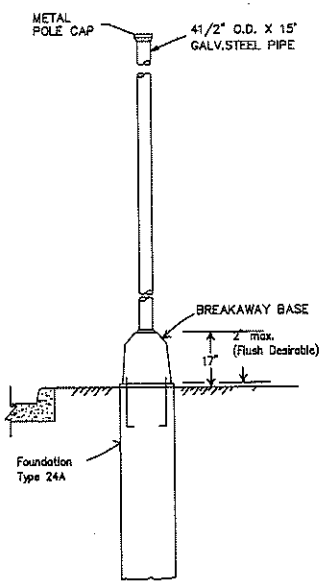
PEDESTAL POLE WITH SCREW-IN ANCHOR FOUNDATION
(FOR SCHOOL ZONE FLASHERS ONLY)
(NOT TO SCALE)

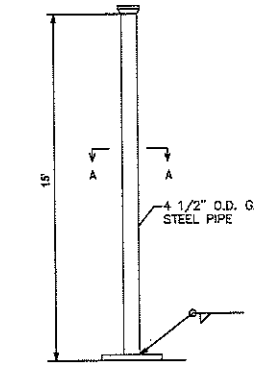
CITY TRAFFIC ENGINEER
CITY ENGINEER

DIRECTOR OF HOUSTON PUBLIC WORKS

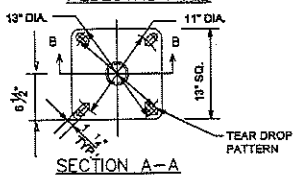
EFF DATE: JUL-01-2018

DWG NO: 02893-06

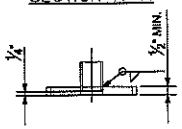




PEDESTAL POLE



SECTION A-A



SECTION B-B

NOTES:

1. DETAILS DEPICTED ON THIS SHEET SHOW A TYPICAL PEDESTAL POLE ASSEMBLY WITH A DRILLED SHAFT FOUNDATION.
2. USE 24 IN. DRILLED SHAFT FOUNDATION AS SHOWN.
3. PROVIDE BREAKAWAY FUSE HOLDER WITH DOUBLE-POLE HOUSING. ENSURE FUSE HOLDER IS POLARIZED, WATER-RESISTANT, UL RECOGNIZED, AND RATED FOR 30A MAXIMUM CURRENT CAPACITY AT 600V OR LESS. PROVIDE BREAKAWAY FUSE HOLDER FROM MANUFACTURERS PRE-QUALIFIED BY THE TRAFFIC OPERATIONS DIVISION. SEE HTTP://WWW.DOT.STATE.TX.US/BUSINESS/PRODUCER_LIST.HTM FOR LIST OF PRE-QUALIFIED MANUFACTURERS. CATEGORY IS "ROADWAY ILLUMINATION AND ELECTRICAL SUPPLIES." PROVIDE 10 AMP TIME DELAY FUSES.
4. POLE SHAFT SHALL BE ONE PIECE. ALUMINUM CONDUIT WILL NOT DEVELOP THE NECESSARY STRENGTH AND WILL NOT BE ALLOWED. IN HIGH WINDS, USE A POLE AND BASE COLLAR ASSEMBLY TO ADD STRENGTH AND PREVENT LOOSENING ON CONNECTION.
5. PER MANUFACTURER'S RECOMMENDATIONS, ENGAGE ALL THREADS ON THE PEDESTAL POLE BASE AND PIPE UNLESS THE PIPE IS FULLY SEATED INTO BASE.
6. PROVIDE NON-FUSED WATERTIGHT BREAKAWAY ELECTRICAL CONNECTORS FOR BREAKAWAY POLES.(BUSSMANN HET, LITTELFUSE LET, FERRAZ-SHAWMUT FEBN, OR APPROVED EQUAL).
7. PROVIDE SIGNAL HEADS AND MOUNTING AS SHOWN ELSEWHERE ON THE PLANS.

FOUNDATION DESIGN TABLE

FDN TYPE	DRILLED SHAFT DIA	REINFORCING STEEL		DRILLED SHAFT LENGTH--ft	ANCHOR BOLT DESIGN ①				FOUNDATION DESIGN LOAD ②	
		VERT BARS	SPIRAL & PITCH	TEXAS CONE PENETROMETER 10 blows/ft	ANCHOR BOLT DIA	Fy (ksi)	BOLT CIR DIA	ANCHOR TYPE	MOMENT K-ft	SHEAR Kips
24-A	24"	4-#5	#2 at 12"	6	3/4"	36	*13"	1	10	1

*10 1/2" B.C. FOR PUSH BUTTON POLE

NOTES:
① Anchor bolt design develops the foundation capacity given under Foundation Design Loads.
② Foundation Design Loads are the allowable moments and shears at the base of the structure.

ANCHOR BOLT ASSEMBLY INSTALLATION PROCEDURE

Threads of anchor bolts shall be coated with pipe joint compound prior to installation of upper nuts when erecting pole. After pole is plumbed and in permanent alignment, the exposed threads of painted bolts shall be cleaned and an additional coating of zinc-rich paint applied to seal the bolt thread-nut joint.

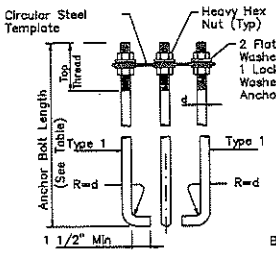
GENERAL NOTES

Design conforms to 1994 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals and interim revisions thereto.

Concrete shall be Class A or C.

Threads for anchor bolts and nuts shall be rolled or cut threads of unified national coarse thread series except for A193B7 bolts which shall have 8 pitch thread series. Bolts and nuts shall have Class 2A and 2B fit tolerances. Galvanized nuts shall be tapped after galvanizing.

Anchor bolts that are 1" in diameter or less shall conform to ASTM A36. Galvanize all anchor bolts unless otherwise noted. Exposed nuts shall be galvanized or coated with zinc-rich paint. Washers shall be galvanized. Templates and embeded nuts need not be galvanized.

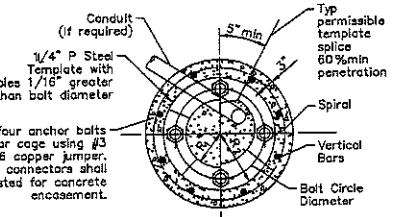


HOOKED ANCHOR (TYPE 1)

ANCHOR BOLT & TEMPLATE SIZES

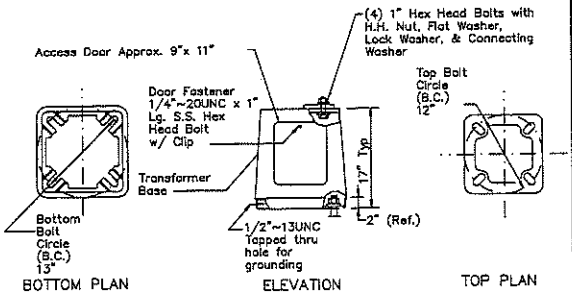
BOLT DIA IN.	③ BOLT LENGTH	TOP THREAD	BOTT THREAD	BOLT CIRCLE	R_2	R_1
3/4"	1'-6"	3"	—	13"	7 1/8"	5 5/8"

③ Min dimensions given, longer bolts are acceptable.



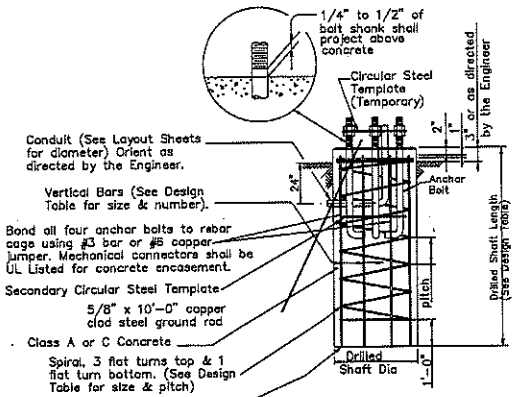
R_1 may equal R_2 if plate is welded of 3 or more segments.

TOP VIEW



BOTTOM PLAN ELEVATION TOP PLAN

BREAKAWAY BASE DETAILS



ELEVATION
FOUNDATION DETAILS

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

PEDESTAL POLE WITH DRILLED SHAFT FOUNDATION

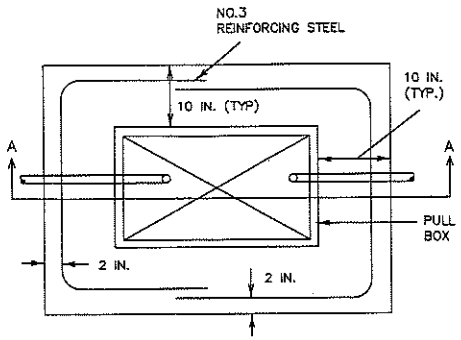
(NOT TO SCALE)

CITY TRAFFIC ENGINEER
CITY ENGINEER

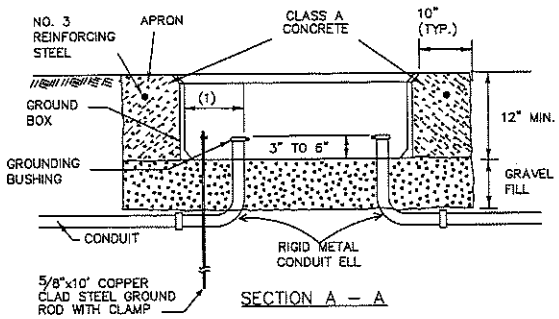
DIRECTOR OF HOUSTON PUBLIC WORKS

EFF DATE: JUL-01-2018

DWG NO: 02893-07



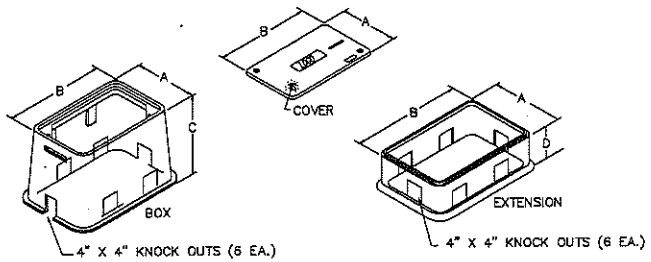
PLAN VIEW



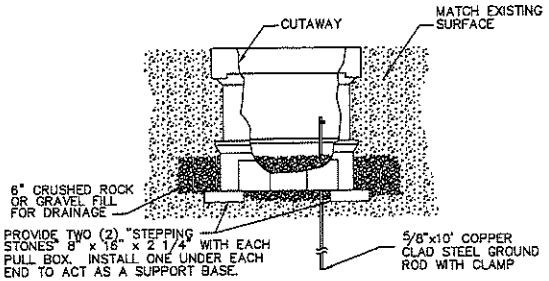
SECTION A – A

APRON FOR PULL BOXES

(1) FINAL POSITION OF END OF CONDUIT SHALL NOT EXCEED ONE-HALF THE DISTANCE TO THE SIDE OF BOX OPPOSITE THE CONDUIT ENTRY.
(2) PLACE GRAVEL "UNDER" THE BOX, NOT "IN" THE BOX. GRAVEL SHOULD NOT ENCROACH ON THE INTERIOR VOLUME OF THE BOX.
(3) INSTALL BUSHING ON THE UPPER END OF ALL ELLS.
(4) PROVIDE A 5/8" GROUND ROD IN ALL PULL BOXES AND CONNECT IT TO ANY AND ALL EQUIPMENT GROUNDING CONDUCTORS USING A LISTED CONNECTOR.
(5) MAINTAIN SUFFICIENT SPACE BETWEEN ALL CONDUITS SO AS TO ALLOW FOR PROPER INSTALLATION OF BUSHINGS.
(6) ALL CONDUITS SHALL BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER.
(7) ALL CONDUITS INSTALLED IN THE GROUND BOX SHALL BE SEALED AFTER COMPLETION OF CONDUCTOR INSTALLATION AND ANY REQUIRED PULL TESTS. SILICONE SHALL NOT BE USED AS THE SEALANT.



NOMINAL DIMENSIONS FOR TRAFFIC SIGNAL PULL BOXES				
Type	A	B	C	D
DETECTOR TYPE A	13"	18"	24"	12"
TRAFFIC SIGNAL TYPE B	17"	30"	24"	12"
COMMUNICATION TYPE C	25"	38"	24"	12"



SIDE VIEW

ELECTRICAL PULL BOX ASSEMBLY

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

PULL BOXES

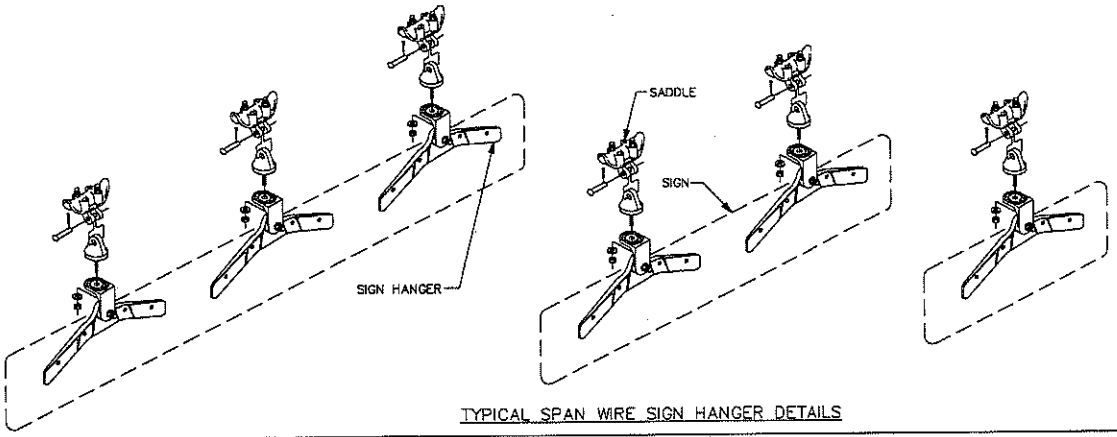
(NOT TO SCALE)

CITY TRAFFIC ENGINEER
CITY ENGINEER

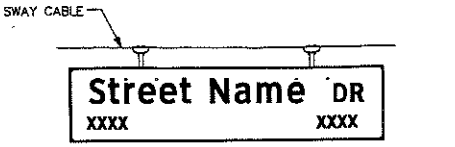
DIRECTOR OF
HOUSTON PUBLIC WORKS

EFF DATE: JUL-01-2018

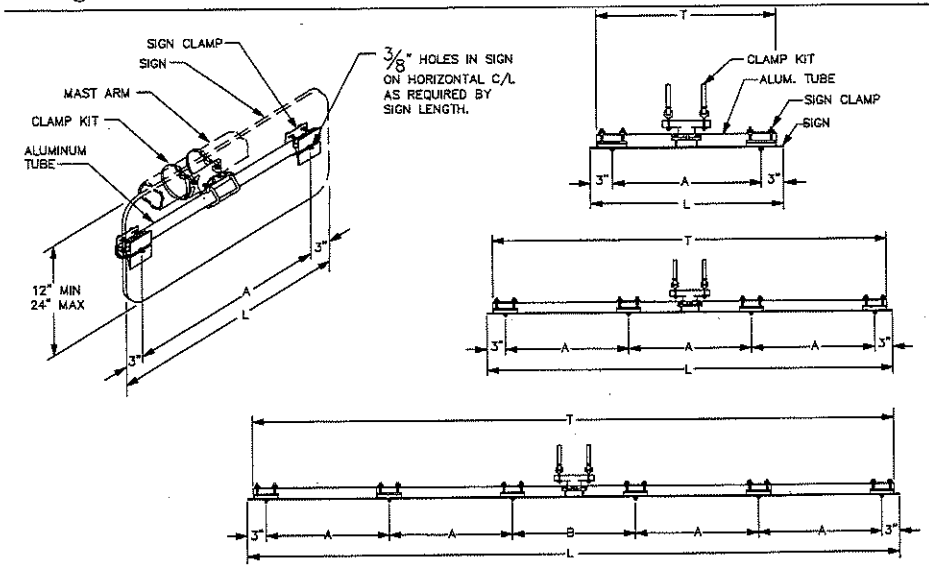
DWG NO: 02893-08



TYPICAL SPAN WIRE SIGN HANGER DETAILS



1) CONTRACTOR SHALL USE PELCO PARTS OR AN APPROVED EQUAL.
2) CONTRACTOR SHALL FURNISH ALL HARDWARE FOR A COMPLETE INSTALLATION.
3) THE 90 DEGREE SPAN WIRE CLAMPS (SADDLES) ARE ATTACHED TO TETHERS (SWAY CABLES).
4) CONTRACTOR SHALL FURNISH ONE (1) ADJUSTABLE FREE SWINGING SIGN HANGERS PER STREET NAME SIGN SMALLER THAN 3'-0". SIGNS 3'-0" TO 6'-0" REQUIRE TWO (2) HANGERS. SIGNS LARGER THAN 6'-0" REQUIRE THREE (3) HANGERS.
5) SEE SIGN MOUNTING SERIES FOR STREET NAME SIGN DETAILS.



TYPICAL MAST ARM SIGN MOUNT DETAILS

SIGNS (1'-6" TO 3'-0" LONG)

SIGN LENGTH (L)	TUBE LENGTH (T)	A
1'-6"	16"	12"
2'-0"	22"	18"
2'-6"	28"	24"
3'-0"	34"	30"

Maximum Sign Height: 48"

SIGNS (3'-6" TO 8'-0" LONG)

SIGN LENGTH (L)	TUBE LENGTH (T)	A
3'-6"	40"	12"
4'-0"	46"	14"
4'-6"	52"	16"
5'-0"	58"	18"
5'-6"	64"	20"
6'-0"	70"	22"
6'-6"	76"	24"
7'-0"	82"	26"
7'-6"	88"	28"
8'-0"	94"	30"

Maximum Sign Height: 24"

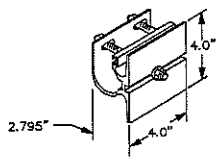
SIGNS (8'-6" TO 10'-0" LONG)

SIGN LENGTH (L)	TUBE LENGTH (T)	A	B
8'-6"	100"	19"	20"
9'-0"	106"	20"	22"
9'-6"	112"	21"	24"
10'-0"	118"	22"	26"

Maximum Sign Height: 16"

Sign square footage not to exceed rotational resistance capacity defined by mounting hardware manufacturer.

GUSSETED TUBE CROSS SECTION



SIGN CLAMP DETAIL

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

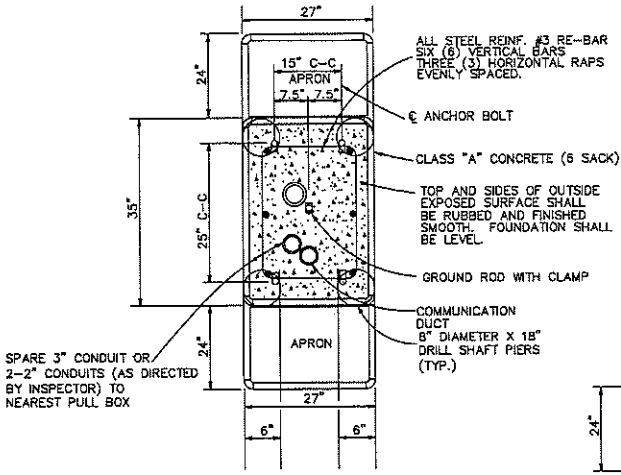
OVERHEAD STREET NAME SIGN MOUNTING DETAILS

(NOT TO SCALE)

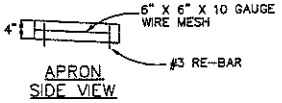
CITY TRAFFIC ENGINEER
CITY ENGINEER
DIRECTOR OF HOUSTON PUBLIC WORKS

EFF DATE: JUL-01-2018

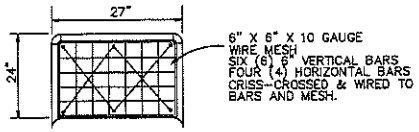
DWG NO: 02893-09



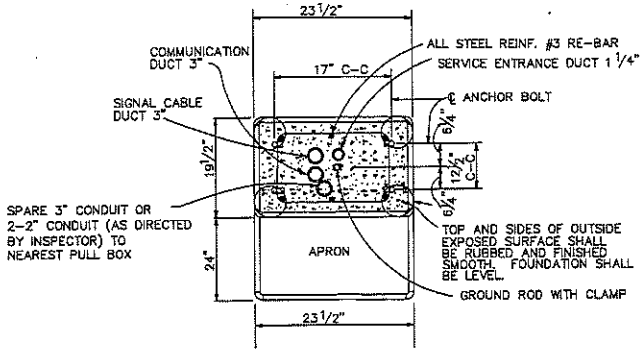
342-HOUSING 1 DETAIL
TOP VIEW



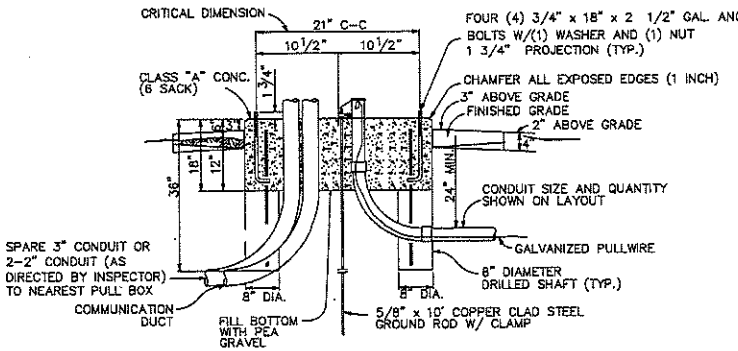
APRON
SIDE VIEW



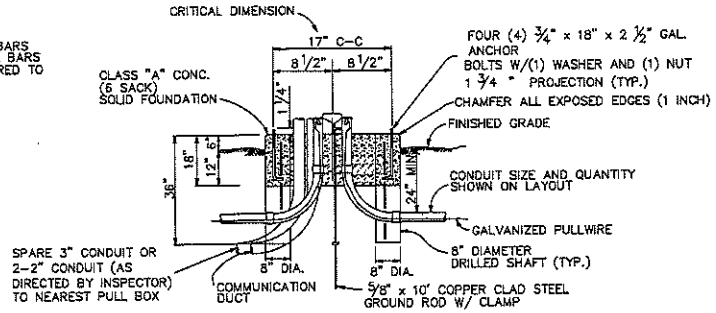
APRON DETAIL
TOP VIEW



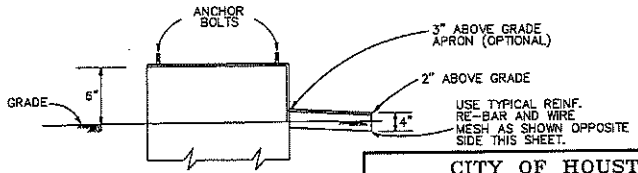
303 DETAIL



342-HOUSING 1 DETAIL
SIDE VIEW



303 DETAIL
SIDE VIEW



303 DETAIL

ALL CONDUIT ELBOWS TO BE RGS

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

CONTROLLER FOUNDATIONS
(SHEET 1 OF 3)

(NOT TO SCALE)

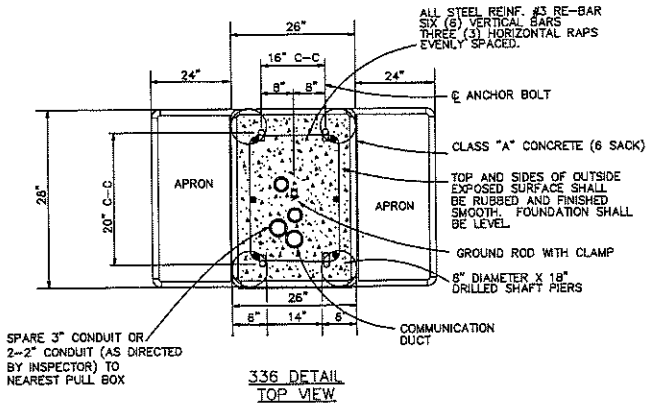
CITY TRAFFIC ENGINEER

CITY ENGINEER

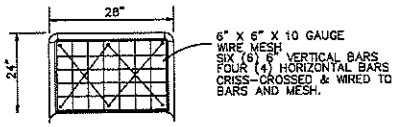
DIRECTOR OF HOUSTON PUBLIC WORKS

EFF DATE: JUL-01-2018

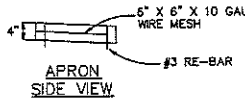
DWG NO: 02893-10A



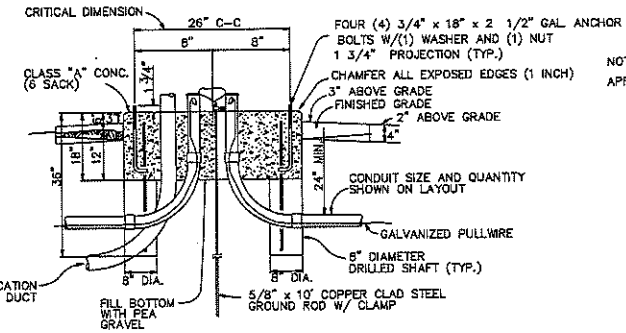
336 DETAIL
TOP VIEW



APRON DETAIL
TOP VIEW

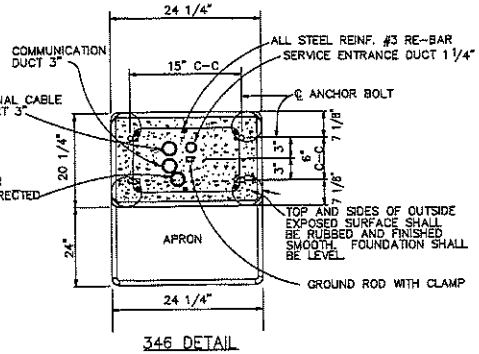


APRON
SIDE VIEW

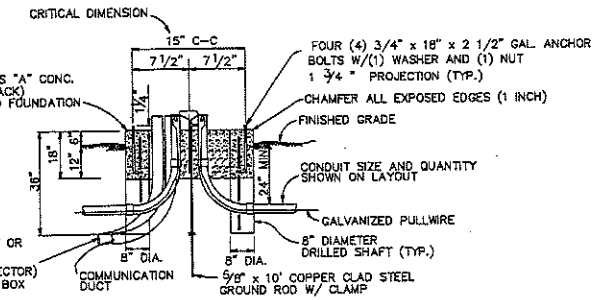


336 DETAIL
SIDE VIEW

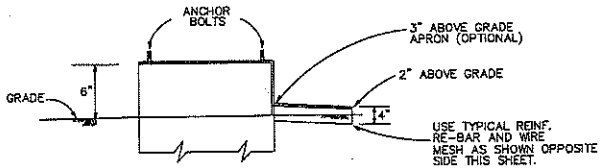
NOTE:
APRON TO BE INSTALLED IF NEEDED.



346 DETAIL



346 DETAIL
SIDE VIEW



346 DETAIL

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

CONTROLLER FOUNDATIONS
(SHEET 2 OF 3)

(NOT TO SCALE)

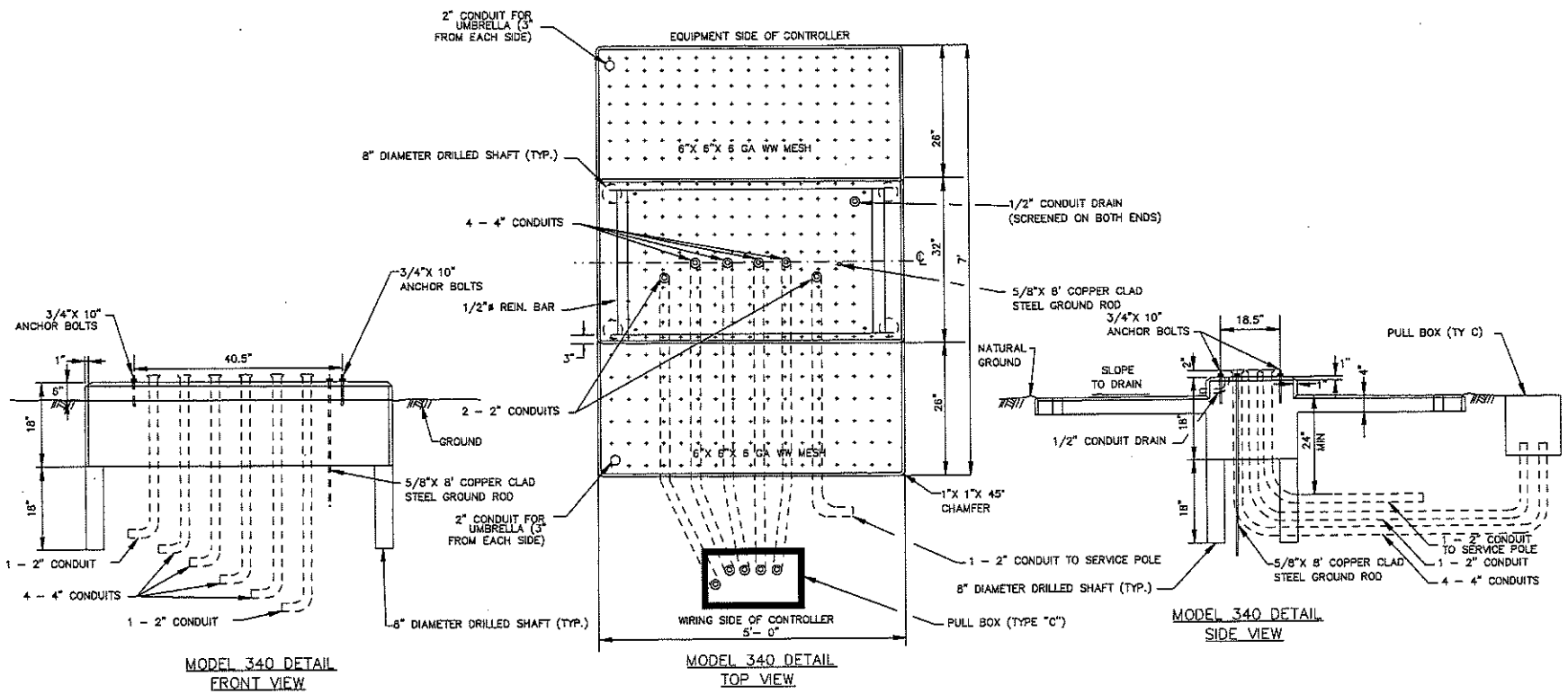
CITY TRAFFIC ENGINEER

CITY ENGINEER

DIRECTOR OF HOUSTON PUBLIC WORKS

EFF DATE: JUL-01-2018

DWG NO: 02893-108



ALL CONDUIT ELBOWS TO BE RGS

CONTROLLER FOUNDATION NOTES:

1. ALL CONCRETE TO BE IN ACCORDANCE WITH CITY OF HOUSTON SPECIFICATION SECTION 03310.
2. SET THE TOP OF THE STEP OF THE CONTROLLER FOUNDATION NO LOWER THAN THE LEVEL OF THE PAVEMENT SURFACE. ANY NECESSARY ADJUSTMENT SHALL BE APPROVED BY THE ENGINEER.
3. CENTER THE CABINET ON THE FOUNDATION.
4. THE FOUNDATION SHALL BE SUPPORTED BY UNDISTURBED SOIL OR BY SOIL THAT HAS BEEN COMPACTED TO 90% PROCTOR DENSITY IN 6" LIFTS.

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

CONTROLLER FOUNDATIONS
(SHEET 3 OF 3)

(NOT TO SCALE)

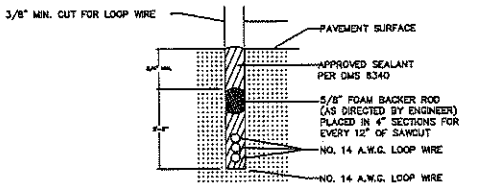
CITY TRAFFIC ENGINEER

CITY ENGINEER

DIRECTOR OF HOUSTON PUBLIC WORKS

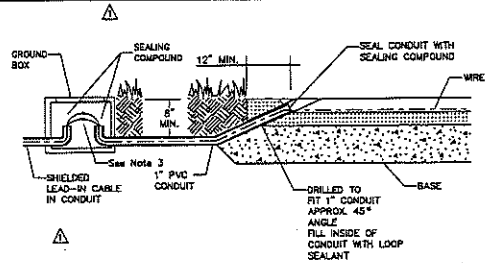
EFF DATE: JUL-01-2018

DWG NO: 02893-10C

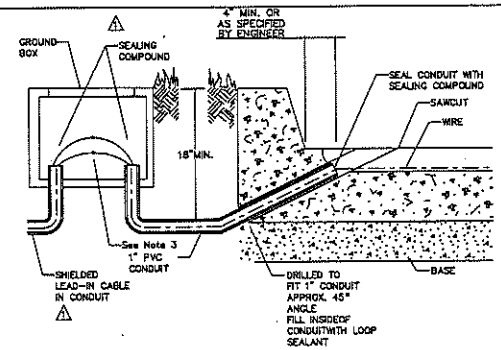


LOOP SAW CUT CROSS-SECTION

* SAWCUTS IN BRIDGE DECKS ARE TYPICALLY 1" DEPTH MAXIMUM
SAWCUTS IN BRIDGE DECKS AND ACROSS EXPANSION JOINTS SHALL BE AS APPROVED BY ENGINEER

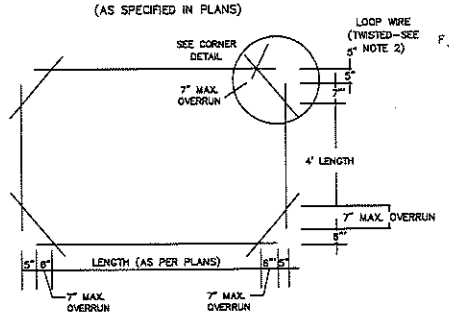


TYPICAL LEAD IN CONFIGURATION (WITHOUT CURBING)

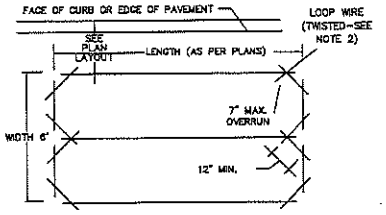


TYPICAL LEAD IN CONFIGURATION (WITH CURBING)

TYPICAL VEHICULAR LOOP DETECTOR LAYOUT
(AS SPECIFIED IN PLANS)

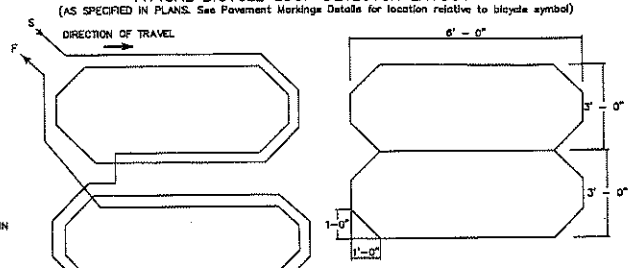


RECTANGULAR



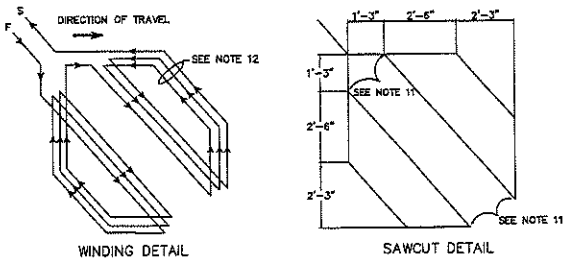
QUADRAPOLE

TYPICAL BICYCLE LOOP DETECTOR LAYOUT
(AS SPECIFIED IN PLANS. See Pavement Markings Details for location relative to bicycle symbol)



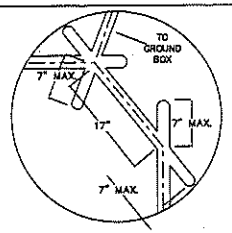
WINDING DETAIL SAWCUT DETAIL

QUADRUPOLE (Q) TYPE LOOP DETECTOR CONFIGURATION

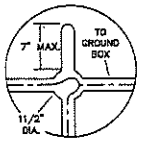


WINDING DETAIL SAWCUT DETAIL

DIAGONAL SLASHED (D) TYPE LOOP DETECTOR CONFIGURATION



RECTANGULAR & HEXIGON LOOP
SAWCUT CORNER DETAIL
7" OVERRUN BASED ON
24" DIAMETER SAW BLADE



RECTANGULAR & HEXIGON LOOP (ALT.)
DRILLED CORNER DETAIL

TYPICAL CORNER DETAILS

GENERAL NOTES:

1. The pavement cut is to be made with a concrete saw to neat lines and loose material removed. The cut shall be clean and dry when the wire and sealing compound is placed.
2. Loop wire shall be 14 AWG Stranded Type XHHW. Wire from the loop to the ground box shall be twisted a minimum of 5 turns per foot. No splices shall be permitted in the loop or in the run to the ground box.
3. The home run cable from the pull box to the controller shall be IMSA 50-2 shielded cable and shall be soldered to the loop wire. The solder joints shall be sealed with Scotchcast or other method acceptable to the Engineer. The shield shall be grounded only at the controller end. Loop home run cable shall be two conductor 14 AWG shielded, Type XHHW.
4. All wire placed in the saw cut shall be sealed by fully encapsulating it in a sealant acceptable to the Engineer. Sealing compound shall be in accordance with DMS 6340.
5. The loop location, configuration and number of turns shall be as indicated on the plans or as directed by the Engineer.

Recommended Number of Turns for Loop Detectors

LOOPS PERIMETER SIZE (FT.)	NUMBER OF TURNS	APPROXIMATE LOOP SIZES INCLUDED
24' or Less	3 or 4	5' x 5', 6' x 6'
25' - 110'	2 or 3	6' x 10', 6' x 45'
110' or More	1 or 2	6' x 50' or Longer

6. A separate saw cut shall be made from each loop to the edge of pavement or as specified by the Engineer.
7. Splices between the loop lead-in cable and loop detector shall be made only in the ground box near the loop it is serving.
8. Circular loops may use prewound loops encased in continuous pvc tubing. Sawcut width may be adjusted to accommodate tubing.
9. The lead-in wire in the circular loop shall be coiled at the 3 inch drilled corner to reduce bending stress.
10. Loop duct may be used as specified by Engineer. For additional information refer to "Texas Traffic Signal Detector" manual, TTI Report 1163-1.
11. Round corners of acute angles to prevent damage to conductors.
12. Install 3 turns when only one type D loop is on a single channel. Install 5 turns when one type D is connected w/3-6'x6' loops on a single channel.

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

LOOP DETECTOR INSTALLATION DETAILS

(NOT TO SCALE)

CITY TRAFFIC ENGINEER

CITY ENGINEER

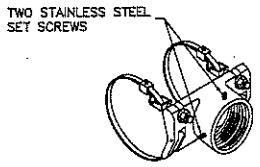
DIRECTOR OF HOUSTON PUBLIC WORKS

EFF. DATE: JUL-01-2018

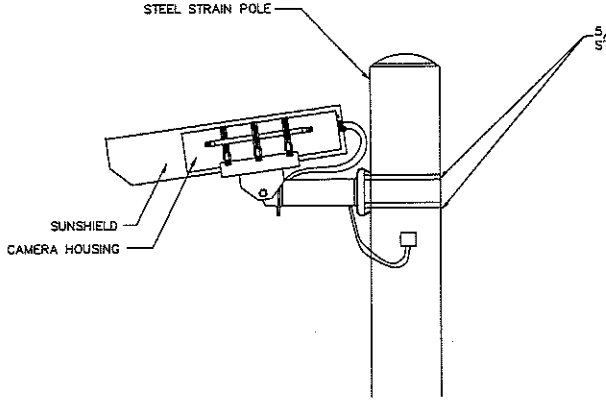
DWG NO: 02893-11

VIDEO DETECTION NOTES

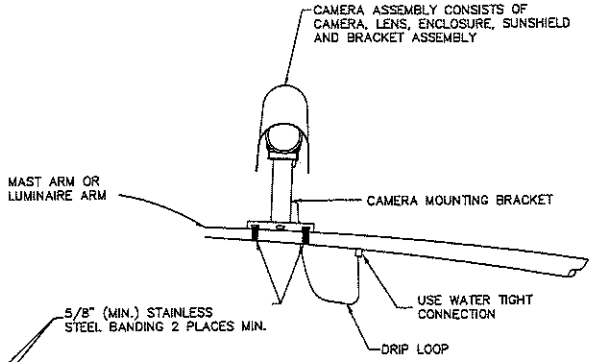
1. VIDEO DETECTION PROCESSOR UNIT SHALL BE INSTALLED INSIDE CONTROLLER CABINET.
2. VIDEO DETECTION CAMERA & BRACKET SHALL BE INSTALLED AS DETAILED OR AS DIRECTED BY THE VIDEO DETECTION SUPPLIER.
3. CAMERAS SHALL BE MOUNTED AS FAR OVER THE ROADWAY AS POSSIBLE.
4. 5/8" (MIN.) STAINLESS STEEL BANDING MATERIAL SHALL BE USED TO INSTALL CAMERA MOUNTS.
5. WHEN AIMING CAMERA, HORIZON SHALL NOT BE VISIBLE IN THE FIELD OF VIEW.
6. CAMERA ENCOSURE ASSEMBLY SHALL BE ROTATABLE AFTER INSTALLATION TO PROVIDE PROPER ALIGNMENT.
7. ALL CABLE ENTRY AND EXIT POINTS IN THE MAST ARM AND/OR POLES SHALL BE WATER TIGHT.

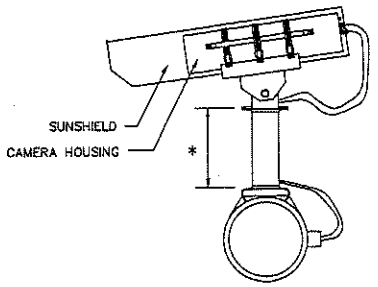


BAND MOUNT BRACKET DETAIL



POLE MOUNT





SIDE VIEW

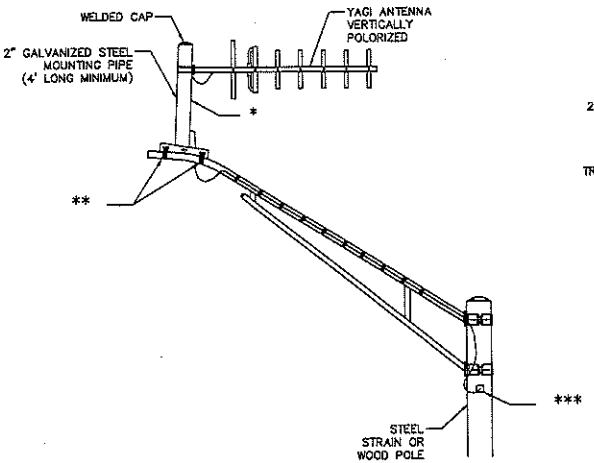
* 4.0' PIPE EXTENSION WHEN MOUNTED ON TRAFFIC SIGNAL MAST ARM

CITY OF HOUSTON HOUSTON PUBLIC WORKS	
VIDEO CAMERA MOUNTING DETAILS (NOT TO SCALE)	
CITY TRAFFIC ENGINEER CITY ENGINEER	DIRECTOR OF HOUSTON PUBLIC WORKS
EFF DATE: JUL-01-2018	DWG NO: 02693-12

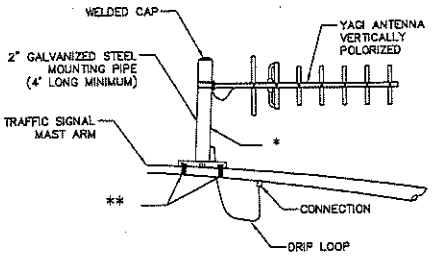
NOTES FOR SPREAD SPECTRUM ANTENNAS:

1. MOUNT ANTENNAS TO PROVIDE THE HIGHEST LEVEL OF RELIABILITY BETWEEN SENDING AND RECEIVING UNITS.
2. PERFORM A PATH STUDY TO DETERMINE EXACT MOUNTING LOCATION OF ANTENNAS BY RADIO SUPPLIER.
3. INSTALL ANTENNAS AS DETAILED OR AS DIRECTED BY THE SPREAD SPECTRUM RADIO SUPPLIER.
4. FURNISH MOUNTING BRACKETS FOR ANTENNAS ATTACHED TO VERTICAL PIPE AS RECOMMENDED BY SPREAD SPECTRUM RADIO SUPPLIER.
5. UNLESS NOTED, USE 5/8" STAINLESS STEEL BANDING MATERIAL TO INSTALL ANTENNA MOUNTS.
6. PROVIDE WATER TIGHT CABLE ENTRY AND EXIT POINTS IN THE TRAFFIC SIGNAL MAST ARM AND/OR POLES.
7. FOR SPREAD SPECTRUM COAX OR HELIAX CABLE ATTACHED TO LUMINAIRE ARM, PROVIDE UV STABILIZED TIE-WRAP THAT IS APPROVED FOR OUTDOOR USE.

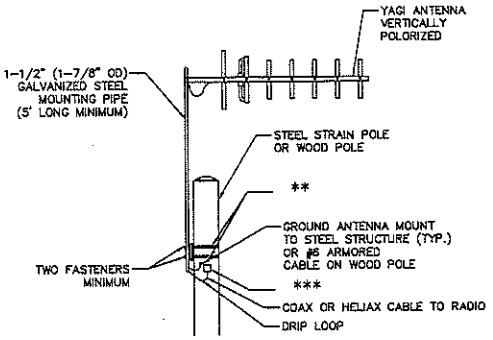
*	4.0' PIPE EXTENSION WHEN MOUNTED ON TRAFFIC SIGNAL MAST ARM OR LUMINAIRE ARM.
**	5/8" (MIN.) STAINLESS STEEL BANDING 2 PLACES MIN.
***	ENTRY INTO STEEL POLE OR CONDUIT WEATHERHEAD ON WOOD POLE



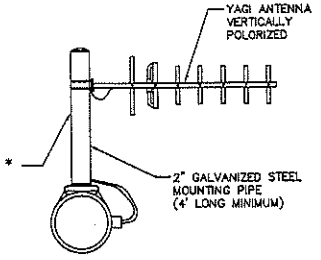
LUMINAIRE ARM MOUNT



MAST ARM MOUNT



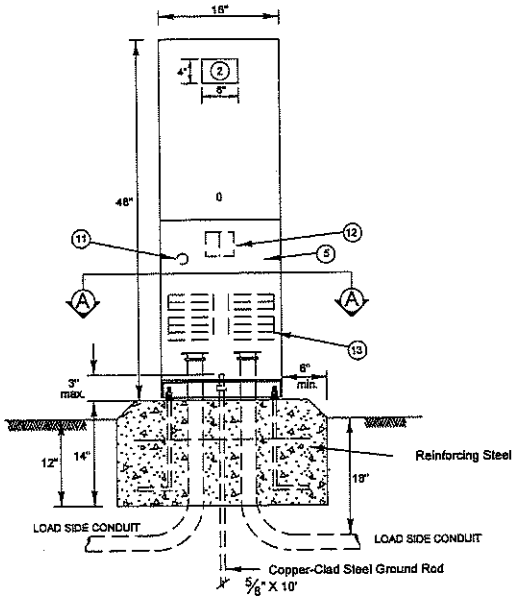
POLE MOUNT



SIDE VIEW

BAND MOUNT BRACKET DETAIL

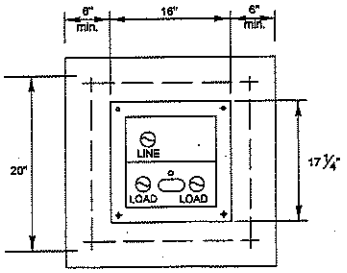
CITY OF HOUSTON HOUSTON PUBLIC WORKS	
ANTENNA MOUNTING DETAILS (NOT TO SCALE)	
CITY TRAFFIC ENGINEER CITY ENGINEER	DIRECTOR OF HOUSTON PUBLIC WORKS
EFF DATE: JUL-01-2018	DWG NO: 02893-13



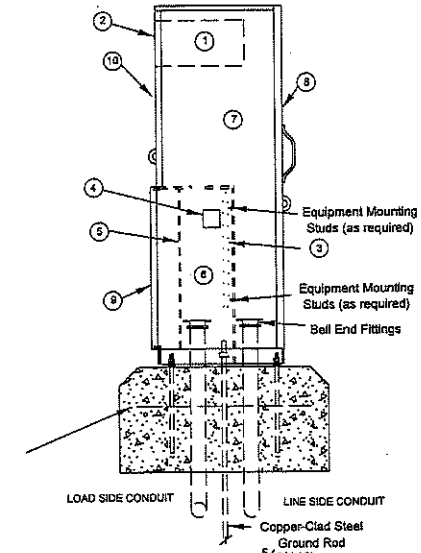
NOTE: ELLS IN FOUNDATION ARE RIGID METAL, SIZE CALLED FOR ON THE PLANS. EXTENSION CONDUITS FROM THESE ELLS MAY BE PVC, PROVIDED ENDS OF RIGID METAL CONDUITS ARE MORE THAN 2 IN. BELOW TOP OF CONCRETE FOUNDATION. WHERE EXTENSION CONDUITS ARE METAL, GROUNDING BUSHING MUST BE INSTALLED AND A BONDING JUMPER PROPERLY TERMINATED.

FRONT VIEW

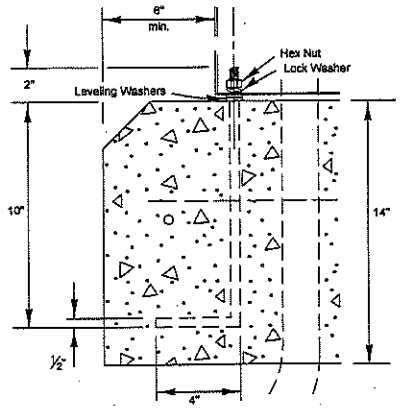
TY C SHOWN, TY A SIMILAR EXCEPT THAT TY A SHALL HAVE INDIVIDUAL CIRCUIT BREAKERS MOUNTED ON A EQUIPMENT MOUNTING PANEL. CB HANDLES SHALL PROTRUDE THROUGH HINGED DEADFRONT TRIM.



SECTION A-A



SIDE VIEW



ANCHOR BOLT DETAIL

GENERAL NOTES:

1. THE PEDESTAL SERVICE SHALL BE UL TYPE 3R, AND SHALL BE CONSTRUCTED OF A MINIMUM OF 12 GAUGE STAINLESS STEEL OR ALUMINUM AS REQUIRED. STAINLESS STEEL SHALL NOT BE PAINTED. FOR ALUMINUM, THE FINISH SHALL BE AN ELECTROSTATIC APPLIED POLY-URETHANE BAKED ON POWDER, LIGHT GREEN IN COLOR, OR COLOR AS SHOWN ELSEWHERE AND AS APPROVED BY THE ENGINEER. THE FRONT OF THE INTERIOR DEAD FRONT TRIM SHALL BE PERMANENTLY LABELED, "DANGER HIGH VOLTAGE" WITH OSHA STYLE LABEL. THE EXTERIOR OF THE PEDESTAL SERVICE DOOR SHALL BE PERMANENTLY LABELED WITH A PLACARD AS TO ITS USE (I.E. ROADWAY LIGHTING, TRAFFIC SIGNALS, ETC.). PLACARD SHALL BE NEAT AND PROFESSIONAL IN APPEARANCE. LETTERING SHALL BE 1" MINIMUM HEIGHT.
2. UTILITY ACCESS DOOR SHALL HAVE STAINLESS STEEL PIANO HINGE AND PROVISIONS FOR PADLOCKING.
3. PEDESTAL DOOR SHALL HAVE STAINLESS STEEL PIANO HINGE AND STAINLESS STEEL LATCH WITH PROVISIONS FOR PADLOCKING.
4. METER ACCESS SHALL BE HINGED AND CAPABLE OF PADLOCKING.
5. ALL MOUNTING HARDWARE AND INSTALLATION DETAILS OF SERVICES SHALL BE IN ACCORDANCE WITH UTILITY COMPANY SPECIFICATIONS. THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING THE LOCAL UTILITY COMPANY AND OBTAINING THEIR APPROVAL OF PEDESTAL DETAILS PRIOR TO MAKING SUBMITTAL TO THE CITY AND PRIOR TO CONSTRUCTING THE ELECTRICAL PEDESTAL SERVICE. ANY CHANGES REQUIRED BY THE UTILITY COMPANY SHALL BE NOTED ON THE SUBMITTALS.
6. METER SOCKET SHALL BE A MINIMUM OF 100 AMP RATING AND SHALL COMPLY WITH THE LOCAL UTILITY REQUIREMENTS.
7. PHOTOELECTRIC CONTROL SHALL MEET THE REQUIREMENTS AS SHOWN ON ED(5). SHIELD TO CONTROL STRAY LIGHT IS ALLOWABLE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER OPERATION OF THE PHOTO-ELECTRIC CONTROL. THE CONTRACTOR SHALL MOVE AND/OR ADJUST OR SHIELD THE PHOTOCELL FROM STRAY OR AMBIENT NIGHTTIME LIGHT OR SHALL MAKE ANY OTHER ADJUSTMENTS REQUIRED FOR PROPER OPERATION. THE PHOTOCELL SHALL FACE NORTH WHEN PRACTICABLE. UNLESS OTHERWISE SHOWN ON THE PLANS, THE PHOTOCELL SHALL TURN ON THE ILLUMINATION SYSTEM AT 1.0 +(-) 0.5 FOOTCANDLE AND TURN OFF THE ILLUMINATION SYSTEM AT TWO FOOTCANDLES HIGHER THAN TURN ON.
8. THE CONTROL STATION (H-O-A SWITCH) SHALL BE AS SHOWN ON TxDOT STANDARD ED(5) EXCEPT THAT H-O-A SWITCH OPERATING HANDLE SHALL PROTRUDE THROUGH HINGED DEADFRONT TRIM AND NEMA 1 ENCLOSURE WILL NOT BE REQUIRED.
9. CONCRETE FOR PEDESTAL SERVICE FOUNDATION SHALL BE CLASS A OR C , AND SHALL BE IN ACCORDANCE WITH TxDOT ITEM 420, "CONCRETE STRUCTURES", EXCEPT THAT CONCRETE WILL NOT BE PAID FOR DIRECTLY BUT SHALL BE CONSIDERED INCIDENTAL.
10. REINFORCING STEEL SHALL BE #4 REBAR IN ACCORDANCE WITH TxDOT ITEM 440, "REINFORCING STEEL".
11. ANCHOR BOLTS SHALL BE A36M55 IN ACCORDANCE WITH ITEM 449, "ANCHOR BOLTS". ANCHOR BOLTS SHALL BE ½ INCH X 12 INCHES X 4 INCHES (DIA. X LENGTH X HOOK LENGTH).
12. ALL CONDUIT AND CONDUCTORS ATTACHED TO THE PEDESTAL SERVICE AND WITHIN 12 INCHES OF THE PEDESTAL SERVICE WILL NOT BE PAID FOR DIRECTLY, BUT SHALL BE SUBSIDIARY TO THE PEDESTAL SERVICE. ALL SERVICE CONDUIT AND CONDUCTORS FROM THE UTILITY COMPANY TRANSFORMER TO A POINT 12 INCHES FROM THE THE PEDESTAL SERVICE SHALL BE PAID FOR SEPARATELY. SERVICE CONDUIT SHALL BE THE SIZE AND TYPE AS SHOWN IN THE ELECTRICAL SERVICE DATA.
13. DIMENSIONS MAY VARY TO ACCOMODATE REQUIRED EQUIPMENT, UTILITY COMPANY REQUIREMENTS, OR MANUFACTURER'S STANDARD EQUIPMENT DIMENSIONS. THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER FOR APPROVAL SIX (6) COPIES OF BROCHURES AND/OR DRAWINGS OF THE PEDESTAL SERVICE TO BE SUPPLIED, INCLUDING ACTUAL DIMENSIONS, AND A PAINT COLOR SAMPLE.
14. A SEPARATE ENCLOSURE AS SHOWN ON TxDOT STANDARD ED(4) OR ED(5) FOR PHOTOCELL SHALL NOT BE USED FOR PEDESTAL SERVICES. PHOTOCELL SHALL BE INSTALLED AS SHOWN HERE.
15. THE PEDESTAL DOOR SHALL HAVE A MECHANICALLY ATTACHED DATA POCKET ON THE INSIDE. POCKET SHALL BE EITHER METAL OR THEMOPLASTIC AND SHALL MEASURE AT LEAST 12 INCHES BY 12 INCHES. THE CONTRACTOR SHALL PREPARE AND SUBMIT A SCHEMATIC DRAWING UNIQUE TO AN INDIVIDUAL SERVICE. THE APPROVED DRAWING SHALL BE LAMINATED AND PLACED IN THE DOCUMENT POCKET OF THE SERVICE AT THE TIME OF SHIPMENT TO THE JOB SITE. ALL APPLICABLE WIRING DIAGRAMS AND PLAN SHEET LAYOUTS FOR ALL EQUIPMENT AND BRANCH BREAKER CIRCUITS SUPPLIED BY THAT SERVICE SHALL ALSO BE LAMINATED AND PLACED IN THE DOCUMENT POCKET PRIOR TO SHIPPING.
16. GROUND ROD CLAMP TO BE UL LISTED FOR DIRECT BURIAL. ALL NON-CONDUCTIVE COATING TO BE REMOVED FROM GROUND ROD WIRE TO BE #8 AWG SOLID COPPER. METAL CONDUIT ELLS TO HAVE GROUNDING BUSHING AND BONDING JUMPERS CORRECTLY INSTALLED.
17. ALL CONDUITS ENTERING ENCLOSURES FROM UNDERGROUND MUST BE SEALED. SILICONE SHALL NOT BE ALLOWED.
18. ALL CONDUCTORS SHALL BE MEGGED AND PULL TESTED. TRAFFIC SIGNAL CABLE NOT TO BE MEGGED AFTER CONNECTION, AS ELECTRONICS WILL BE DAMAGED.
19. TOP OF CONCRETE FOUNDATION TO BE FINISHED IN A NEAT AND WORKMAN LIKE MANNER. IF LEVELING WASHERS ARE USED, NO MORE THAN ⅛ IN. HEIGHT SHALL BE USED AT ANY ONE CORNER. MAXIMUM DIP OR RISE IN FOUNDATION IS NOT TO EXCEED ⅛ IN PER FOOT. WHEN PROPERLY INSTALLED, TOP OF SERVICE ENCLOSURE SHALL READ LEVEL FRONT TO BACK AND SIDE TO SIDE WITHIN ¼ IN. ROCKING OR MOVEMENT OF THE SERVICE ENCLOSURE SHALL BE PREPARED BY THE CONTRACTOR AT NO COST TO THE STATE.
20. LIQUID TIGHT FLEXIBLE METAL CONDUIT SHALL NOT BE ALLOWED ON PS TYPE SERVICES.

LEGEND

1. METER SOCKET, (when required)
2. METER SOCKET 4" x 6" Plexiglas window installed in the lid.
3. EQUIPMENT MOUNTING PANEL
4. PHOTO ELECTRIC CONTROL WINDOW, (when required)
5. HINGED DEADFRONT TRIM
6. LOAD SIDE CONDUIT AREA
7. LINE SIDE CONDUIT AREA
8. UTILITY ACCESS DOOR, with handle
9. PEDESTAL DOOR
10. HINGED METER ACCESS
11. CONTROL STATION (H-O-A Switch)
12. MAIN DISCONNECT
13. BRANCH CIRCUIT BREAKERS

CITY OF HOUSTON
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ELECTRICAL SERVICE SUPPORT
PEDESTAL SERVICE TYPE PS

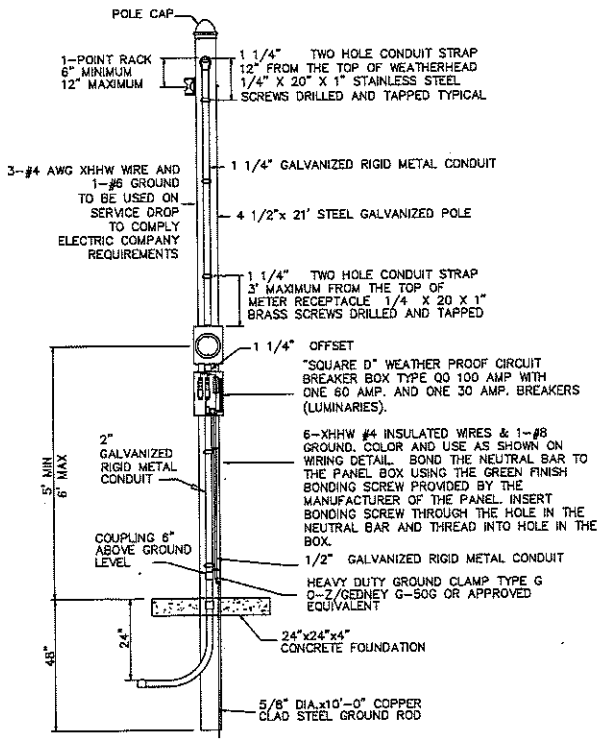
(NOT TO SCALE)

CITY TRAFFIC ENGINEER
CITY ENGINEER

DIRECTOR OF
HOUSTON PUBLIC WORKS

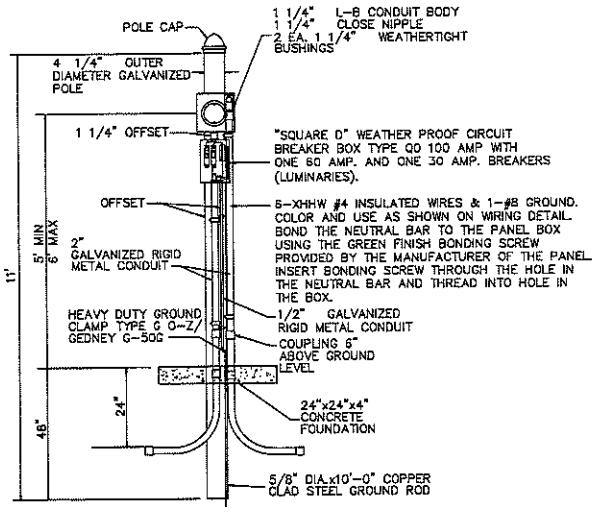
EFF DATE: JUL-01-2018

DWG NO: 02893-14



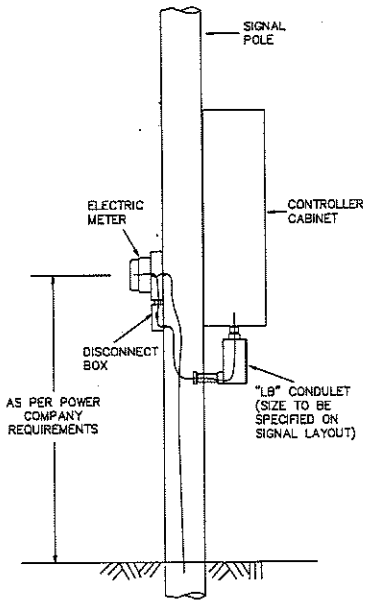
METER POLE ASSEMBLY
(AERIAL SERVICE)

NOT TO SCALE



METER POLE ASSEMBLY
(UNDERGROUND SERVICE)

NOT TO SCALE

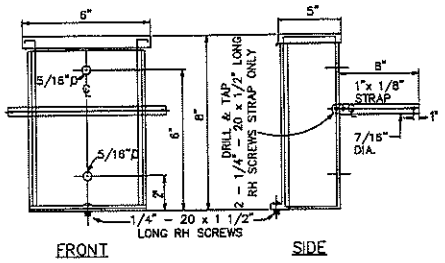


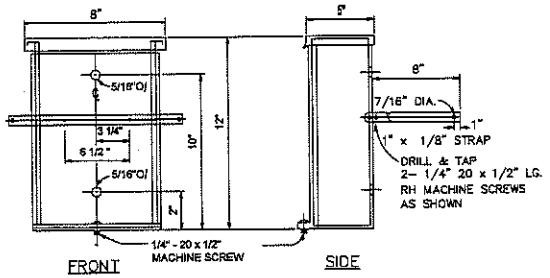
POLE MOUNTED CONTROLLER
& ELECTRIC METER DETAIL

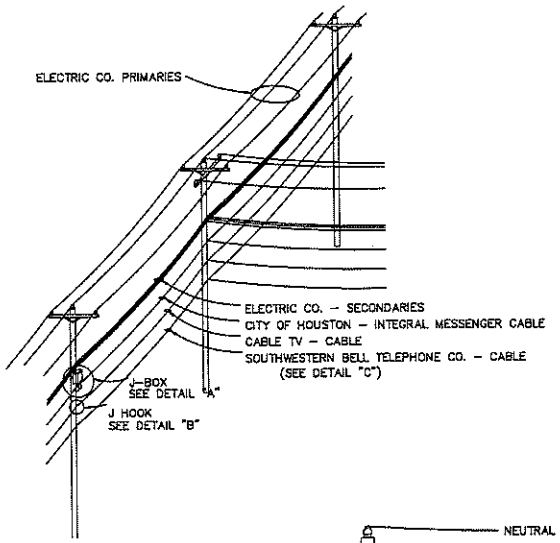
NOTES:

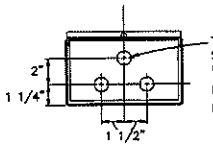
1. CLEARANCE FOR SERVICE ENTRANCE AND DROP CONDUCTORS 12 FT. ABOVE FINISHED GRADE, SIDEWALKS, RESIDENTAL DRIVEWAYS OR AREAS WHERE TRUCK TRAFFIC IS NOT ENCOUNTERED TRUCKS SHALL BE DEFINED AS ANY VEHICLE EXCEEDING 8 FT IN HEIGHT.
2. 18 FT. OVER NON-RESIDENTAL DRIVEWAYS, PARKING LOTS, ALLEYS AND OTHER AREAS SUBJECT TO TRUCK TRAFFIC 22 FT. OVER PUBLIC STREETS AND ROADS.

CITY OF HOUSTON HOUSTON PUBLIC WORKS	
METER LOOP (NOT TO SCALE)	
CITY TRAFFIC ENGINEER CITY ENGINEER	DIRECTOR OF HOUSTON PUBLIC WORKS
EFF DATE: JUL-01-2018	DWG NO: 02893-15



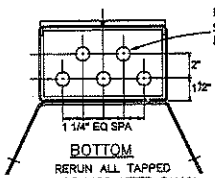






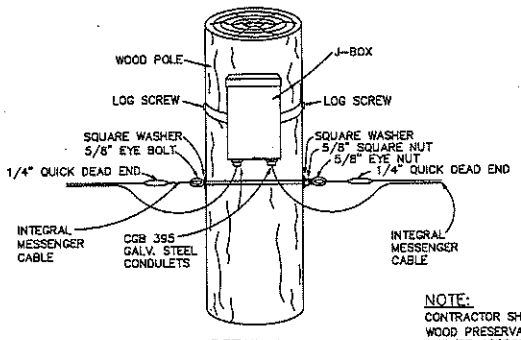
MATERIAL: 12 GA. SHEET STEEL
FASTENINGS: TO BE NON-FERROUS MATL.
FINISH: COMPLETE BOX SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION, PER ASTM 123-68 OR LATEST REVISION WITH 2 oz. PER SQ. FT. OF COATED AREA. RERUN ALL TAPPED OPENINGS.

RAINTIGHT JUNCTION BOX
8" X 6" X 5" O.A. DIM.
3 - 1 /8" BOTTOM K.O.

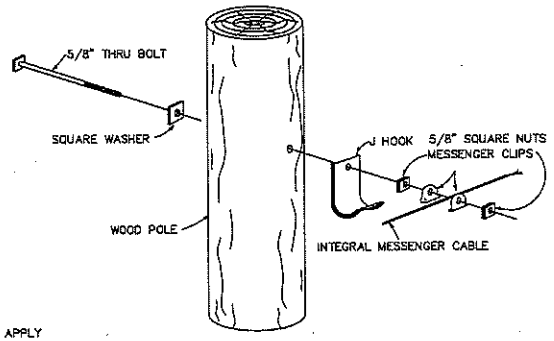


MATERIAL: 12 GA. SHEET STEEL
FASTENINGS: TO BE NON-FERROUS MATL.
FINISH: COMPLETE BOX SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION, PER ASTM 123-68 OR LATEST REVISION WITH 2 oz. PER SQ. FT. OF COATED AREA.
RERUN ALL TAPPED OPENINGS AFTER GALVN.

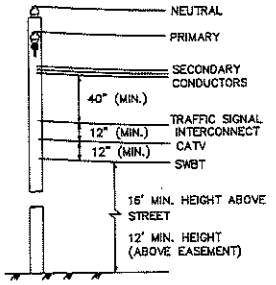
RAINTIGHT JUNCTION BOX
8" X 5" X 12" O.A. DIM.
5 - 1 3/8" BOTTOM K.O.



DETAIL A



DETAIL B



DETAIL C

NOTE:
CONTRACTOR SHALL TRIM TREES AND APPLY WOOD PRESERVATIVE AS DIRECTED BY ENGINEER AND/OR APPROVED CITY OF HOUSTON REPRESENTATIVE.

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

HARDWIRE INTERCONNECT DETAILS

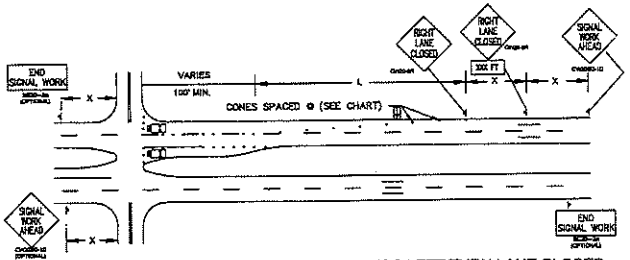
(NOT TO SCALE)

CITY TRAFFIC ENGINEER
CITY ENGINEER

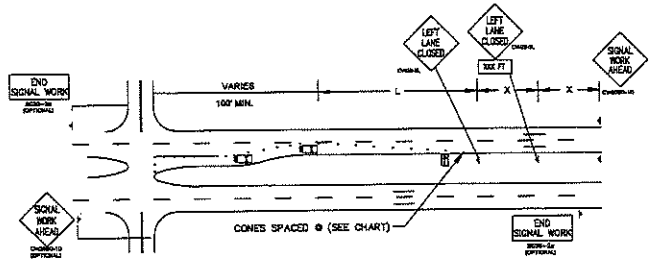
DIRECTOR OF
HOUSTON PUBLIC WORKS

EFF DATE: JUL-01-2018

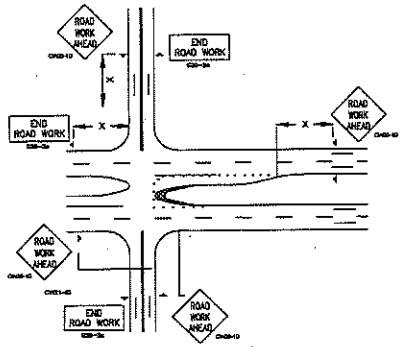
DWG NO: 02893-16



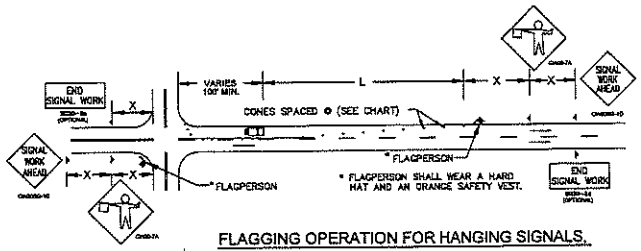
ONE LANE CLOSURE W/ RIGHT LANE AND/OR LEFT TURN LANE CLOSED



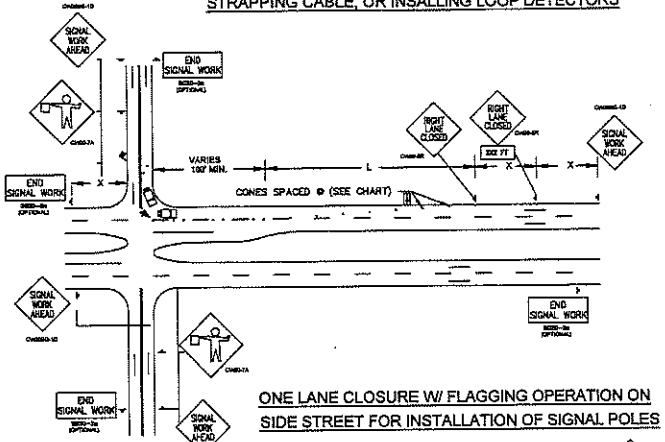
ONE LANE CLOSURE W/ LEFT LANE AND/OR LEFT TURN LANE CLOSED



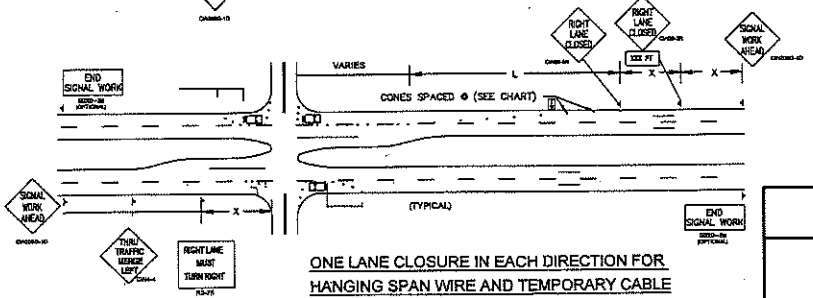
MEDIAN NOSE MODIFICATION



FLAGGING OPERATION FOR HANGING SIGNALS, STRAPPING CABLE, OR INSALLING LOOP DETECTORS



ONE LANE CLOSURE W/ FLAGGING OPERATION ON SIDE STREET FOR INSTALLATION OF SIGNAL POLES



ONE LANE CLOSURE IN EACH DIRECTION FOR HANGING SPAN WIRE AND TEMPORARY CABLE

TYPICAL TRANSITION LENGTHS
SUGGESTED MAXIMUM SPACING OF DEVICES

POSTED SPEED	FORMULA	MINIMUM DESIRABLE TAPER LENGTHS ** 10' OFFSET	11' OFFSET	12' OFFSET	SUGGESTED MAXIMUM SPACING OF DEVICE ON A TAPER	ON A TANGENT	MINIMUM SIGN SPACING X DISTANCE
30	$L=\frac{WS^2}{60}$	150'	165'	180'	30'	60'–75'	120'
35		205'	225'	245'	35'	70'–90'	160'
40		285'	295'	320'	40'	80'–100'	240'
45	L=WS	450'	495'	540'	45'	90'–110'	320'
50		500'	550'	600'	50'	100'–125'	400'
55		550'	605'	660'	55'	110'–140'	500'
60		600'	660'	720'	60'	120'–150'	600'

** TAPER LENGTHS HAVE BEEN ROUNDED OFF

L=LENGTH OF TAPER (FT.)
W=WIDTH OF OFFSET (FT.)
S=POSTED SPEED(MPH)

LEGEND

HEAVY WORK VEHICLE

FLASHING ARROW PANEL

NOTES:

1. ALL TRAFFIC CONTROL DEVICES SHALL BE INSTALLED IN ACCORDANCE WITH THE "TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES", LATEST REVISION.
2. THE MINIMUM LANE WIDTH ALLOWED IS 10 FEET. THE MINIMUM BUFFER ZONE BETWEEN THE WORK ZONE AN ADJACENT TRAFFIC IS 2 FEET.
3. FLORESCENT ORANGE SHALL BE THE BACK GROUND COLOR ON ALL WORK ZONE SIGNS.
4. THE CONTRACTOR SHALL REMOVE ADVANCE SIGNS WHEN NO CONSTRUCTION OPERATIONS ARE UNDERWAY.
5. OBSTRUCTIONS OR HAZARDS AT THE WORK AREA SHALL BE CLEARLY MARKED AND DELINEATED AT ALL TIMES.
6. ALL HOLES, TRENCHES OR OTHER HAZARDOUS AREAS SHALL BE ADEQUATELY PROTECTED BY LIGHTS OR OTHER PROTECTIVE DEVICES.
7. TRENCHES SHALL BE COVERED OR SURROUNDED WITH ORANGE PLASTIC CONSTRUCTION FENCE AS DIRECTED BY THE ENGINEER.
8. FLAGGER AND FCW20-7a SIGN MAY BE REQUIRED ACCORDING TO FIELD CONDITIONS.
9. VEHICLES PARKED IN ROADWAY SHALL BE EQUIPPED WITH TWO STROBES.

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

TRAFFIC CONTROL PLAN
FOR SIGNAL CONTRUCTION

(NOT TO SCALE)

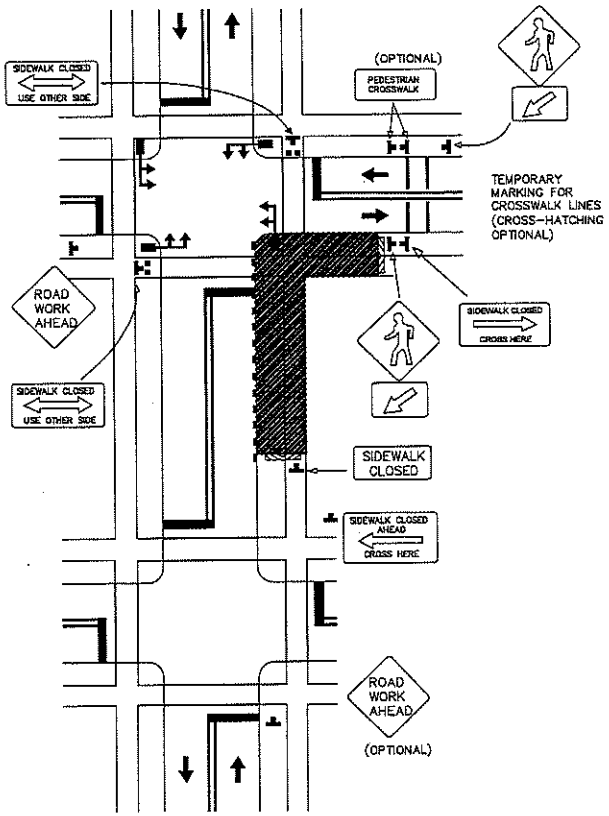
TRAFFIC ENGINEER
CITY ENGINEER

DIRECTOR OF
HOUSTON PUBLIC WORKS

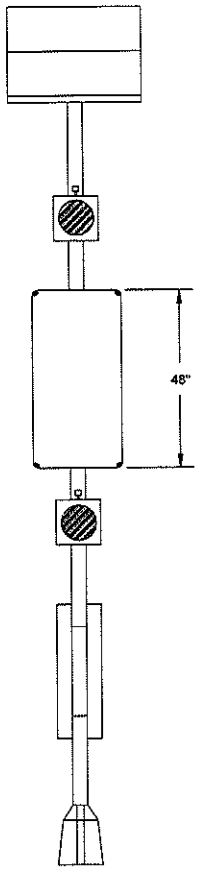
EFF DATE: JUL-01-2018

DWG NO: 02893-17

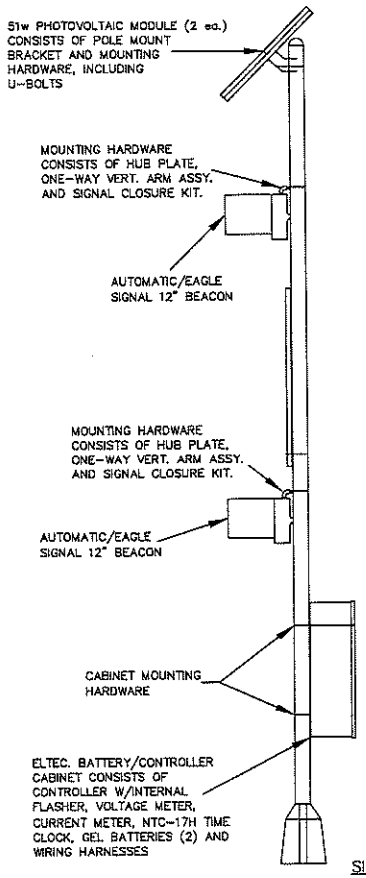
CROSSWALK CLOSURES AND PEDESTRIAN DETOURS



SOLAR SCHOOL ZONE FLASHING BEACON



FRONT VIEW

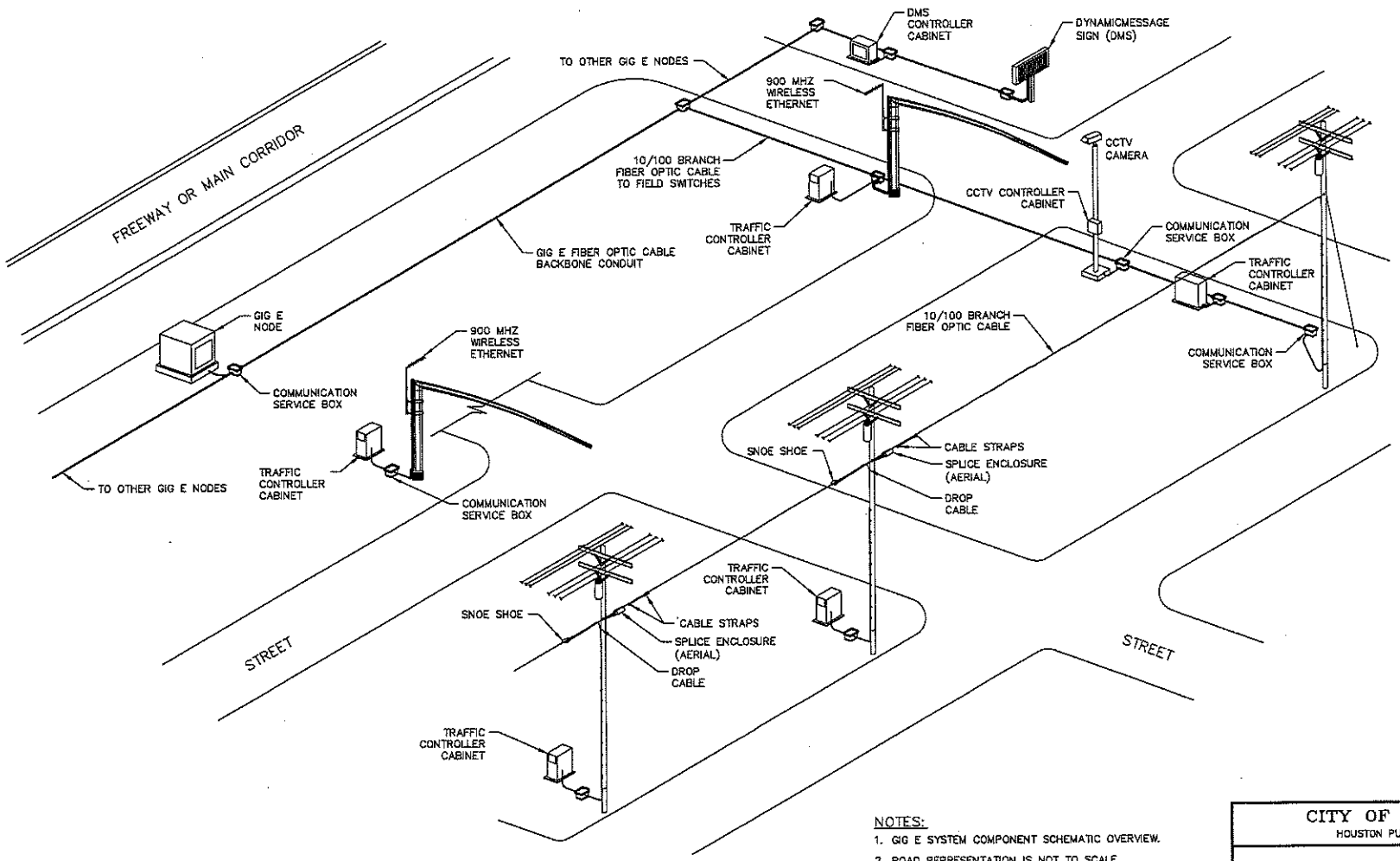


SIDE VIEW

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

CROSSWALK CLOSURES AND PEDESTRIAN DETOURS, SOLAR SCHOOL ZONE FLASHING BEACON
(NOT TO SCALE)

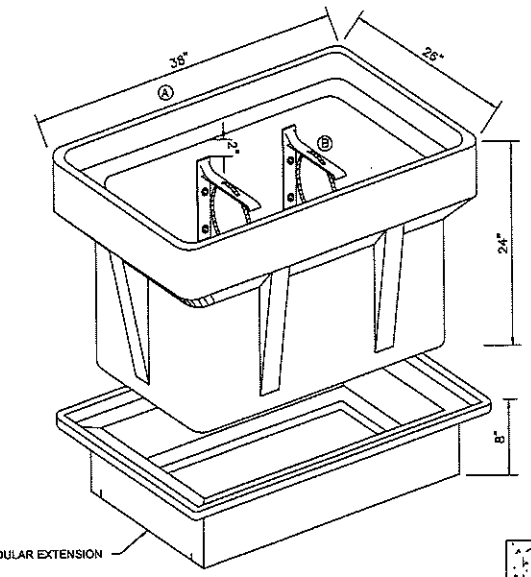
TRAFFIC ENGINEER CITY ENGINEER	DIRECTOR OF HOUSTON PUBLIC WORKS
EFF DATE: JUL-01-2018	DWG NO: 02893-18



NOTES:

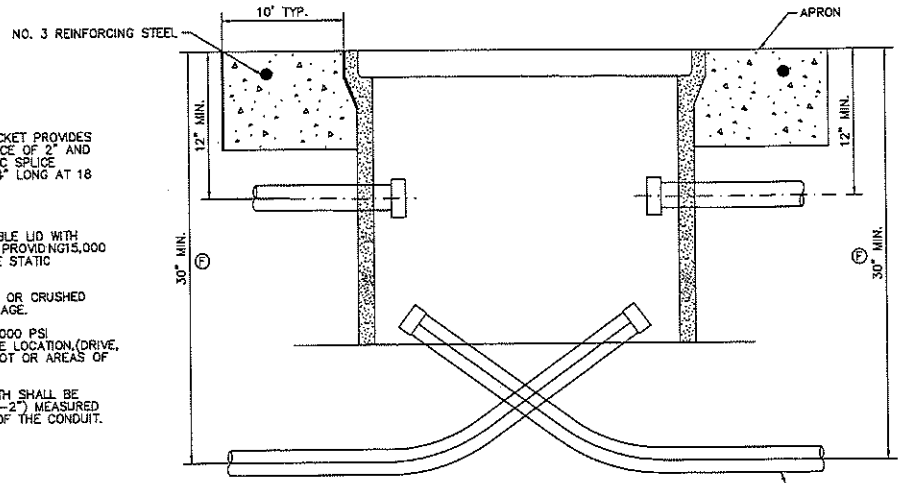
1. GIG E SYSTEM COMPONENT SCHEMATIC OVERVIEW.
2. ROAD REPRESENTATION IS NOT TO SCALE.
3. ALL ILLUSTRATED AERIAL CLEARANCES ARE PER NATIONAL ELECTRICAL CODE (N.E.C.)
4. GROUND HAS BEEN ILLUSTRATED AS TRANSPARENT TO VIEW SERVICE BOX & CONDUIT LOCATION.

CITY OF HOUSTON HOUSTON PUBLIC WORKS	
COMMUNICATIONS OVERVIEW (NOT TO SCALE)	
COTH TRAFFIC ENGINEER CITY ENGINEER	DIRECTOR OF HOUSTON PUBLIC WORKS
EFF DATE: JUL-01-2018	DWG NO: 02893-19

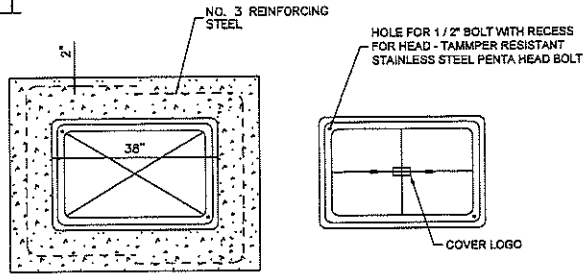


LEGEND

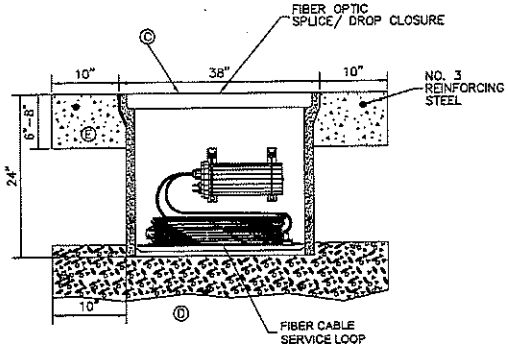
- Ⓐ SPLICE CLOSURE BRACKET PROVIDES MINIMUM LID CLEARANCE OF 2" AND SUPPORTS FIBER OPTIC SPLICE CLOSURE(8" DIA. X 24" LONG AT 18 LBS).
- Ⓑ NYLON TIES
- Ⓒ HEAVY DUTY REMOVABLE LID WITH LOCKING PROVISIONS, PROVIDING 15,000 LB. OVER 10" SQUARE STATIC LOAD SUPPORT.
- Ⓓ 6" TO 8" OF GROUND OR CRUSHED ROCK BED FOR DRAINAGE.
- Ⓔ CONCRETE APRON; 3,000 PSI AS REQUIRED FOR THE LOCATION.(DRIVE, SIDEWALK, PARKING LOT OR AREAS OF LIGHT TRAFFIC).
- Ⓕ CONDUIT BURIAL DEPTH SHALL BE 30" MIN. OR 12" (+/-2") MEASURED TO THE CENTERLINE OF THE CONDUIT.



SERVICE BOX CUT AWAY SIDE VIEW
(ACCEPTABLE CONDUIT TERMINATION)
(N.T.S.)



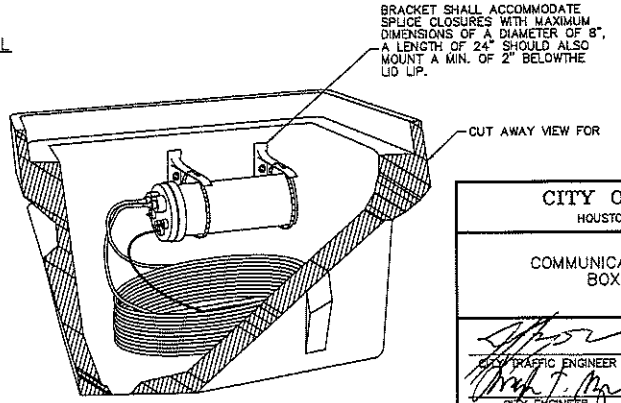
COMMUNICATION SERVICE BOX DETAIL
TOP VIEW
(N.T.S.)



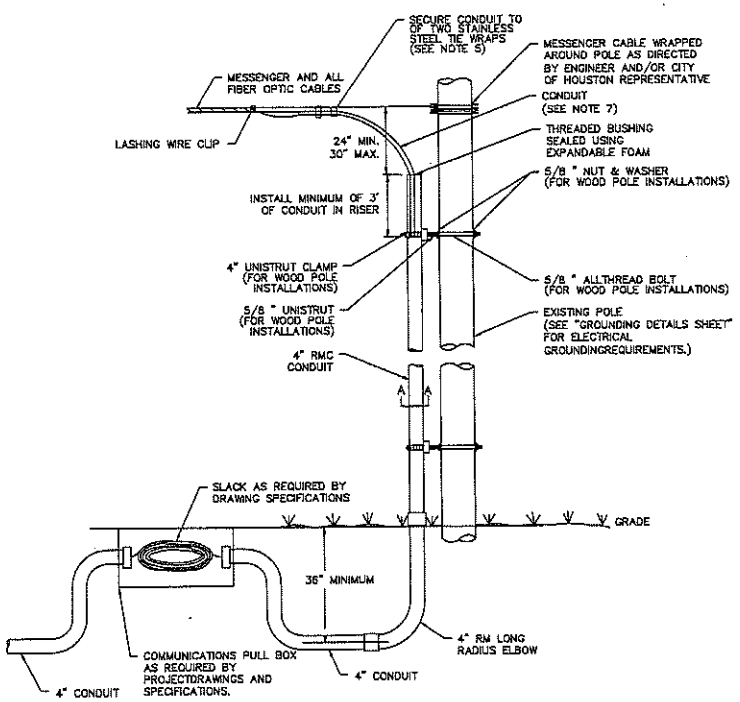
INSTALLED COMMUNICATION
SERVICE BOX DETAIL
(N.T.S.)

NOTE:

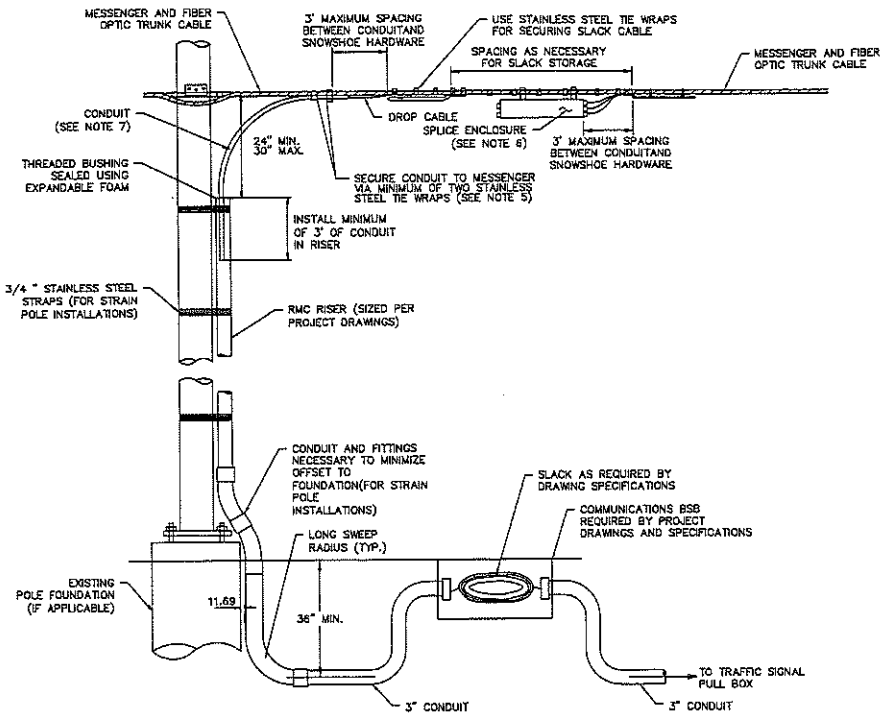
CROSS SECTION VIEW OF BOX IN ORDER TO VIEW DROP CLOSURE AND CABLE CONTAINED WITHIN.



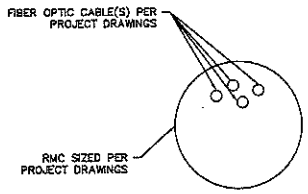
CITY OF HOUSTON HOUSTON PUBLIC WORKS	
COMMUNICATIONS SERVICE BOX DETAILS (NOT TO SCALE)	
TRAFFIC ENGINEER CITY ENGINEER	DIRECTOR OF HOUSTON PUBLIC WORKS
EFF DATE: JUL-01-2018	DWG NO: 02893-20



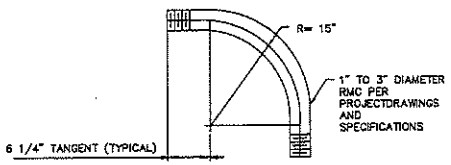
TYPICAL RIGID RISER ASSEMBLY
FOR TRUNK FIBER
AERIAL TO UNDERGROUND TRANSITIONS



TYPICAL RIGID RISER ASSEMBLY
FOR FIBER OPTIC DROP CABLE INSTALLATION



SECTION A-A



LONG RADIUS ELBOW DETAIL

NOTES:

1. THIS DETAIL SHALL BE UTILIZED WHERE APPLICABLE FOR ALL AERIAL SLACK STORAGE, AERIAL TO UNDERGROUND TRUNK CABLE TRANSITIONS, AND AERIAL SPLICING ACTIVITIES FOR TRUNK AND DROP CABLE INSTALLATIONS.
2. CABLE STORAGE AND MANAGEMENT WITHIN FIELD CABINETS SHALL BE PERFORMED BY SECURING FIBER OPTIC CABLE SLACK AND CONNECTORS IN THE TOP OF THE CABINENTS.
3. MINIMUM BEND RADII FOR ALL CONDUIT AND CONDUIT FITTINGS SHALL CONFORM TO THE REQUIREMENTS ESTABLISHED IN THE "LONG RADIUS ELBOW DETAIL" DRAWING.
4. SLACK CABLE STORAGE REQUIREMENTS SHALL BE IN ACCORDANCE WITH PROJECT DRAWINGS AND SPECIFICATIONS. SNOWSHOE HARDWARE UTILIZED SHALL BE MOORE OPTIRACK PART# MFSR24-HCK OR APPROVED EQUAL.
5. ALL TRUNK CABLE NOT DESIGNATED FOR SLACK STORAGE OR SPLICING ACTIVITIES SHALL BE OVERLASHED TO THE MESSENGER CABLE. ALL OTHER CABLE SHALL BE ATTACHED AERIALLY USING STAINLESS STEEL TIE WRAPS (PANDUIT PART# MLT 4H-LP OR APPROVED EQUAL).
8. SPLICE ENCLOSURES USED SHALL BE PART# 3M 2178 LS, L,OR LL AS NECESSARY TO ACCOMMODATE CABLES TO BE SPLICED. ALL CABLES SHALL ENTER THE ENCLOSURE FROM THE SAME END AND SHALL BE SPLICED IN BUTT CONFIGURATION UNLESS OTHERWISE DIRECTED BY THE ENGINEER AND/OR THE APPROVED CITY OF HOUSTON REPRESENTATIVE.
7. TWO CONDUITS MAY BE REQUIRED BY THE PROJECT DRAWINGS.
8. NO SPLICE CLOSURES OR SLACK STORAGE SHALL BE LOCATED OVER PUBLIC OR PRIVATE TRAVEL WAYS.
9. ALL REQUIRED HARDWARE AND CONDUIT SHALL BE GALVANIZED.

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

TRUNK FIBER AERIAL TO UNDERGROUND TRANSITIONS

(NOT TO SCALE)

CITY TRAFFIC ENGINEER
CITY ENGINEER

DIRECTOR OF HOUSTON PUBLIC WORKS

EFF DATE: JUL-01-2018

DWG NO: 02893-21

HSIP Project Submission

Texas Department of Transportation

Save a Copy | Reset Form

Proposal Information

District	Houston	County	Harris
Comments	Incapacitating Injury Crash ID:16416596 Non-Incapacitating Injury Crash IDs:15933339,15685167,17297086		
File Name	HOU_RichmondAve&HayesRd_Houston	Supervised By	Irma Sanchez

Roadway Information

Primary Roadway	RICHMOND AVE	Control Section(s)	B54249,T02527,LZ5056
Limits From	Intersection of Richmond Ave and Hayes Rd	DFO*	29.728,-95.576
Limits To	Intersection of Richmond Ave and Hayes Rd	DFO*	29.728,-95.576

*Lat/Long pairs for off-system

On or Off System	Off	Speed Limit	35
Length	0.011	Current AADT	27,603

Intersecting Roadway	HAYES RD	Speed Limit	30
On or Off System	Off	Current AADT	6,362

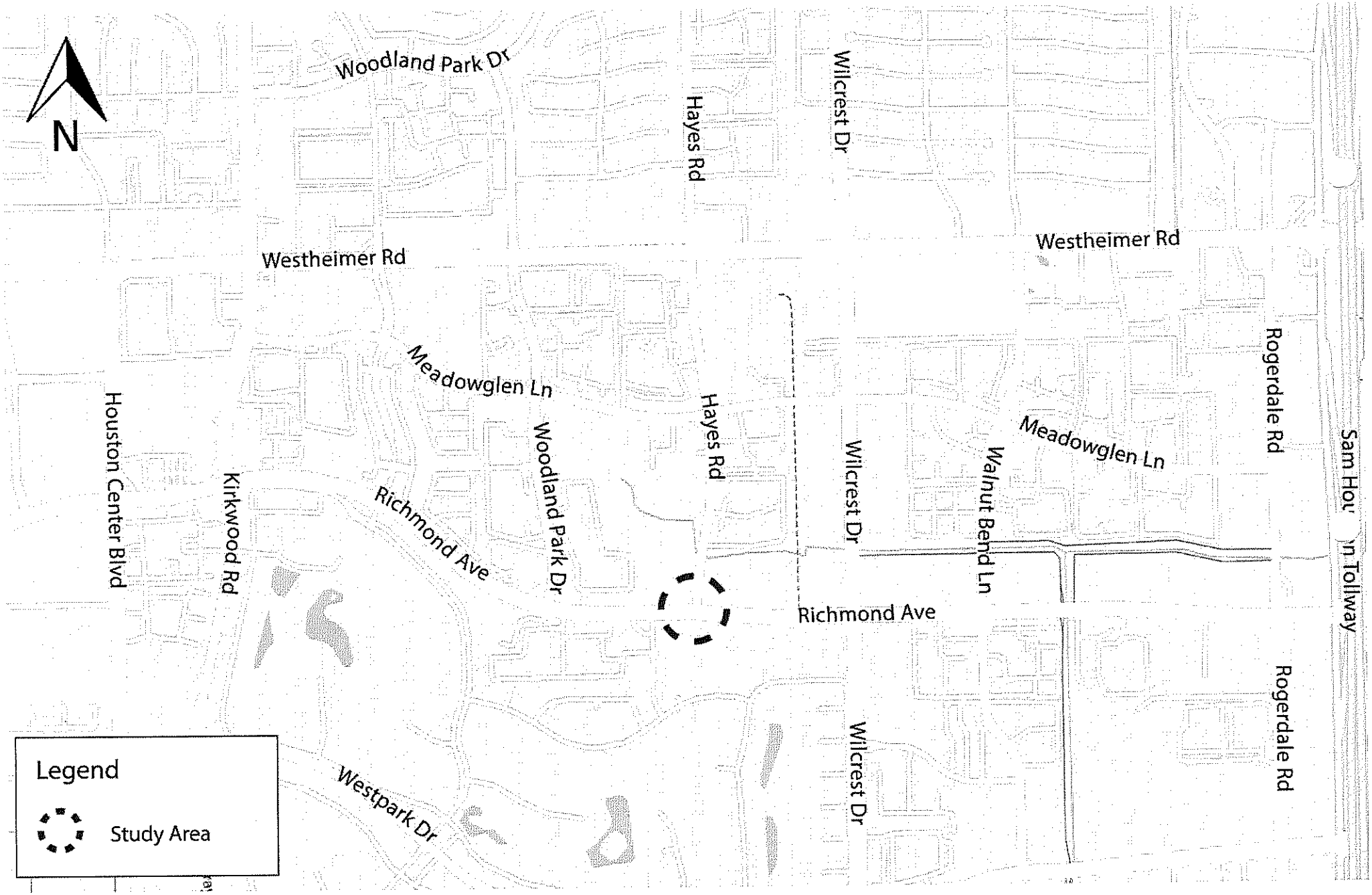
Project Information

Targeted or Systemic	Systemic	Crashes	K	0
Work Code(s)	107		A	1
Preferred Letting	05/2022		B	3
			SII	9.4

Estimate

Bid Items (See Guidelines instructions)	$ 427,800
ROW (if required)	
Mobilization and Barricades (≥ 8%)	$ 42,780
Safety (2-5%)	$ 21,390
Inflation (≥ 10%)	$ 42,780
Total	$ 534,750

HOU_RichmondAve&HayesRd_Houston
Location Map



2020 SII Calculator (2016-2018 Crash Data, 2017 NSC Data)
Enter data in the shaded cells where applicable.

	Number of Crashes	Years of Data: 3 — Cost
Number of Fatal Crashes (K)	0	$3,600,000
Number of Incapacitating Injury Crashes (A)	1	$3,600,000
Number of Non-Incapactitating Injury Crashes (B)	3	$500,000

Reduction Factor	35%
Service Life	10
Total ROW & Construction Cost	$534,750
Annual Maintenance Cost	$3,900
Present ADT	27603
Future ADT	37096

SII Calculation **9.40**

Texas Department of Transportation

2020 HSIP
WESTCHASE DISTRICT
RICHMOND AND HAYES

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
01046015	REMOVING CONC (SIDEWALKS)	SY	98	$ 12.00	$ 1,200.00
05316002	CONC SIDEWALKS (5")	SY	115	$ 55.00	$ 6,300.00
01046001	REMOVING CONC (PAV)	SY	887	$ 8.00	$ 7,100.00
01046017	REMOVING CONC (DRIVEWAYS)	SY	74	$ 15.00	$ 1,100.00
01046021	REMOVE CONC CURB	LF	181	$ 5.00	$ 900.00
05316015	CURB RAMPS (TY 20)	EA	4	$ 3,000.00	$ 12,000.00
05316018	CURB RAMPS (TY 1)	SY	25	$ 140.00	$ 3,500.00
05316022	CURB RAMPS (TY 5)	SY	49	$ 170.00	$ 8,300.00
05066038	TEMP SEDMT CONT FENCE (INSTALL)	LF	425	$ 3.00	$ 1,300.00
05066039	TEMP SEDMT CONT FENCE (REMOVE)	LF	425	$ 1.00	$ 400.00
	REMOVE AND DISPOSE OF LIGHT POLE	EA	1	$ 1,500.00	$ 1,500.00
03606005	CONC PVMT (CONT REINF - CRCP) (11")	SY	887	$ 70.00	$ 62,100.00
02606073	LIME TRT (SUBGRADE)(8")	SY	900	$ 5.00	$ 4,500.00
05306004	DRIVEWAYS (CONC)	SY	74	$ 75.00	$ 5,600.00
01606004	FURNISHING AND PLACING TOPSOIL (6")	SY	40	$ 5.00	$ 200.00
01626008	ROLL SODDING	SY	40	$ 5.00	$ 200.00
06446078	REMOVE SM RD SN SUP&AM (SIGN ONLY)	EA	5	$ 90.00	$ 500.00
06446075	RELOCATE SM RD SN SUP&AM(SIGN ONLY)	EA	5	$ 400.00	$ 2,000.00
60206008	MLTPLY PV MK W/WTY (W) (12") (SLD)	LF	464	$ 4.00	$ 1,900.00
60206010	MLTPLY PV MK W/WTY (W) (24") (SLD)	LF	95	$ 8.00	$ 800.00
	INTERSECTION TRAFFIC SIGNALS	EA	1	$ 300,000.00	$ 300,000.00
03606027	CURB (TYPE II)	LF	181	$ 6.00	$ 1,100.00
04796001	ADJUSTING MANHOLES	EA	1	$ 1,500.00	$ 1,500.00
04796002	ADJUSTING INLETS	EA	2	$ 1,200.00	$ 2,400.00
04796005	ADJUSTING MANHOLES (WATER VALVE BOX)	EA	2	$ 700.00	$ 1,400.00
				CONSTRUCTION COST	**$ 427,800.00**

ROW	$	-
MOBILIZATION AND BARRICADES (10%)	$	42,780.00
SAFETY (5%)	$	21,390.00
INFLATION (10%)	$	42,780.00
TOTAL	**$**	**106,950.00**

HSIP TOTAL ESTIMATE COST $ 534,750.00

Updated 9/29/2020

W:\00_TGC Project Files\WCH###\Layouts\191028.WCH1 elim.dwg

LEGEND:

- EXIST. EDGE OF PVMT./CURB
- EXIST. PVMT./CURB/SIDEWALK
- EXIST. MANHOLE
- EXIST. INLET
- EXIST. FIRE HYDRANT
- EXIST. WATER VALVE
- EXIST. POWER POLE
- EXIST. LIGHT
- PROP. CONC. REHAB
- PROP. SIDEWALK
- PROP. ADA RAMP
- PROP. CURB
- PROP. PAVEMENT MARKING
- PROP. SIGNAL POLE

NOTES:
UTILITIES, SIGNS AND OTHER CONFLICTS WILL BE ADJUSTED TO ACCOMMODATE PROPOSED SIDEWALK

0 20 40 Feet

WESTCHASE MANAGEMENT DISTRICT
INTERSECTION IMPROVEMENTS
RICHMOND AVE. AT HAYES RD.

THE GOODMAN CORPORATION
TBPE No. F-19990
3200 Travis, Suite 200 Houston, Texas 77006

SHEET NO. 1 OF 3
DWG No. WCH107.2
SCALE:
BY: WKM
REV: 10/25/19

TRAFFIC ENGINEERING STUDY

FOR

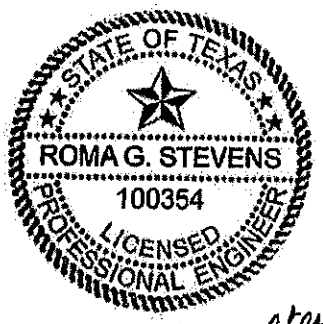
RICHMOND AVENUE AT HAYES ROAD

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
14531 FM 529, SUITE 160 - HOUSTON, TX. 77095
PHONE: (713) 828-4742
www.stevens-technical.com

TRAFFIC ENGINEERING STUDY

FOR

RICHMOND AVENUE AT HAYES ROAD



Roma Stevens
1/21/2020

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
14531 FM 529, SUITE 160 - HOUSTON, TX. 77095
PHONE: (713) 828-4742
www.stevens-technical.com

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APPENDICES

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LIST OF FIGURES

I. INTRODUCTION

This report documents a traffic engineering study and traffic signal warrant analysis for the intersection of Richmond Avenue at Hayes Road, located in Harris County. The study location for Richmond Avenue at Hayes Road is shown in Figure 1. A site location map is shown in Figure 2.

The study was comprised of the following tasks:

- Evaluation of existing roadway characteristics, including lane configurations, intersection geometry, and pavement markings at the study intersection.
- Evaluation of existing traffic data, including turning movement counts and analysis of crash data for the last 36 months.
- Recommendations and completion of a Traffic Signal Warrant Analysis (TSWA) in accordance with the guidelines defined in Part 4, Section C of the 2011 Texas Manual on Uniform Traffic Control Devices (TMUTCD) – Revision 2 (2014).

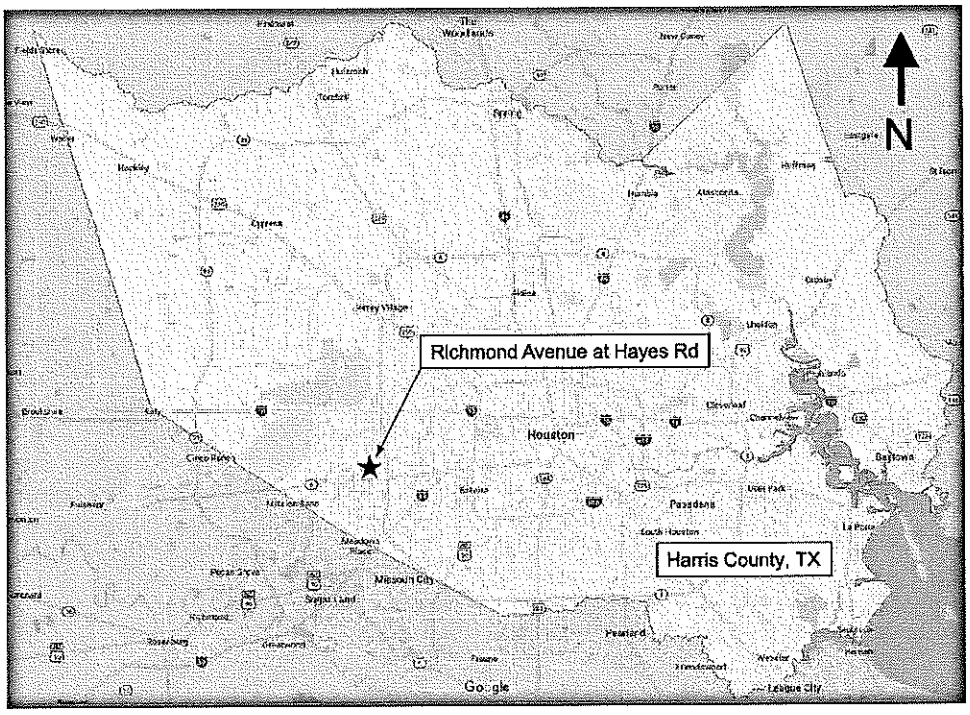
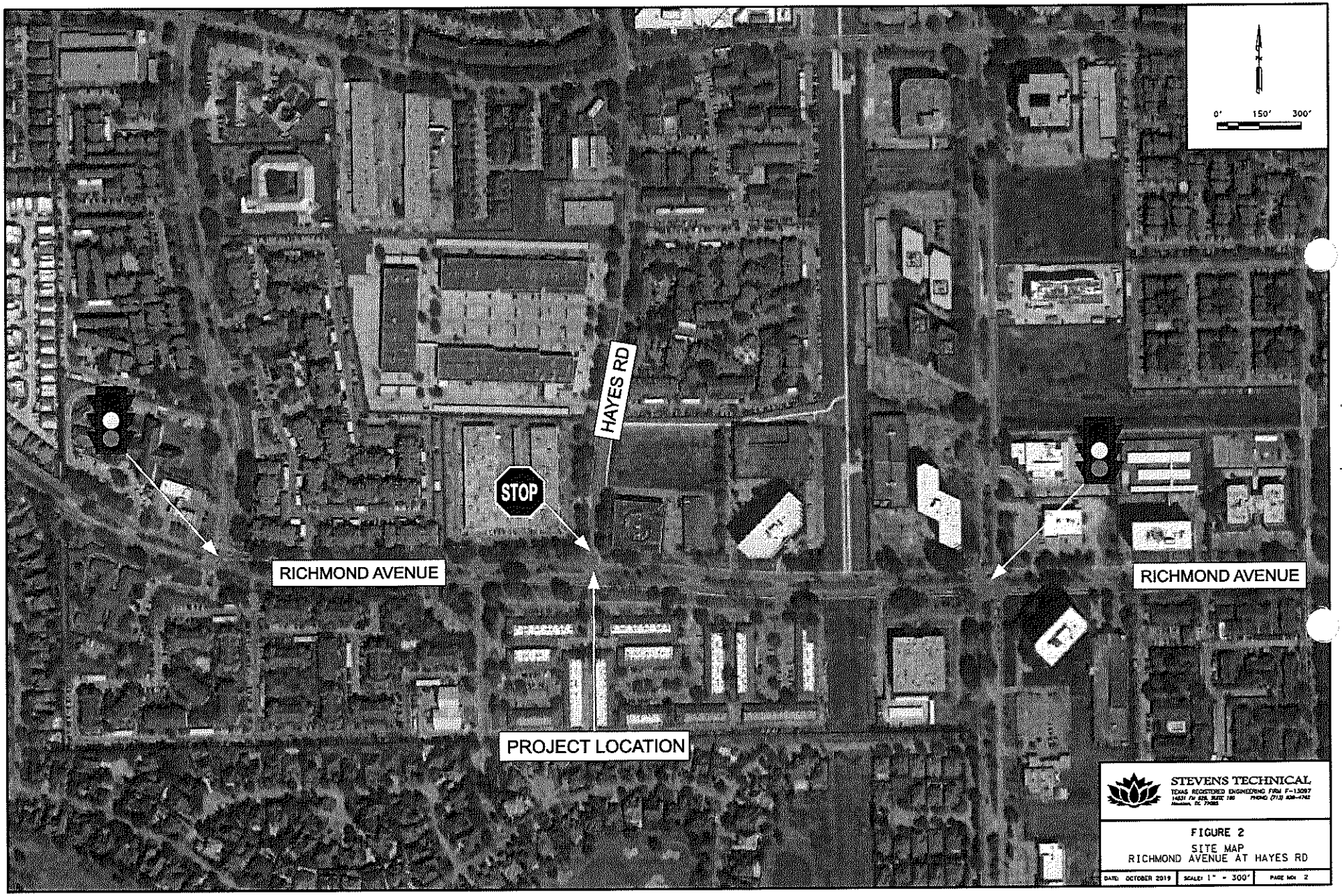


Figure 1 – Study Location for Richmond Avenue at Hayes Road



STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
14631 FM 529, SUITE 180 PHONE: (713) 436-4745
Houston, TX 77095

FIGURE 2
SITE MAP
RICHMOND AVENUE AT HAYES RD

DATE: OCTOBER 2019 | SCALE: 1" = 300' | PAGE NO: 2

II. EXISTING CONDITIONS

The existing conditions section outlines the characteristics of the approach roadways, the intersection of the roadways, and the current land use of the study area.

A. Major Roadway: Richmond Avenue

Richmond Avenue is a minor arterial that runs east-west and has the following characteristics near the study intersection:

- Number of Lanes – Richmond Avenue has a four-lane cross section with additional dedicated left lanes at major intersections.
- Lane Width – 10 feet.
- Shoulder Width – Richmond Avenue has a shoulder of width 4 feet.
- Median Type/Width – Richmond Avenue has a raised median of varying widths, 28- foot being the most occurred width of the median.
- Turn Lane – Eastbound Richmond Avenue has a delineated left turn lane towards northbound Hayes Road at the study intersection of width 11 ft.
- Lighting – There is regular street lighting along Richmond Avenue towards either side of the study intersection. The average space between light poles is 380 ft.
- Posted Speed Limit – 35 mph.
- Existing Traffic Control – Currently, approaches of Richmond Avenue to the study intersection have no traffic control.
- Existing Pavement – Concrete is in good condition having infrequent to occasional distress with mild severity.
- Existing Signing and Markings – All signings on Richmond Avenue appear to be in good condition with little to no deterioration and the pavement markings appear to be slightly faded due to deterioration.

B. Minor Roadway: Hayes Road & Westchase Park Driveway

a) Hayes Road

Hayes Road is a major collector that runs north-south and has the following characteristics near the study intersection:

- Number of Lanes – Hayes Road has a four-lane cross section and has no dedicated turning lanes.
- Lane Width – 10 feet.
- Shoulder Width – No shoulders; raised curbs on both sides.
- Median Type/Width – Hayes Road is undivided throughout
- Turn Lane – Hayes Road has no dedicated turn lanes.
- Lighting – There is regular street lighting along Hayes Road near the study intersection. The average space between light poles is 400 ft.
- Posted Speed Limit – 30 mph.
- Existing Traffic Control – Currently, a stop sign and stop bar provide traffic control for Hayes Road at the study intersection.
- Existing Pavement – Concrete is in good condition having occasional distresses with slight severity and infrequent distress with moderate severity.
- Existing Signing and Markings – All signings are in good condition. Pavement markings on Hayes Road appear to be worn off in some spots with the stop bar mostly faded.

b) Westchase Park Driveway

Westchase Park is a commercial space that has several businesses. One of its driveways along Richmond Avenue align with Hayes Road and serve as the south leg of the study intersection.

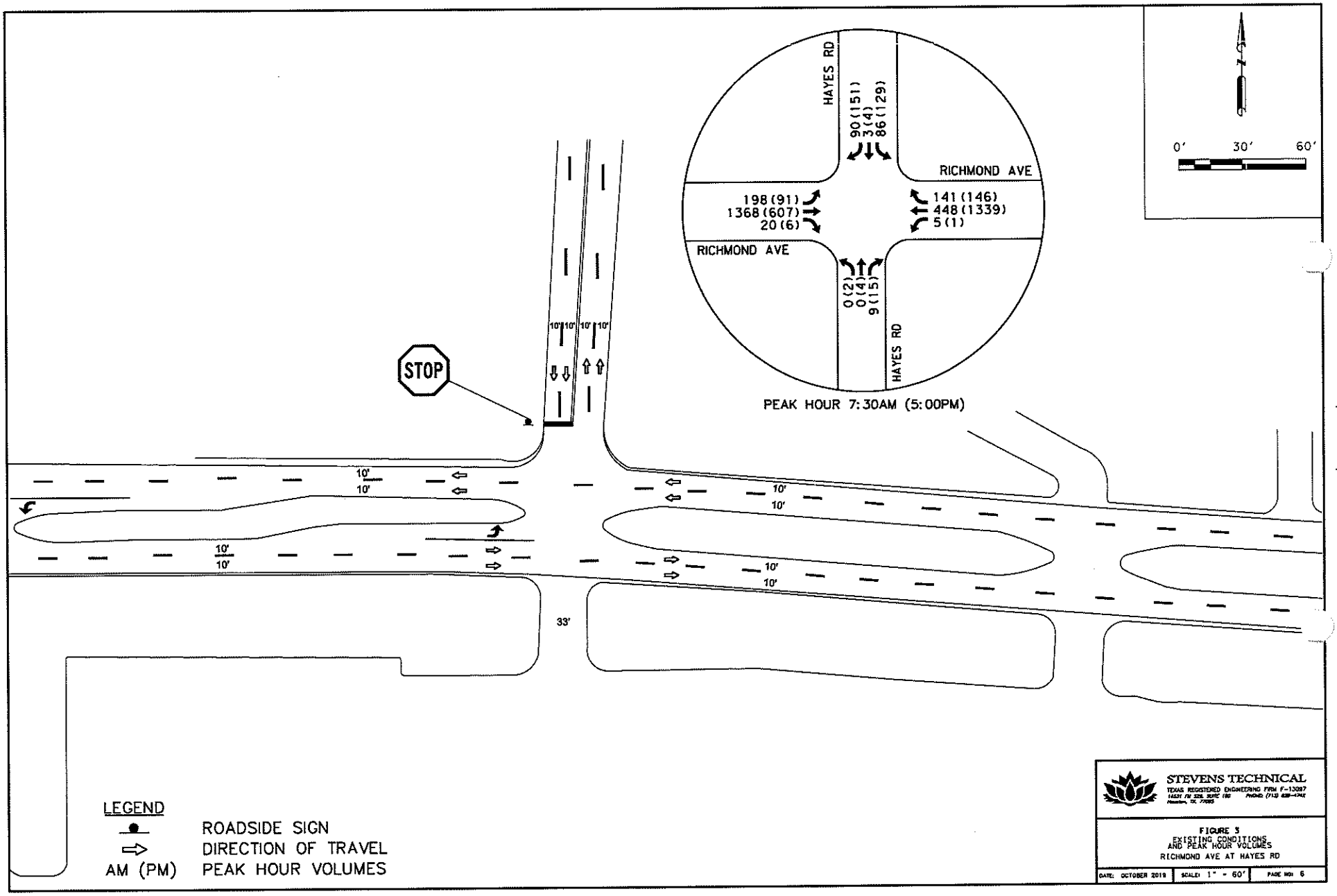
- Driveway Width – 33 feet
- Existing Traffic Control – There is no traffic control device at the driveway.
- Existing Pavement – Concrete is in decent condition having visible distresses.
- Existing Signing and Markings – There is no signage as well as visible pavement marking.

C. Intersection Characteristics

The intersection of Richmond Avenue and Hayes Road is a four-legged intersection. The south leg of Hayes Rd is one of the three driveways of Westchase Park that connect to Richmond Avenue. At the study intersection, a stop sign controls the approaching southbound traffic on Hayes Road, while traffic on Richmond Avenue flows freely. There is regular street lighting along the east, west and north of the intersection. There is a horizontal curve on Richmond Avenue 1000 ft west of the intersection. There is also a slight horizontal curve on Hayes Road around 800 ft north of Richmond Avenue. There are five traffic signals within one mile of the study intersection. An existing conditions diagram of the study intersection is shown in Figure 3. Appendix D contains photographs of the intersection approaches.

D. Land Use

The study intersection is located in Houston, Texas. Land use surrounding the study intersection is mostly commercial and residential. Towards the south of the study intersection is the Westchase park which is a busy commercial space. The area towards the north of the intersection along Hayes Rd is residential. Sam Houston Tollway runs one mile east of the intersection. Royal Oaks Country Club is just 3000 ft along Richmond Avenue from the intersection. A fire station in addition to several businesses are located at east and west of the intersection along Richmond Avenue.


HAYES RD
90 (151)
3 (4)
86 (129)
RICHMOND AVE
198 (91)
1368 (607)
20 (6)
141 (146)
448 (1339)
5 (1)
RICHMOND AVE
0 (2)
0 (4)
9 (15)
HAYES RD
PEAK HOUR 7:30AM (5:00PM)
0'
30'
60'
STOP
10'
10'
10'
10'
10'
10'
10'
10'
10'
10'
10'
10'
33'
LEGEND
ROADSIDE SIGN
DIRECTION OF TRAVEL
AM (PM) PEAK HOUR VOLUMES
STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13087
FIGURE 5
EXISTING CONDITIONS
AND PEAK HOUR VOLUMES
RICHMOND AVE AT HAYES RD
DATE: OCTOBER 2019
SCALE: 1" = 60'
PAGE NO: 6

III. TRAFFIC DATA

The data collection effort for this study included conducting a twelve-hour turning movement count at the study intersection and obtaining crash data using Crash Records Information System (CRIS) from 09/01/2016 to 08/31/2019.

A. Traffic Volumes

Twelve-hour turning movement counts were recorded in 15-minute intervals at the study intersection on Wednesday, September 4, 2019 from 6:00 AM to 6:00 PM. The complete traffic count data can be found in Appendix A. A summary of the data is presented in Table 1. Peak hour movements are shown in Figure 3.

Table 1 – Traffic Volumes Summary

Time Period	Traffic Volumes (vph)			
	Major Street			Minor Street
	Richmond Avenue			Hayes Road
	EB	WB	Both Apps.	High Vol. App.
6:00-7:00 AM	680	246	926	100
7:00-8:00 AM	1505	505	2010	211
8:00-9:00 AM	1489	541	2030	158
9:00-10:00 AM	870	485	1355	141
10:00-11:00 AM	681	556	1237	154
11:00 -12:00 PM	610	642	1252	187
12:00-1:00 PM	760	762	1522	234
1:00-2:00 PM	674	718	1392	203
2:00-3:00 PM	634	709	1343	209
3:00-4:00 PM	693	823	1516	216
4:00-5:00 PM	718	1111	1829	281
5:00-6:00 PM	706	1487	2193	305
Total Volume	**10020**	**8585**	**18605**	**2399**

*These volumes are shown for summary purposes only. See Figure 3 for peak hour volumes and Appendix E for volumes used for signal warrants.

B. Crash Experience

Crash records were obtained using online CRIS Database from September 1, 2016 to August 31, 2019. Table 2 summarizes the data that shows 29 crashes were reported at or near the intersection (250 ft buffer) during the 3-year time period. 14 crashes were reported as "no injuries", 9 crashes were reported as "possible injury", 4 crashes were reported as "non-incapacitating injury" and 1 crash was reported as "suspected serious injury". 16 of the 29 crashes are considered correctable based on TxDOT's 2018 Highway Safety Improvement Program Call. The correctable crashes are summarized in Table 3. Collision diagrams for all crashes are shown in Figure 4, Figure 5 and Figure 6. The complete set of crash data for this location can be found in Appendix B.

Table 2 – Crash Data Summary

Crash Factor	Description	# of Crash
Crash Type	Fixed Object	2
	Motor Vehicle in Transport	25
	Pedestrian	1
	Overturned	1
Cause	Unsafe Speed	3
	Motor Vehicle Failed to Yield Right of Way	5
	Unsafe Lane Changes	5
	Driver Inattention	1
Light Condition	Daylight	14
	Dark/Not Lighted	4
	Dark/Lighted	10
Weather/Surface Condition	Clear, Dry	22
	Cloudy, Dry	3
	Cloudy, Wet	1
	Rain, Wet	1
Severity	Not Injured	14
	Possible Injury	9
	Non-Incapacitating Injury	4
	Suspected Serious Injury	1

*Table represents multiple years of crash data. Only 12 months of data were used for Warrant 7.

Table 3 – Summary of Correctable Crashes

Crash ID	Crash Severity	Crash Date	First Harmful Event	Intersecting Street Name	Intersection Related	Manner of Collision
15510217	B - NON-INCAPACITATING INJURY	12/27/2016	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
15685167	B - NON-INCAPACITATING INJURY	4/4/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - ONE STRAIGHT-ONE LEFT TURN
15738099	N - NOT INJURED	4/29/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
15796625	C - POSSIBLE INJURY	5/27/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION RELATED	OPPOSITE DIRECTION - BOTH GOING STRAIGHT
15811010	C - POSSIBLE INJURY	6/6/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - ONE STRAIGHT-ONE LEFT TURN
15844829	N - NOT INJURED	7/4/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - ONE STRAIGHT-ONE LEFT TURN
15890354	N - NOT INJURED	7/30/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	SAME DIRECTION - BOTH GOING STRAIGHT-REAR END
15933339	B - NON-INCAPACITATING INJURY	8/25/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
16295004	N - NOT INJURED	3/9/2018	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
16300115	N - NOT INJURED	3/12/2018	MOTOR VEHICLE IN TRANSPORT	RICHMOND AVE	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
16364522	C - POSSIBLE INJURY	4/19/2018	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - ONE STRAIGHT-ONE LEFT TURN
16416596	A - SUSPECTED SERIOUS INJURY	5/17/2018	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
16900248	N - NOT INJURED	2/13/2019	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
17032433	C - POSSIBLE INJURY	4/22/2019	PEDESTRIAN	N/A	NON INTERSECTION	ONE MOTOR VEHICLE - GOING STRAIGHT
17157388	N - NOT INJURED	6/28/2019	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
17251163	C - POSSIBLE INJURY	8/21/2019	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT

The above table shows multiple 12-months periods involving 5 or more reported crashes susceptible to correction by a traffic control signal. The time periods and number of crashes are summarized below:

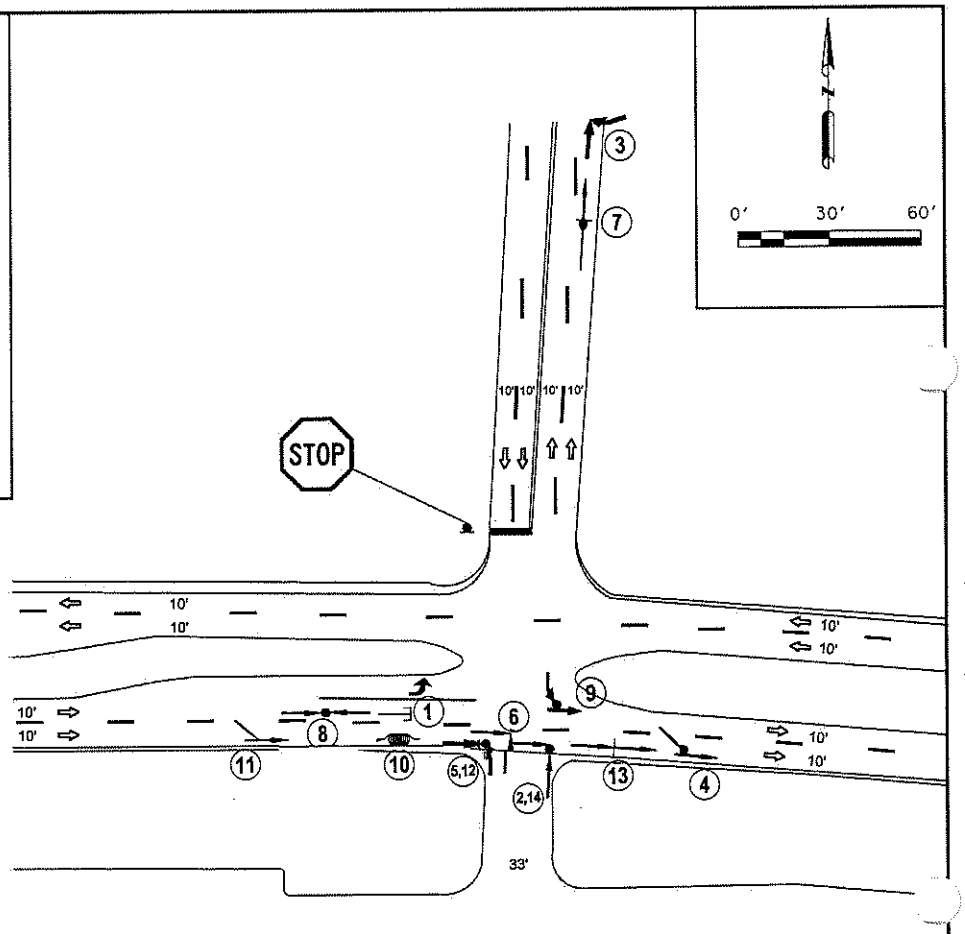
- 1/1/2017 to 12/31/2017: 7 crashes
- 3/9/2018 to 3/8/2019: 5 crashes

LEGEND

D DRY ROAD
W WET ROAD
CR CLEAR WEATHER
CD CLOUDY WEATHER
R RAINING
DL DAYLIGHT
DK DARK
U UNKNOWN
⇨ DIRECITON OF TRAVEL

COLLISION SYMBOLS

RIGHT ANGLE
FIXED OBJECT
REAR-END COLLISION
SIDE SWIPE
OVERTURNED
HEAD ON
LEFT TURN
MOVING MOTOR VEHICLE
FATAL ACCIDENT
PERSONAL INJURY
PROPERTY DAMAGE ONLY



NO.	DATE	CONDITION	CRASH SEVERITY
1	9/8/2016	CR, DL , D	POSSIBLE INJURY
2	12/27/2016	CD, DK\L , W	NON-INCAPACITATING INJURY
3	3/1/2017	CR, DK\NL ,D	NOT INJURED
4	4/3/2017	CR, DL , D	POSSIBLE INJURY
5	4/4/2017	CR, DL, D	NON-INCAPACITATING INJURY
6	4/29/2017	CR, DL, D	NOT INJURED
7	5/23/2017	CR, DK\L, D	POSSIBLE INJURY
8	5/27/2017	CR, DK\NL, D	POSSIBLE INJURY
9	6/6/2017	CR, DK\L, D	POSSIBLE INJURY
10	6/10/2017	CR, DL, D	NON-INCAPACITATING INJURY
11	6/18/2017	CR, DK\L, D	NOT INJURED
12	7/4/2017	CD, DK\NL, D	NOT INJURED
13	7/30/2017	CR, DK\L, D	NOT INJURED
14	8/25/2017	CR, DK\L, D	NON-INCAPACITATING INJURY

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13087
14331 FM 529, SUITE 160 PHONE: (713) 929-4742
Houston, TX 77095

FIGURE 4
COLLISION DIAGRAM
RICHMOND AVE AT HAYES RD
(09/2016 - 08/2017)

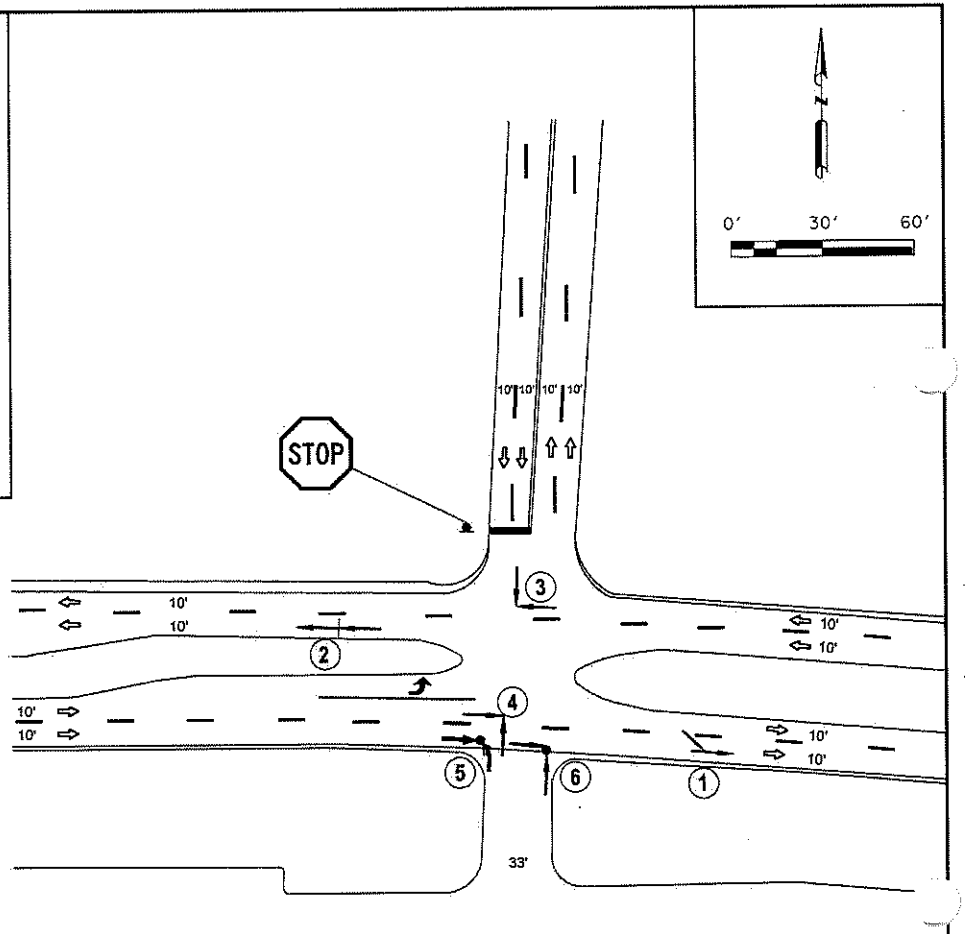
DATE: OCTOBER 2019 | SCALE: 1" = 60' | PAGE NO: 10

LEGEND

D	DRY ROAD
W	WET ROAD
CR	CLEAR WEATHER
CD	CLOUDY WEATHER
R	RAINING
DL	DAYLIGHT
DK	DARK
U	UNKNOWN
⇨	DIRECITON OF TRAVEL

COLLISION SYMBOLS

RIGHT ANGLE
FIXED OBJECT
REAR-END COLLISION
SIDE SWIPE
OVERTURNED
HEAD ON
LEFT TURN
MOVING MOTOR VEHICLE
FATAL ACCIDENT
PERSONAL INJURY
PROPERTY DAMAGE ONLY



NO.	DATE	CONDITION	CRASH SEVERITY
1	10/28/2017	CR, DL , D	NOT INJURED
2	12/6/2017	CR, DK\L , D	NOT INJURED
3	3/9/2018	CR, DL ,D	NOT INJURED
4	3/12/2018	CR, DK\NL , D	NOT INJURED
5	4/19/2018	CD, DL, D	POSSIBLE INJURY
6	5/17/2018	CR, DK\L, D	SUSPECTED SERIOUS INJURY

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Houston, TX 77095

FIGURE 5
COLLISION DIAGRAM
RICHMOND AVE AT HAYES RD
(09/2017 - 08/2018)

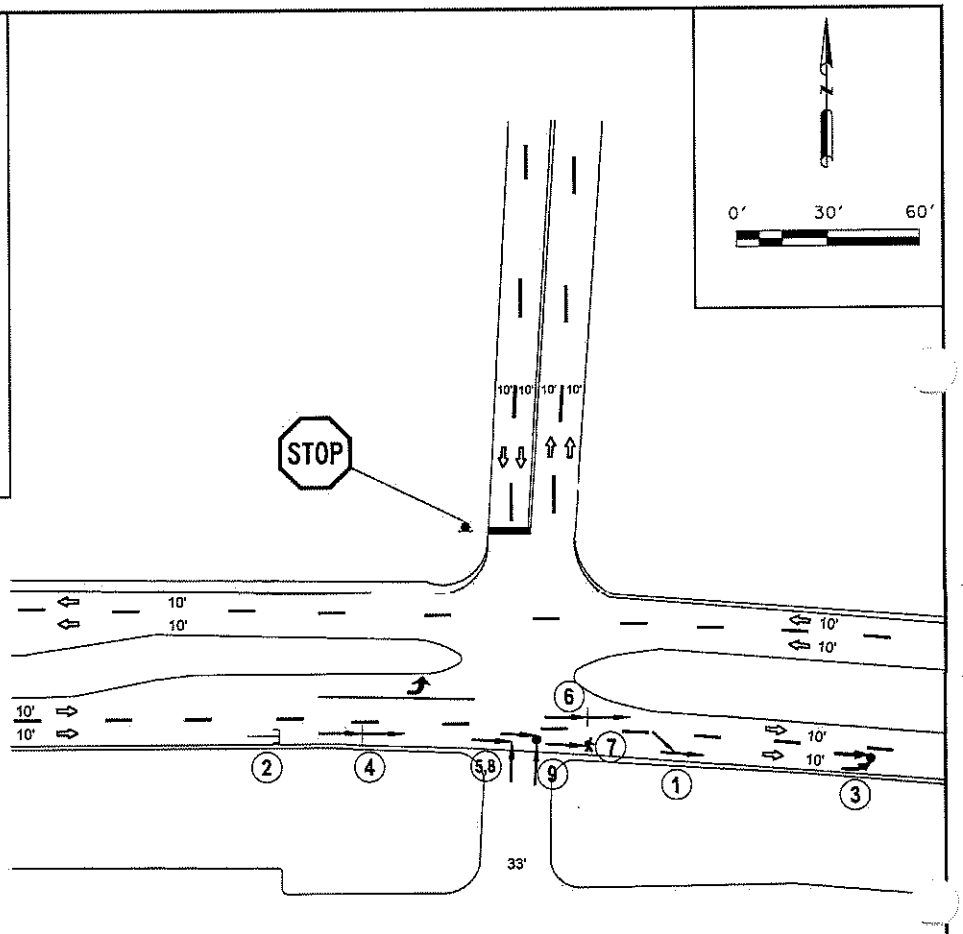
DATE: OCTOBER 2019 | SCALE: 1" = 60' | PAGE NO: 11

LEGEND

D	DRY ROAD
W	WET ROAD
CR	CLEAR WEATHER
CD	CLOUDY WEATHER
R	RAINING
DL	DAYLIGHT
DK	DARK
U	UNKNOWN
⇨	DIRECITON OF TRAVEL

COLLISION SYMBOLS

RIGHT ANGLE
FIXED OBJECT
REAR-END COLLISION
SIDE SWIPE
OVERTURNED
HEAD ON
LEFT TURN
MOVING MOTOR VEHICLE
PEDESTRIAN
FATAL ACCIDENT
PERSONAL INJURY
PROPERTY DAMAGE ONLY



NO.	DATE	CONDITION	CRASH SEVERITY
1	10/30/2018	CR, DK\L , D	NOT INJURED
2	11/4/2018	CD, DK\L , U	UNKNOWN
3	11/24/2018	CR, DK\U ,D	POSSIBLE INJURY
4	1/31/2019	CR, DL , U	NOT INJURED
5	2/13/2019	CR, DL, D	NOT INJURED
6	3/11/2019	CD, DL, D	NOT INJURED
7	4/22/2019	CR, DL, D	POSSIBLE INJURY
8	6/28/2019	R, DL, W	NOT INJURED
9	8/21/2019	CR, DL, D	POSSIBLE INJURY

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14331 FM 529, SUITE 160 PHONE: (713) 828-4742
Houston, TX 77095

FIGURE 6
COLLISION DIAGRAM
RICHMOND AVE AT HAYES RD
(09/2018 - 08/2019)

DATE: OCTOBER 2019 | SCALE: 1" = 60' | PAGE NO: 12

IV. TRAFFIC SIGNAL WARRANT ANALYSIS

The twelve-hour turning movement counts recorded at the intersection of Richmond Avenue at Hayes Road were used to determine if the existing conditions warrant the installation of a traffic signal. The analysis was performed in accordance with Part 4, Section C, of the 2011 TMUTCD. For signal warrant analysis, Richmond Avenue was considered as the major road and Hayes Road as the minor road. Right-turn traffic was assumed to enter the major street with minimal conflict, and the lane used for right turns was acting as a de facto right-turn lane. Therefore, right-turn traffic was not included in the minor-street volume and a one-lane minor street approach was considered for the signal warrant analysis as per TMUTCD guidance.

Table 4 contains a summary of the signal warrant analysis. The complete analysis is included in Appendix C.

Table 4 – Signal Warrant Analysis: Richmond Avenue at Hayes Road

TMUTCD Warrant	Satisfaction of Requirement	Notes
1. Eight-Hour Vehicular Volume	Yes	Condition B is met
2. Four-Hour Vehicular Volume	Yes	More than four points fall above the applicable curve
3. Peak Hour	Not Applicable	Applied only in unusual cases (ex: manufacturing plants)
4. Pedestrian Volumes	No	All points fall below applicable curve
5. School Crossing	Not Applicable	School is at a significant distance from study intersection
6. Coordinated Signal System	Not Applicable	Not a coordinated corridor
7. Crash Experience	Yes	5 correctable crashes in 12 months period
8. Roadway Network	Not Applicable	No need to encourage or concentration of traffic flow on a roadway network
9. Intersection Near a Grade Crossing	Not Applicable	No railroad nearby

Based on the Traffic Signal Warrant Analysis, a traffic signal is warranted for the intersection of Richmond Avenue at Hayes Road, meeting three of the nine warrants.

V. CONCLUSIONS AND RECOMMENDATIONS

This report summarizes a traffic engineering study and a TSWA performed at the intersection of Richmond Avenue at Hayes Road, located in Harris County, in Houston, Texas. A traffic signal was found to be warranted based on existing conditions and traffic volumes recorded in September 2019 at the study intersection.

Recommendations:

- Three traffic signal warrants: Warrant 1-Eight Hour Vehicular Volume (Condition B), Warrant 2-Four Hour Volumes, and Warrant 7- Crash Experience are met, therefore a traffic signal installation is recommended at this location.
- The pavement markings such as the lane markings and the 24-inch stop bar are recommended to be reinstalled to improve safety.

Appendix A
Turning Movement Counts
Richmond Avenue at Hayes Road

12 Hour Turning Movement Counts
Richmond Avenue at Hayes Rd

Leg	Hayes Road							Richmond Avenue							Hayes Road							Richmond Avenue						
Direction	Southbound							Westbound							Northbound							Eastbound						
Start Time	Right	Thru	Left	U-Turn	App Total	Peds CW	Peds CCW	Right	Thru	Left	U-Turn	App Total	Peds CW	Peds CCW	Right	Thru	Left	U-Turn	App Total	Peds CW	Peds CCW	Right	Thru	Left	U-Turn	App Total	Peds CW	Peds CCW	Int Total
2019-09-04 06:00:00	1	1	11	0	13	0	0	4	36	2	0	42	0	0	0	0	0	0	0	0	0	0	86	3	0	89	0	1	144
2019-09-04 06:15:00	6	1	14	0	21	0	0	5	49	1	0	55	0	0	1	0	0	0	1	0	0	0	126	11	0	137	0	1	205
2019-09-04 06:30:00	10	0	23	0	33	0	0	9	57	1	0	67	0	0	1	0	0	0	1	0	0	0	189	12	0	201	0	0	298
2019-09-04 06:45:00	15	0	15	0	30	0	0	16	78	2	0	96	0	0	0	1	0	0	1	0	0	0	232	21	0	253	0	0	379
2019-09-04 07:00:00	16	1	34	0	51	0	0	12	79	0	0	92	0	0	0	0	0	0	0	0	0	1	322	26	0	349	1	1	492
2019-09-04 07:15:00	21	0	34	0	55	0	0	17	75	0	0	92	0	0	1	0	0	0	1	0	0	1	336	23	0	361	1	0	509
2019-09-04 07:30:00	24	1	22	0	47	0	0	35	117	2	0	154	0	0	4	0	0	0	4	0	0	1	351	48	1	401	1	0	606
2019-09-04 07:45:00	25	0	27	0	52	0	0	52	123	2	0	177	0	0	1	0	0	0	1	0	0	8	324	82	0	394	0	0	624
2019-09-04 08:00:00	28	0	21	1	48	2	0	34	104	1	0	139	0	0	1	0	0	0	1	0	0	7	339	53	0	399	2	0	587
2019-09-04 08:15:00	16	2	16	1	34	0	0	20	104	0	0	124	0	0	3	0	0	0	3	0	0	4	354	35	0	393	0	0	554
2019-09-04 08:30:00	11	1	19	0	31	0	0	27	119	4	0	159	0	0	3	0	0	0	3	0	0	3	336	24	2	368	0	0	552
2019-09-04 08:45:00	17	1	16	0	34	0	1	22	105	1	0	128	0	0	3	1	0	0	4	0	0	4	293	32	0	329	0	0	495
2019-09-04 09:00:00	9	1	15	0	25	1	1	27	87	2	0	116	1	1	3	1	0	0	4	0	0	4	223	40	0	267	0	0	412
2019-09-04 09:15:00	21	0	19	0	40	1	0	22	85	1	0	108	0	0	3	0	0	0	3	0	0	2	181	36	0	221	1	0	372
2019-09-04 09:30:00	17	3	15	0	35	0	0	19	110	1	0	130	0	0	3	0	0	0	3	0	0	2	166	20	0	188	0	1	356
2019-09-04 09:45:00	10	2	15	0	27	2	0	14	115	2	0	131	0	0	2	2	0	0	4	0	0	2	174	17	1	194	2	2	356
2019-09-04 10:00:00	10	0	14	0	24	0	0	20	109	4	0	133	1	0	2	1	0	0	3	2	0	1	136	16	1	154	0	0	314
2019-09-04 10:15:00	14	0	20	0	34	0	1	10	109	1	0	120	0	1	3	0	2	0	5	0	1	4	136	19	0	159	0	0	318
2019-09-04 10:30:00	21	1	16	0	38	0	0	19	104	3	0	126	0	0	1	0	0	0	1	0	0	3	147	28	0	178	0	0	343
2019-09-04 10:45:00	28	0	19	0	47	0	0	32	143	2	0	177	0	1	1	0	1	0	2	0	1	3	148	38	0	190	1	0	416
2019-09-04 11:00:00	31	0	30	0	61	0	0	28	108	0	1	135	0	0	1	2	2	0	5	0	0	1	125	13	0	139	0	1	356
2019-09-04 11:15:00	22	1	17	0	40	0	0	23	148	1	0	170	0	1	3	1	0	0	4	0	1	2	140	13	0	181	0	0	395
2019-09-04 11:30:00	14	1	24	0	39	0	0	14	148	1	0	163	0	0	2	2	0	0	4	0	1	2	146	10	1	159	0	0	378
2019-09-04 11:45:00	18	0	11	0	29	0	0	21	154	1	0	176	0	0	4	0	1	0	5	0	0	2	155	10	1	168	0	0	378
2019-09-04 12:00:00	24	1	26	0	51	0	0	25	163	2	0	190	0	0	2	2	3	0	7	0	0	6	165	12	0	183	0	1	431
2019-09-04 12:15:00	26	1	18	0	45	0	0	32	198	1	0	231	0	0	5	1	0	0	6	0	0	1	171	32	0	204	0	0	486
2019-09-04 12:30:00	35	0	31	0	66	0	0	24	134	2	0	160	0	0	5	0	0	0	5	0	0	2	154	18	0	175	0	0	406
2019-09-04 12:45:00	21	1	30	0	52	0	1	23	157	1	0	181	1	0	1	1	0	0	2	1	0	4	184	9	1	198	0	0	433
2019-09-04 13:00:00	13	2	23	0	38	0	1	24	163	0	1	188	0	0	1	0	0	0	1	0	0	3	149	18	0	170	0	1	397
2019-09-04 13:15:00	23	0	26	0	49	0	0	19	129	3	0	151	0	0	2	0	1	0	3	0	1	2	155	15	0	172	0	0	375
2019-09-04 13:30:00	26	0	22	0	48	0	0	25	159	3	0	190	0	0	0	1	0	0	1	1	0	2	142	15	0	159	0	1	398
2019-09-04 13:45:00	35	0	20	0	55	0	0	30	158	1	0	189	0	0	7	1	0	0	8	0	0	1	143	26	3	173	1	0	425
2019-09-04 14:00:00	32	0	23	0	55	0	0	14	143	2	1	160	0	0	4	0	0	0	4	0	0	2	164	20	0	186	0	0	405
2019-09-04 14:15:00	23	1	24	0	48	0	1	17	169	1	0	187	0	0	1	0	0	0	1	1	0	2	135	14	0	151	0	0	387
2019-09-04 14:30:00	31	0	22	0	53	0	0	24	160	1	0	185	0	0	2	0	1	0	3	1	2	1	141	9	1	152	0	0	393
2019-09-04 14:45:00	25	0	17	0	42	0	2	13	162	2	0	177	1	0	2	0	1	0	3	1	0	1	134	9	1	145	0	0	367
2019-09-04 15:00:00	20	0	27	0	47	0	0	21	186	0	0	209	0	0	1	0	0	0	1	2	0	0	149	13	0	162	0	0	419
2019-09-04 15:15:00	38	0	26	0	64	0	0	37	172	1	0	210	0	2	2	0	0	0	2	0	3	1	153	18	0	172	0	0	448
2019-09-04 15:30:00	29	1	17	0	47	0	0	26	175	1	1	203	0	0	2	0	0	1	3	0	0	1	158	23	0	182	1	0	435
2019-09-04 15:45:00	27	0	23	0	50	0	0	15	186	0	0	201	0	0	2	0	0	0	2	0	0	3	155	19	0	177	0	0	430
2019-09-04 16:00:00	25	0	19	0	44	0	0	32	248	2	0	282	0	0	1	1	1	0	3	0	0	0	172	13	2	187	0	0	516
2019-09-04 16:15:00	40	2	23	0	65	0	0	27	240	0	0	267	0	0	6	3	1	0	10	0	0	1	155	11	0	167	0	0	509
2019-09-04 16:30:00	43	0	47	0	90	0	2	29	250	1	0	280	0	0	4	1	2	0	7	0	2	1	175	17	1	194	0	1	671
2019-09-04 16:45:00	35	1	21	0	57	0	1	35	246	1	0	282	0	0	3	1	1	0	5	1	0	0	155	15	0	170	0	1	514
2019-09-04 17:00:00	40	0	36	0	76	0	0	40	310	0	0	350	0	0	4	2	1	0	7	0	0	1	164	25	0	190	0	0	623
2019-09-04 17:15:00	39	2	31	0	72	0	2	41	359	1	0	401	1	0	4	2	0	0	6	1	0	2	142	27	1	172	0	0	651
2019-09-04 17:30:00	34	0	32	0	66	0	0	28	358	0	1	387	0	0	5	0	1	0	7	0	0	2	141	18	1	163	0	0	623
2019-09-04 17:45:00	38	2	30	0	70	0	0	37	312	0	0	349	1	0	1	0	0	0	1	0	0	1	160	20	0	181	0	0	601
Grand Total	1124	31	1081	2	2238	6	13	1138	7381	61	5	8585	6	6	114	27	19	1	161	11	14	98	8874	1030	18	10020	11	13	21004
% Approach	50.2%	1.4%	48.3%	0.1%				13.3%	86.0%	0.7%	0.1%				70.8%	16.8%	11.8%	0.6%				1.0%	88.6%	10.3%	0.2%				
% Total	5.4%	0.1%	5.1%	0.0%	10.7%			5.4%	35.1%	0.3%	0.0%	40.9%			0.5%	0.1%	0.1%	0.0%	0.8%			0.5%	42.2%	4.9%	0.1%	47.7%			
Lights	1093	31	1072	2	2198			1128	7253	58	5	8441			105	24	19	1	149			92	8738	994	17	9841			20629
% Lights	97.2%	100.0%	99.2%	100.0%	98.2%			99.1%	98.3%	90.2%	100.0%	98.3%			92.1%	88.9%	100.0%	100.0%	92.5%			93.9%	98.5%	96.5%	94.4%	98.2%			98.2%
Articulated Trucks	0	0	1	0	1			9	6	2	0	8			2	0	0	0	2			2	6	0	0	8			19
% Articulated Trucks	0.0%	0.0%	0.1%	0.0%	0.0%			0.0%	0.1%	3.3%	0.0%	0.1%			1.8%	0.0%	0.0%	0.0%	1.2%			2.0%	0.1%	0.0%	0.0%	0.1%			0.1%
Buses and Single-Unit Trucks	31	0	8	0	39			9	121	1	0	134			7	2	0	0	9			4	129	35	1	169			351
% Buses and Single-Unit Trucks	2.8%	0.0%	0.7%	0.0%	1.7%			0.8%	1.6%	0.6%	0.0%	1.6%			6.1%	7.4%	0.0%	0.0%	5.6%			4.1%	1.5%	3.4%	5.6%	1.7%			1.7%
Bicycles on Road	0	0	0	0	0			1	1	0	0	2			0	1	0	0	1			0	1	1	0	2			5
% Bicycles on Road	0.0%	0.0%	0.0%	0.0%	0.0%			0.1%	0.0%	0.0%	0.0%	0.0%			0.0%	3.7%	0.0%	0.0%	0.6%			0.0%	0.0%	0.1%	0.0%	0.0%			0.0%
Pedestrians						5	10						0	6						10	14						11	12	
% Pedestrians						83.3%	76.9%						100.0%	100.0%						90.9%	100.0%						100.0%	92.3%	
Bicycles on Crosswalk						1	3						0	0						1	0						0	1	
% Bicycles on Crosswalk						16.7%	23.1%						0.0%	0.0%						9.1%	0.0%						0.0%	7.7%	

Appendix B

Crash Data

Richmond Avenue at Hayes Road

Crash Data at the Intersection of Richmond Avenue at Hayes Rd (09/01/2016 - 08/31/2019)

Crash Data near the Intersection of Richmond Avenue at Hayes Rd (within 250 ft)

Crash ID	Crash Fatality	Crash Severity	Crash Time	Crash Date	First Harmful Event	Intersecting Street Name	Intersection Related	Latitude	Light Condition	Longitude	Manner of Collision	Object Struck	Roadway Part	Surface Condition	Weather Condition	Contributing Factor 1	Vehicle Travel Direction	Crash RPD
15308133	0	C - POSSIBLE INJURY	6:21 PM	9/9/2016	FIXED OBJECT	HAYES RD	INTERSECTION RELATED	29.72774492	1 - DAYLIGHT	-95.57613617	ONE MOTOR VEHICLE - GOING STRAIGHT	HIT LUMINAIRE POLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	23 - FAILED TO DRIVE IN SINGLE LANE	W - WEST	No Data
15516137	0	B - NON-INCAPACITATING INJURY	10:00 PM	12/27/2016	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	29.72774482	3 - DARK, LIGHTED	-95.57606304	ANGLE - BOTH GOING STRAIGHT	NOT APPLICABLE	1 - MAIN/PROPER LANE	2 - WET	2 - CLOUDY		W - WEST	No Data
15616638	0	N - NOT INJURED	8:54 PM	1/1/2017	MOTOR VEHICLE IN TRANSPORT	N/A	DRIVEWAY ACCESS	29.72813745	2 - DARK, NOT LIGHTED	-95.57605405	SAME DIRECTION - ONE STRAIGHT-ONE RIGHT TURN	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	27 - FAILED TO PASS TO RIGHT SAFELY	S - SOUTH	No Data
15689397	0	C - POSSIBLE INJURY	12:25 PM	4/3/2017	MOTOR VEHICLE IN TRANSPORT	N/A	NON INTERSECTION	29.72778213	1 - DAYLIGHT	-95.57605362	SAME DIRECTION - BOTH GOING STRAIGHT-SIDESWIPE	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	25 - FAILED TO DRIVE IN SINGLE LANE	W - WEST	No Data
15683167	0	B - NON-INCAPACITATING INJURY	4:46 PM	4/4/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	29.72778409	1 - DAYLIGHT	-95.57606304	ANGLE - ONE STRAIGHT-ONE LEFT TURN	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	2 - CLOUDY	0 - NONE	E - EAST	No Data
15738099	0	N - NOT INJURED	4:30 PM	4/25/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	29.72778482	1 - DAYLIGHT	-95.57606304	ANGLE - BOTH GOING STRAIGHT	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	No Data	S - SOUTH	No Data
15774095	0	C - POSSIBLE INJURY	9:14 PM	5/23/2017	MOTOR VEHICLE IN TRANSPORT	N/A	DRIVEWAY ACCESS	29.72838745	3 - DARK, LIGHTED	-95.57607405	SAME DIRECTION - ONE STRAIGHT-ONE STOPPED	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	22 - FAILED TO CONTROL SPEED	S - SOUTH	No Data
15796625	0	C - POSSIBLE INJURY	10:00 PM	5/27/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION RELATED	29.72778483	2 - DARK, NOT LIGHTED	-95.57631971	OPPOSITE DIRECTION - BOTH GOING STRAIGHT	HIT LUMINAIRE POLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	23 - FAILED TO DRIVE IN SINGLE LANE	E - EAST	No Data
15813910	0	C - POSSIBLE INJURY	9:50 PM	6/6/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	29.72778232	3 - DARK, LIGHTED	-95.57605162	ANGLE - ONE STRAIGHT-ONE LEFT TURN	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	37 - FAILED TO YIELD RIGHT OF WAY - TURNING LEFT	S - SOUTH	No Data
15806331	0	B - NON-INCAPACITATING INJURY	6:33 PM	6/18/2017	OVERTURNED	N/A	NON INTERSECTION	29.72778482	1 - DAYLIGHT	-95.57615774	ONE MOTOR VEHICLE - GOING STRAIGHT	OVERTURNED	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	70 - DRIVER INATTENTION	W - WEST	No Data
15828395	0	N - NOT INJURED	4:00 AM	6/28/2017	MOTOR VEHICLE IN TRANSPORT	N/A	NON INTERSECTION	29.72778482	1 - DAYLIGHT	-95.57606304	ANGLE - ONE STRAIGHT-ONE LEFT TURN	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	No Data	S - SOUTH	No Data
15844879	0	N - NOT INJURED	9:10 PM	7/4/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	29.72778482	2 - DARK, NOT LIGHTED	-95.57606304	ANGLE - ONE STRAIGHT-ONE LEFT TURN	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	2 - CLOUDY	37 - FAILED TO YIELD RIGHT OF WAY - TURNING LEFT	S - SOUTH	No Data
15890354	0	N - NOT INJURED	9:50 PM	7/20/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	29.72778482	3 - DARK, LIGHTED	-95.57606304	SAME DIRECTION - BOTH GOING STRAIGHT-REAR END	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	22 - FAILED TO CONTROL SPEED	W - WEST	No Data
15933395	0	B - NON-INCAPACITATING INJURY	9:31 AM	8/25/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	29.72778482	3 - DARK, LIGHTED	-95.57606304	ANGLE - BOTH GOING STRAIGHT	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	4 - CHANGED LANE WHEN UNSAFE	E - EAST	No Data
16059673	0	N - NOT INJURED	9:10 AM	10/24/2017	MOTOR VEHICLE IN TRANSPORT	N/A	NON INTERSECTION	29.72775789	1 - DAYLIGHT	-95.5757eeeh	SAME DIRECTION - BOTH GOING STRAIGHT-SIDESWIPE	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	22 - FAILED TO CONTROL SPEED	W - WEST	No Data
16130104	0	N - NOT INJURED	10:00 PM	12/6/2017	MOTOR VEHICLE IN TRANSPORT	N/A	DRIVEWAY ACCESS	29.73902555	3 - DARK, LIGHTED	-95.57629228	SAME DIRECTION - ONE STRAIGHT-ONE STOPPED	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	No Data	W - WEST	No Data
16295084	0	N - NOT INJURED	4:10 PM	3/9/2018	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	29.72778482	1 - DAYLIGHT	-95.57606304	ANGLE - BOTH GOING STRAIGHT	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	0 - NONE	W - WEST	No Data
16300155	0	N - NOT INJURED	10:05 PM	3/12/2018	MOTOR VEHICLE IN TRANSPORT	RICHMOND AVE	INTERSECTION	29.72778482	2 - DARK, NOT LIGHTED	-95.57606304	ANGLE - BOTH GOING STRAIGHT	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	3 - CLEAR	0 - NONE	W - WEST	No Data
16304722	0	C - POSSIBLE INJURY	8:36 AM	4/25/2018	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	29.72778492	1 - DAYLIGHT	-95.57606304	ANGLE - ONE STRAIGHT-ONE LEFT TURN	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	2 - CLOUDY	37 - FAILED TO YIELD RIGHT OF WAY - TURNING LEFT	S - SOUTH	No Data
16416596	0	A - SUSPECTED SERIOUS INJURY	10:10 PM	5/17/2018	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	29.72778482	3 - DARK, LIGHTED	-95.57606304	ANGLE - BOTH GOING STRAIGHT	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	3 - CLEAR	0 - NONE	W - WEST	No Data
16716776	0	N - NOT INJURED	8:30 PM	10/30/2018	MOTOR VEHICLE IN TRANSPORT	N/A	NON INTERSECTION	29.72778078	3 - DARK, LIGHTED	-95.57605591	SAME DIRECTION - BOTH GOING STRAIGHT-SIDESWIPE	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	No Data	E - EAST	No Data
16719327	0	99 - UNKNOWN	10:13 AM	11/4/2018	OTHER OBJECT	N/A	DRIVEWAY ACCESS	29.72778482	3 - DARK, LIGHTED	-95.57613671	ONE MOTOR VEHICLE - GOING STRAIGHT	HIT TREE, SHRUB, LANDSCAPING	3 - MAIN/PROPER LANE	99 - UNKNOWN	2 - CLOUDY	No Data	S - SOUTH	No Data
16795157	0	C - POSSIBLE INJURY	5:00 AM	12/24/2018	MOTOR VEHICLE IN TRANSPORT	N/A	DRIVEWAY ACCESS	29.72774511	4 - DARK, UNKNOWN LIGHTING	-95.57559174	ANGLE - ONE STRAIGHT-ONE LEFT TURN	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	0 - NONE	E - EAST	No Data
16872378	0	N - NOT INJURED	4:30 PM	1/31/2019	MOTOR VEHICLE IN TRANSPORT	N/A	NON INTERSECTION	29.72778482	1 - DAYLIGHT	-95.57622587	SAME DIRECTION - BOTH GOING STRAIGHT-REAR END	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	No Data	W - WEST	No Data
16900048	0	N - NOT INJURED	7:00 PM	2/13/2019	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	29.72778482	1 - DAYLIGHT	-95.57606304	ANGLE - BOTH GOING STRAIGHT	NOT APPLICABLE	1 - MAIN/PROPER LANE	99 - UNKNOWN	2 - CLOUDY	99 - FAILED TO YIELD RIGHT OF WAY - OPEN INTERSECTION	S - SOUTH	No Data
16952293	0	N - NOT INJURED	1:50 PM	3/31/2019	MOTOR VEHICLE IN TRANSPORT	N/A	NON INTERSECTION	29.72778483	1 - DAYLIGHT	-95.57606304	SAME DIRECTION - ONE STRAIGHT-ONE STOPPED	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	2 - CLOUDY	No Data	W - WEST	No Data
17012433	0	C - POSSIBLE INJURY	7:30 AM	4/22/2019	PEDESTRIAN	N/A	NON INTERSECTION	29.72778482	1 - DAYLIGHT	-95.57606304	ONE MOTOR VEHICLE - GOING STRAIGHT	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	No Data	E - EAST	No Data
17157388	0	N - NOT INJURED	5:45 PM	6/28/2019	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	29.72778482	1 - DAYLIGHT	-95.57606304	ANGLE - BOTH GOING STRAIGHT	NOT APPLICABLE	2 - WET	1 - Rain	25 - FAILED TO YIELD RIGHT OF WAY - STOP SIGN	W - WEST	No Data
17257743	0	C - POSSIBLE INJURY	7:00 AM	8/21/2019	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	29.72778482	1 - DAYLIGHT	-95.57606304	ANGLE - BOTH GOING STRAIGHT	NOT APPLICABLE	1 - MAIN/PROPER LANE	1 - DRY	1 - CLEAR	No Data	W - WEST	No Data

Crash ID	Intersection Related	Manner of Collision	First Harmful Event	Preventable?
15308133	2	1	7	No
15516137	1	10	7	Yes
15616638	3	23	7	No
15689397	4	21	3	No
15683167	1	14	3	Yes
15738099	1	10	2	Yes
15774095	3	23	7	No
15796625	7	10	3	Yes
15813910	1	14	2	Yes
15806331	4	1	10	No
15828395	4	23	7	No
15844879	1	14	7	Yes
15890354	1	10	2	Yes
15933395	1	10	7	Yes
16059673	4	21	3	No
16130104	3	23	2	No
16295084	1	10	2	Yes
16300155	1	10	3	Yes
16304722	1	14	3	Yes
16416596	1	10	2	Yes
16716776	4	21	3	No
16719327	3	1	7	No
16795157	3	14	2	No
16872378	4	28	7	No
16900048	1	10	2	Yes
16952293	4	23	7	No
17012433	4	1	1	Yes
17157388	1	10	7	Yes
17257743	1	10	7	Yes

Note: Based on Texas Department of Transportation's 2018 Highway Safety Improvement Program Call, installing a traffic signal prevents crashes with the following characteristics:
(Intersection Related = 1 or 2) AND (Manner of Collision = 10,7,9) OR (First Harmful Event = 1 or 5)

Crash Data near the Intersection of Richmond Avenue at Hayes Rd (within 250 ft)

Crash ID	Crash Severity	Crash Date	First Harmful Event	Intersecting Street Name	Intersection Related	Manner of Collision	Correctable?
15308122	C - POSSIBLE INJURY	9/8/2016	FIXED OBJECT	HAYES RD	INTERSECTION RELATED	ONE MOTOR VEHICLE - GOING STRAIGHT	No
15510217	B - NON-INCAPACITATING INJURY	12/27/2016	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT	Yes
15616638	N - NOT INJURED	3/1/2017	MOTOR VEHICLE IN TRANSPORT	N/A	DRIVEWAY ACCESS	SAME DIRECTION - ONE STRAIGHT-ONE RIGHT TURN	No
15689197	C - POSSIBLE INJURY	4/3/2017	MOTOR VEHICLE IN TRANSPORT	N/A	NON INTERSECTION	SAME DIRECTION - BOTH GOING STRAIGHT-SIDESWIPE	No
15685167	B - NON-INCAPACITATING INJURY	4/4/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - ONE STRAIGHT-ONE LEFT TURN	Yes
15738099	N - NOT INJURED	4/29/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT	Yes
15774905	C - POSSIBLE INJURY	5/23/2017	MOTOR VEHICLE IN TRANSPORT	N/A	DRIVEWAY ACCESS	SAME DIRECTION - ONE STRAIGHT-ONE STOPPED	No
15796625	C - POSSIBLE INJURY	5/27/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION RELATED	OPPOSITE DIRECTION - BOTH GOING STRAIGHT	Yes
15811010	C - POSSIBLE INJURY	6/6/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - ONE STRAIGHT-ONE LEFT TURN	Yes
15806331	B - NON-INCAPACITATING INJURY	6/10/2017	OVERTURNED	N/A	NON INTERSECTION	ONE MOTOR VEHICLE - GOING STRAIGHT	No
15828385	N - NOT INJURED	6/18/2017	MOTOR VEHICLE IN TRANSPORT	N/A	NON INTERSECTION	SAME DIRECTION - BOTH GOING STRAIGHT-SIDESWIPE	No
15844829	N - NOT INJURED	7/4/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - ONE STRAIGHT-ONE LEFT TURN	Yes
15890354	N - NOT INJURED	7/30/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	SAME DIRECTION - BOTH GOING STRAIGHT-REAR END	Yes
15933339	B - NON-INCAPACITATING INJURY	8/25/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT	Yes
16059673	N - NOT INJURED	10/28/2017	MOTOR VEHICLE IN TRANSPORT	N/A	NON INTERSECTION	SAME DIRECTION - BOTH GOING STRAIGHT-SIDESWIPE	No
16130164	N - NOT INJURED	12/6/2017	MOTOR VEHICLE IN TRANSPORT	N/A	DRIVEWAY ACCESS	SAME DIRECTION - ONE STRAIGHT-ONE STOPPED	No
16295004	N - NOT INJURED	3/9/2018	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT	Yes
16300115	N - NOT INJURED	3/12/2018	MOTOR VEHICLE IN TRANSPORT	RICHMOND AVE	INTERSECTION	ANGLE - BOTH GOING STRAIGHT	Yes
16364522	C - POSSIBLE INJURY	4/19/2018	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - ONE STRAIGHT-ONE LEFT TURN	Yes
16416596	A - SUSPECTED SERIOUS INJURY	5/17/2018	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT	Yes
16718776	N - NOT INJURED	10/30/2018	MOTOR VEHICLE IN TRANSPORT	N/A	NON INTERSECTION	SAME DIRECTION - BOTH GOING STRAIGHT-SIDESWIPE	No
16719031	99 - UNKNOWN	11/4/2018	FIXED OBJECT	N/A	DRIVEWAY ACCESS	ONE MOTOR VEHICLE - GOING STRAIGHT	No
16785357	C - POSSIBLE INJURY	11/24/2018	MOTOR VEHICLE IN TRANSPORT	N/A	DRIVEWAY ACCESS	ANGLE - ONE STRAIGHT-ONE LEFT TURN	No
16876328	N - NOT INJURED	1/31/2019	MOTOR VEHICLE IN TRANSPORT	N/A	NON INTERSECTION	SAME DIRECTION - BOTH GOING STRAIGHT-REAR END	No
16900248	N - NOT INJURED	2/13/2019	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT	Yes
16952293	N - NOT INJURED	3/11/2019	MOTOR VEHICLE IN TRANSPORT	N/A	NON INTERSECTION	SAME DIRECTION - ONE STRAIGHT-ONE STOPPED	No
17032433	C - POSSIBLE INJURY	4/22/2019	PEDESTRIAN	N/A	NON INTERSECTION	ONE MOTOR VEHICLE - GOING STRAIGHT	Yes
17157388	N - NOT INJURED	6/28/2019	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT	Yes
17251163	C - POSSIBLE INJURY	8/21/2019	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT	Yes

Summary of Correctable crashes

Crash ID	Crash Severity	Crash Date	First Harmful Event	Intersecting Street Name	Intersection Related	Manner of Collision
15510217	B - NON-INCAPACITATING INJURY	12/27/2016	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
15685167	B - NON-INCAPACITATING INJURY	4/4/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - ONE STRAIGHT-ONE LEFT TURN
15738099	N - NOT INJURED	4/29/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
15796625	C - POSSIBLE INJURY	5/27/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION RELATED	OPPOSITE DIRECTION - BOTH GOING STRAIGHT
15811010	C - POSSIBLE INJURY	6/6/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - ONE STRAIGHT-ONE LEFT TURN
15844829	N - NOT INJURED	7/4/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - ONE STRAIGHT-ONE LEFT TURN
15890354	N - NOT INJURED	7/30/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	SAME DIRECTION - BOTH GOING STRAIGHT-REAR END
15933339	B - NON-INCAPACITATING INJURY	8/25/2017	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
16295004	N - NOT INJURED	3/9/2018	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
16300115	N - NOT INJURED	3/12/2018	MOTOR VEHICLE IN TRANSPORT	RICHMOND AVE	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
16364522	C - POSSIBLE INJURY	4/19/2018	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - ONE STRAIGHT-ONE LEFT TURN
16416596	A - SUSPECTED SERIOUS INJURY	5/17/2018	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
16900248	N - NOT INJURED	2/13/2019	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
17032433	C - POSSIBLE INJURY	4/22/2019	PEDESTRIAN	N/A	NON INTERSECTION	ONE MOTOR VEHICLE - GOING STRAIGHT
17157388	N - NOT INJURED	6/28/2019	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT
17251163	C - POSSIBLE INJURY	8/21/2019	MOTOR VEHICLE IN TRANSPORT	HAYES RD	INTERSECTION	ANGLE - BOTH GOING STRAIGHT

Appendix C

Signal Warrant Analysis

Richmond Avenue at Hayes Road

Traffic Survey - Count Analysis

2011 TMUTCD Warrants

County: Harris District: Houston

City: Houston Population: 2,313,000 Survey Date: 12/11/2019

	Route #	Name	Control	Section	85% Speed
Major		Richmond Avenue			35
Minor		Hayes Road			30

Eight Highest Hours: Include the same 8 hours for the Major and Minor St. volumes.

Time Ends	Major St. - Both App.		Minor St. - Hi. Vol. App.	
	Veh. Total	Ped. Total	Veh. Total	Ped. Total
5:15 PM	1,899		130	
1:00 PM	1,521		108	
7:30 AM	1,496		107	
6:15 PM	1,650		97	
2:00 PM	1,388		93	
3:30 PM	1,410		92	
8:30 AM	2,180		89	
11:15 AM	1,223		86	

Comments:

Warrant 1. Eight Hour Vehicular Volume (Warrant met)

☐ Yes ☒ No Meets 70%[c] (and major-street speed exceeds 40 mph and population less than 10,000) *or* 100%[a] (regardless of speed) of Condition A.

- or -

☒ Yes ☐ No Meets 70%[c] (and major-street speed exceeds 40 mph and population less than 10,000) *or* 100%[a] (regardless of speed) of Condition B.

- or -

☐ Yes ☐ No Meets 80%[b] of Conditions A and B.

- or -

☐ Yes ☐ No Meets 56%[d] of Conditions A and B (and major-street speed exceeds 40 mph and population less than 10,000).

Condition A - Minimum Vehicle Volume

Number of Lanes		Vehicles per hour on Major St. (Total of both Approaches)					Vehicles per hour on higher-volume Minor St. approach (One Direction Only)				
Major Street	Minor Street	Required				Existing	Required				Existing
		100%[a]	80%[b]	70%[c]	56%[d]	100%	100%[a]	80%[b]	70%[c]	56%[d]	57%
1	1	500	400	350	280		150	120	105	84	
2 or more	1	600	480	420	336	1,223	150	120	105	84	86
2 or more	2 or more	600	480	420	336		200	160	140	112	
1	2 or more	500	400	350	280		200	160	140	112	

Condition B - Interruption of Continuous Traffic

Number of Lanes		Vehicles per hour on Major St. (Total of both Approaches)					Vehicles per hour on higher-volume Minor St. approach (One Direction Only)				
Major Street	Minor Street	Required				Existing	Required				Existing
		100%[a]	80%[b]	70%[c]	56%[d]	100%	100%[a]	80%[b]	70%[c]	56%[d]	100%
1	1	750	600	525	420		75	60	53	42	
2 or more	1	900	720	630	504	1,223	75	60	53	42	86
2 or more	2 or more	900	720	630	504		100	80	70	56	
1	2 or more	750	600	525	420		100	80	70	56	

[a] Basic minimum hourly volume.

[b] Used for combination of Conditions A and B after adequate trial of other remedial measures.

[c] May be used when the major-street speed exceeds 40 mph or in a community with a population less than 10,000.

[d] May be used for combination of Conditions A and B after adequate trial of other remedial measures when major street exceeds 40 mph or in an isolated community with a population of less than 10,000.

Warrant 2. Four Hour Volumes (Warrant met)

☒ Yes ☐ No Meets each of 4 Highest Hours (Warrant 2 - see Figure 1 and Figure 2).

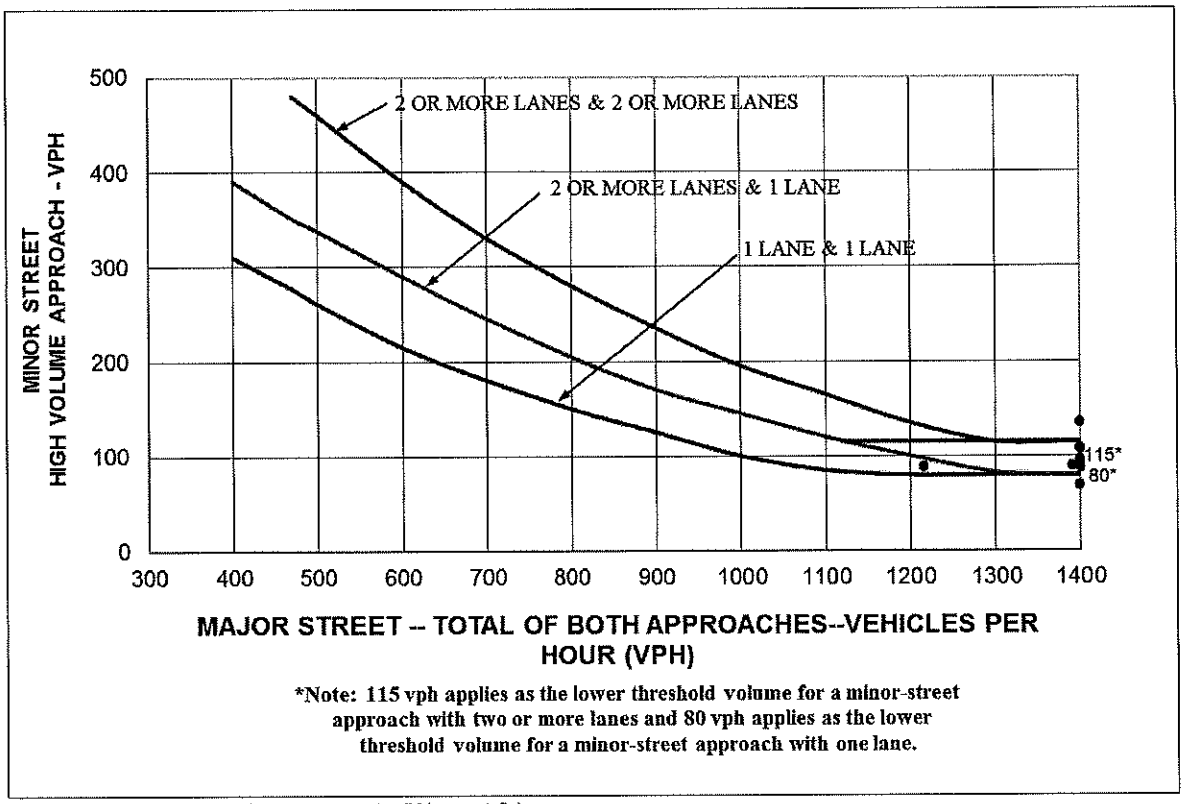

Figure 1. Four-hour volume warrant. (Warrant 2.)

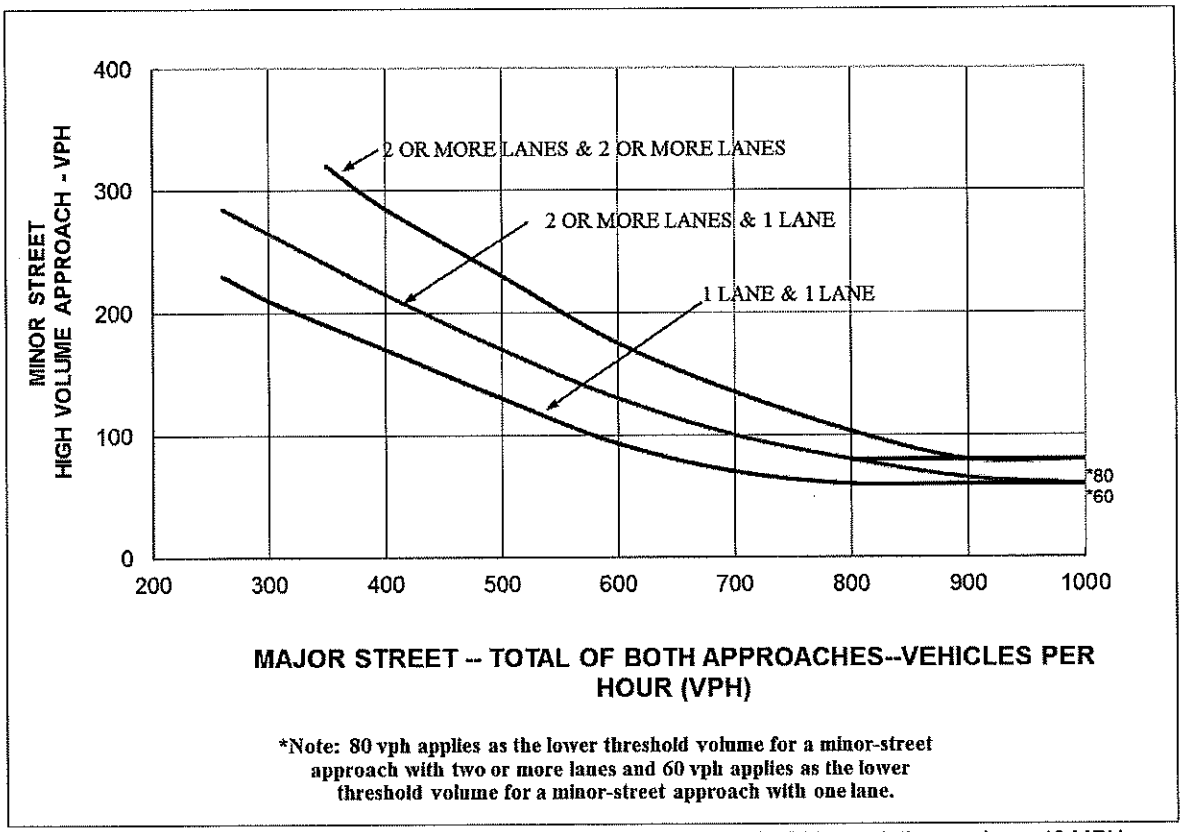

Figure 2. Four-hour volume warrant **(70% Factor)** (community less than 10,000 population or above 40 MPH on major street). (Warrant 2.)

Warrant 3. Peak Hour (Not Applicable)

☐ Yes ☐ No Are all of the following conditions true for the same 1 hour (any four consecutive 15 minute periods)?

1. The total stopped time delay experienced by the traffic on one minor street approach (one direction only) controlled by a stop sign equals or exceeds 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach, *and*

2. The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes, *and*

3. The total entering volume serviced during the hour equals or exceeds 650 vph for intersections with three approaches or 800 vph for intersections with four (or more) approaches.

- or -

☐ Yes ☐ No Meets one High Hour (Warrant 3 - see Figure 3 and Figure 4).

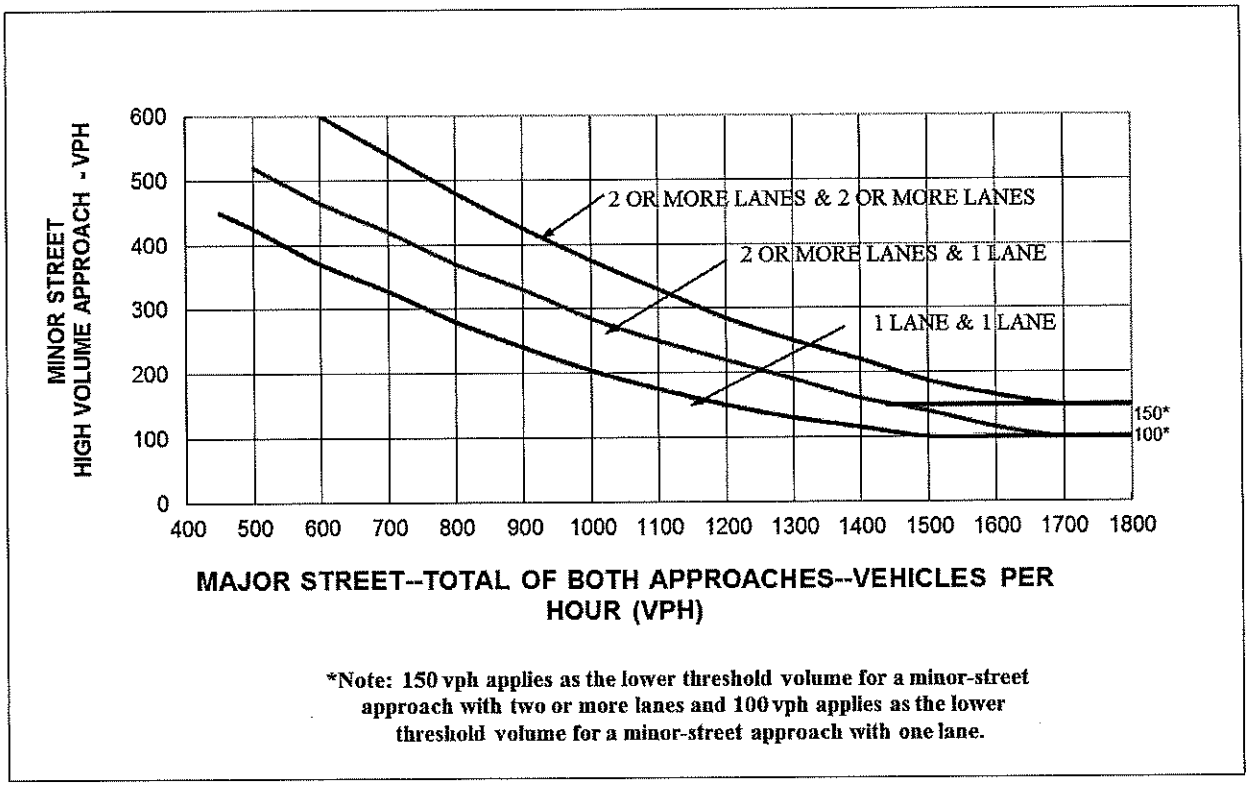

Figure 3. Peak hour volume warrant. (Warrant 3.)

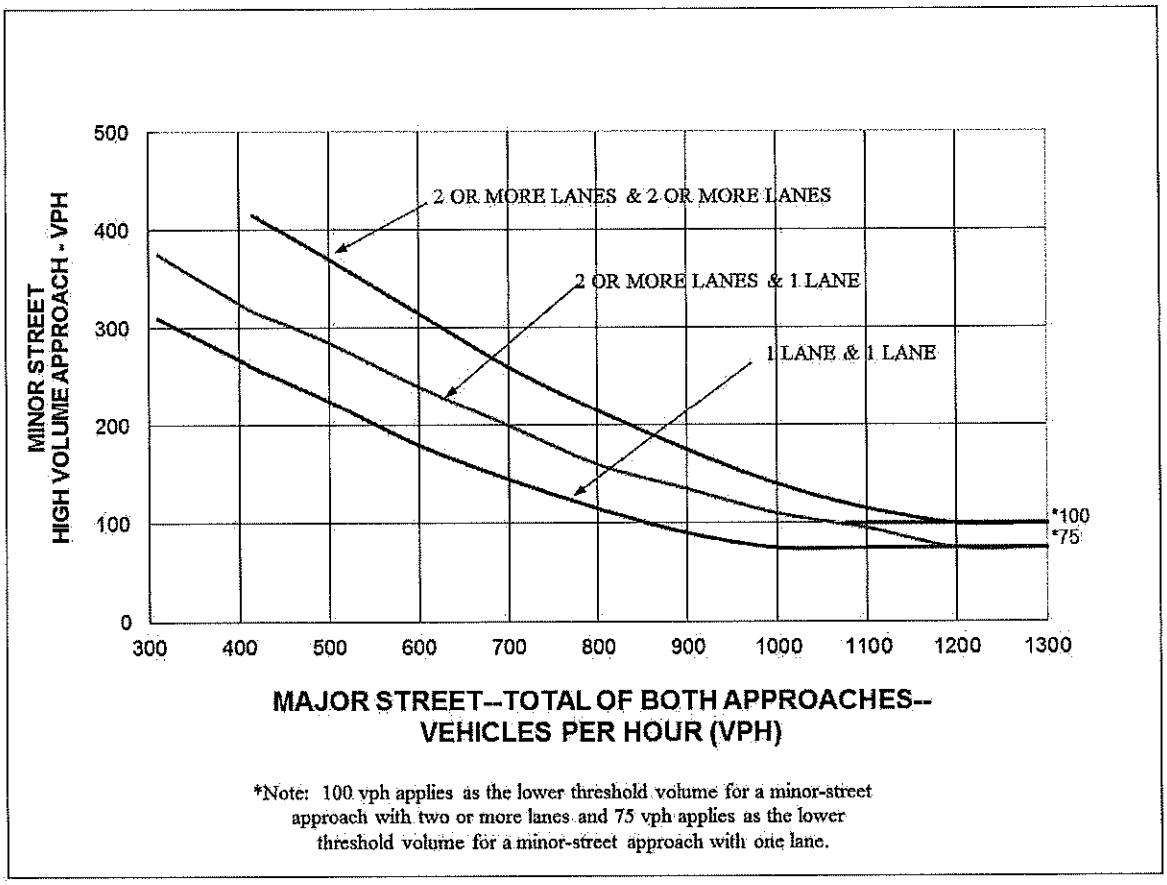

Figure 4. Peak hour volume warrant **(70% Factor)** (community less than 10,000 population or above 40 MPH on major street). (Warrant 3.)

Warrant 4. Four Hour Pedestrian Volume (Warrant not met)

☐ Yes ☒ No Meets each of 4 Highest Hours (Warrant 4 - see Figure 5 and Figure 6.)

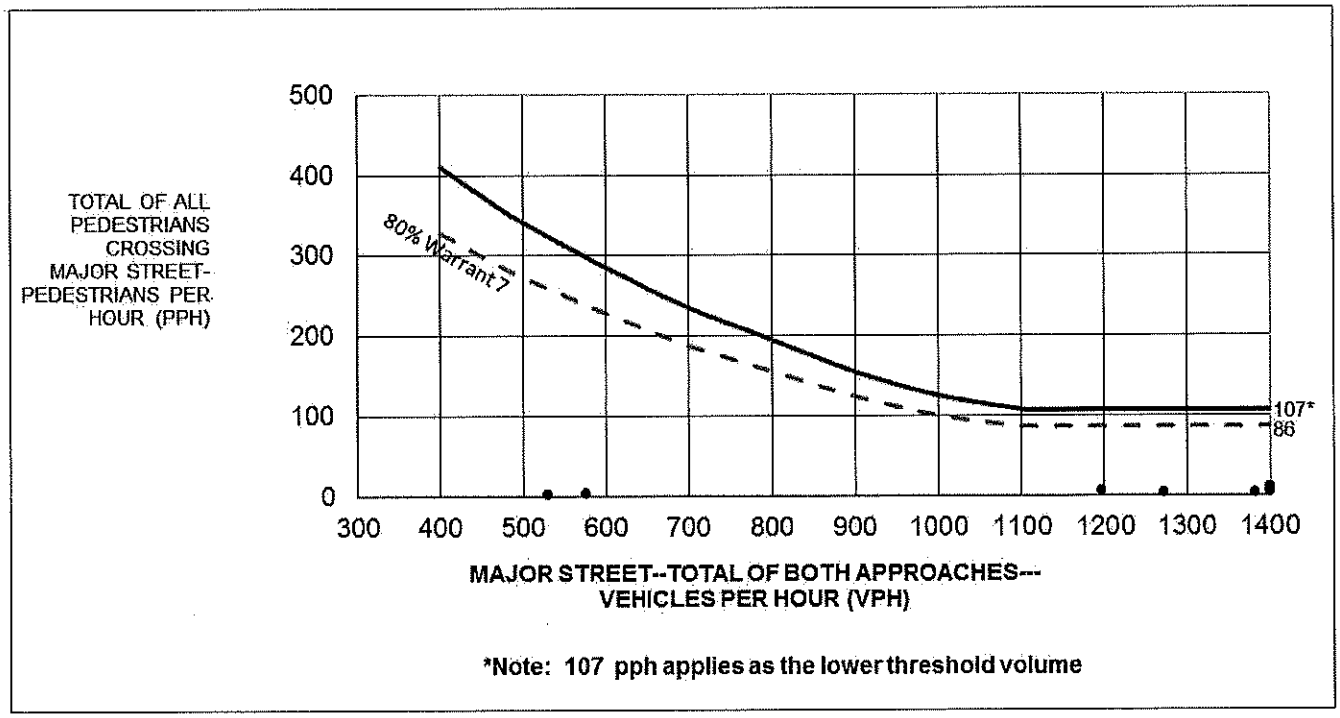

Figure 5. Four hour pedestrian warrant. (Warrant 4.)

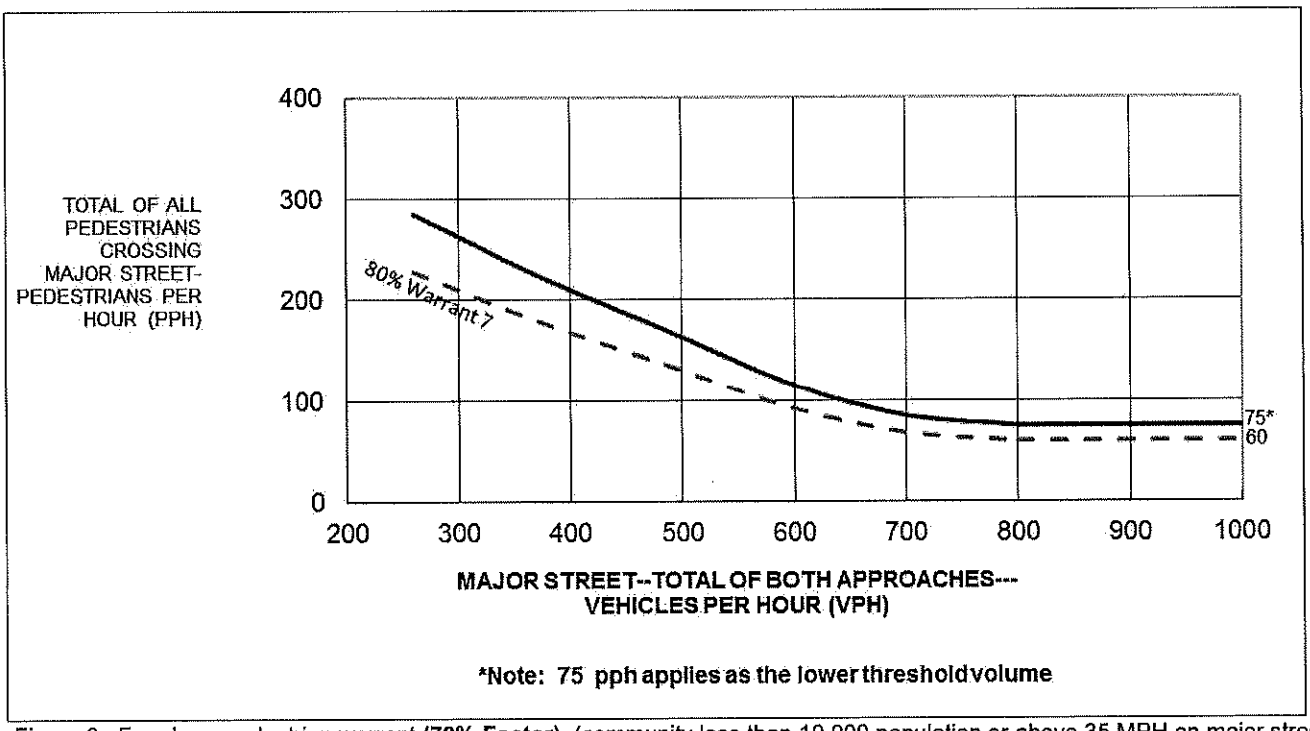

Figure 6. Four hour pedestrian warrant **(70% Factor)**. (community less than 10,000 population or above 35 MPH on major street). (Warrant 4.)

Warrant 4. Peak Hour Pedestrian Volumes (Warrant not met)

☐ Yes ☒ No Meets Peak Hour Pedestrian (Warrant 4 - see Figure 7 and Figure 8.)

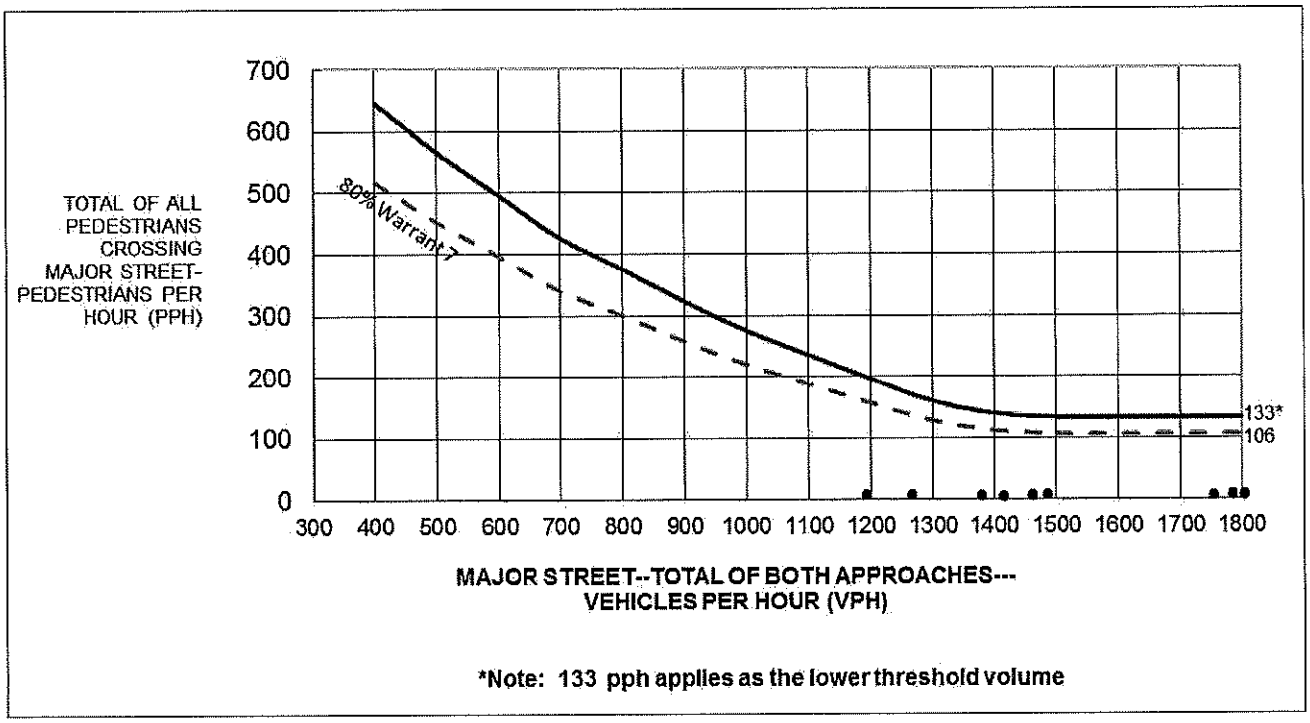

Figure 7. Four hour pedestrian warrant (Warrant 4.)

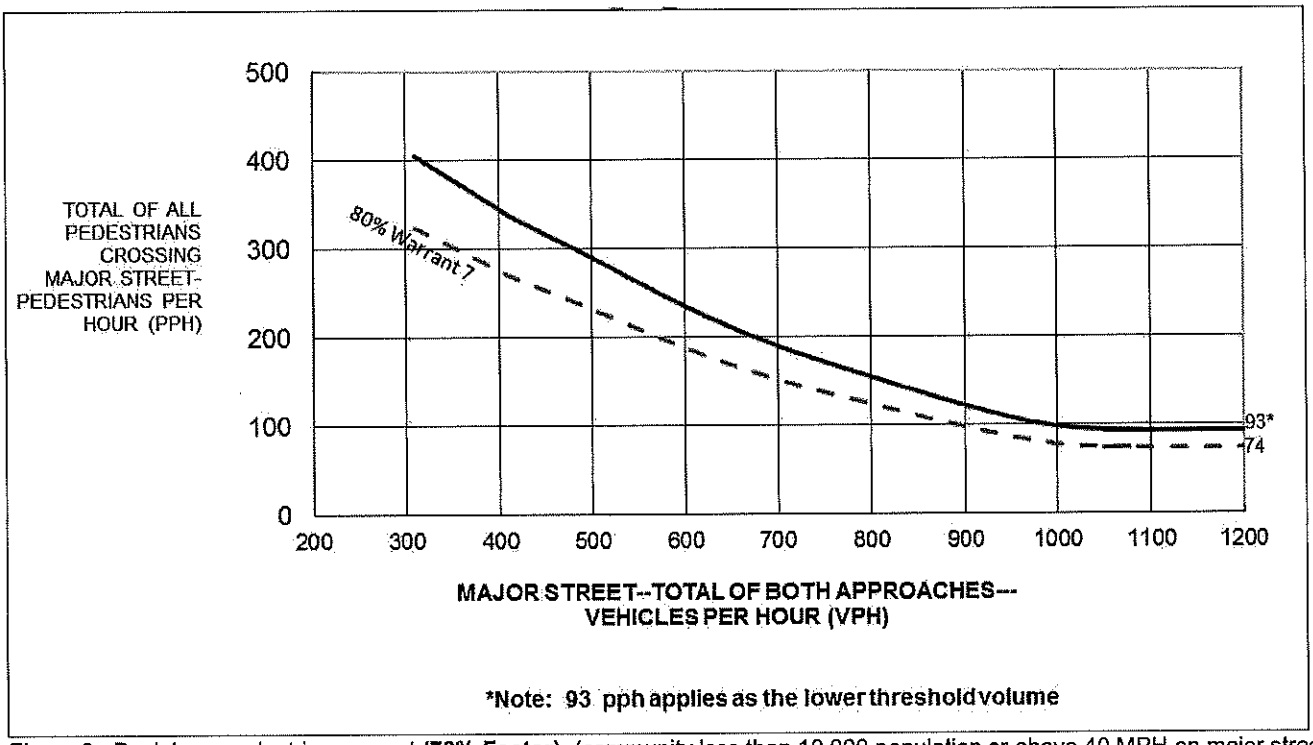

Figure 8. Peak hour pedestrian warrant **(70% Factor)**. (community less than 10,000 population or above 40 MPH on major street). (Warrant 4.)

Warrant 5. School Crossing (Not Applicable)

☐ Yes	☐ No	Is the number of adequate gaps in traffic stream during the period when the children are using the crossing less than the number of minutes in the same period?
		- and -
☐ Yes	☐ No	Are there a minimum of 20 students during the highest crossing hour?
		- and -
☐ Yes	☐ No	Is the nearest signal on the major street located more than 300 feet away? (This warrant may be applied if the proposed signal is less than 300 feet and does not restrict the progressive movement of traffic.)

Warrant 6. Coordinated Signal System (Not Applicable)

☐ Yes	☐ No	On a one-way street or a street with traffic predominantly in one direction, are the adjacent signals far enough apart that the necessary degree of vehicle platooning does not occur?
		- or -
☐ Yes	☐ No	On a two-way street, are the adjacent signals far enough apart that the necessary degree of vehicle platooning does not occur and would the proposed and adjacent traffic control signal provide a progressive operation?

Warrant 7. Crash Experience (Warrant met)

☒ Yes	☐ No	Is one of the following conditions met?: • 80% of Condition A or Condition B in Warrant 1 • 56% of Conditions A or B in Warrant 1 (major-street speed exceeding 40 mph and population less than 10,000) • 80% or more of Warrant 4
		- and -
☒ Yes	☐ No	Have there been 5 or more reported crashes susceptible to correction by a traffic signal in 12 months?

Warrant 8. Roadway Network (Not Applicable)

☐ Yes ☐ No Is the total existing, or immediately projected, entering volume on all approaches greater than 1000 vehicles for each of any 5 hours of a Saturday and/or Sunday.

- or -

☐ Yes ☐ No Is the total existing, or immediately projected, entering volume greater than 1000 vehicles for the peak hour of a typical weekday, and do the 5 year projected traffic volumes meet one or more of Warrants 1, 2, and 3 during an average weekday?

Check applicable characteristics of each route (only 1 needs to be checked):

Major Street	Minor Street	
☐ Yes	☐ No	It is part of street or highway system that serves as the principal roadway network for through traffic flow.
☐ Yes	☐ No	It includes rural or suburban highways outside, entering, or traversing a city.
☐ Yes	☐ No	It appears as a major route on an official plan such as a major street plan in an urban area traffic and transportation study.
☐ Yes	☐ No	It connects areas of principal traffic generation.
☐ Yes	☐ No	It has surface street freeway or expressway ramp terminals.

Warrant 9. Intersection Near a Grade Crossing (One Approach Lane at the Track Crossing) (Not Applicable)

☐ Yes ☐ No Meets one High Hour (Warrant 9 - see Figure 9.)

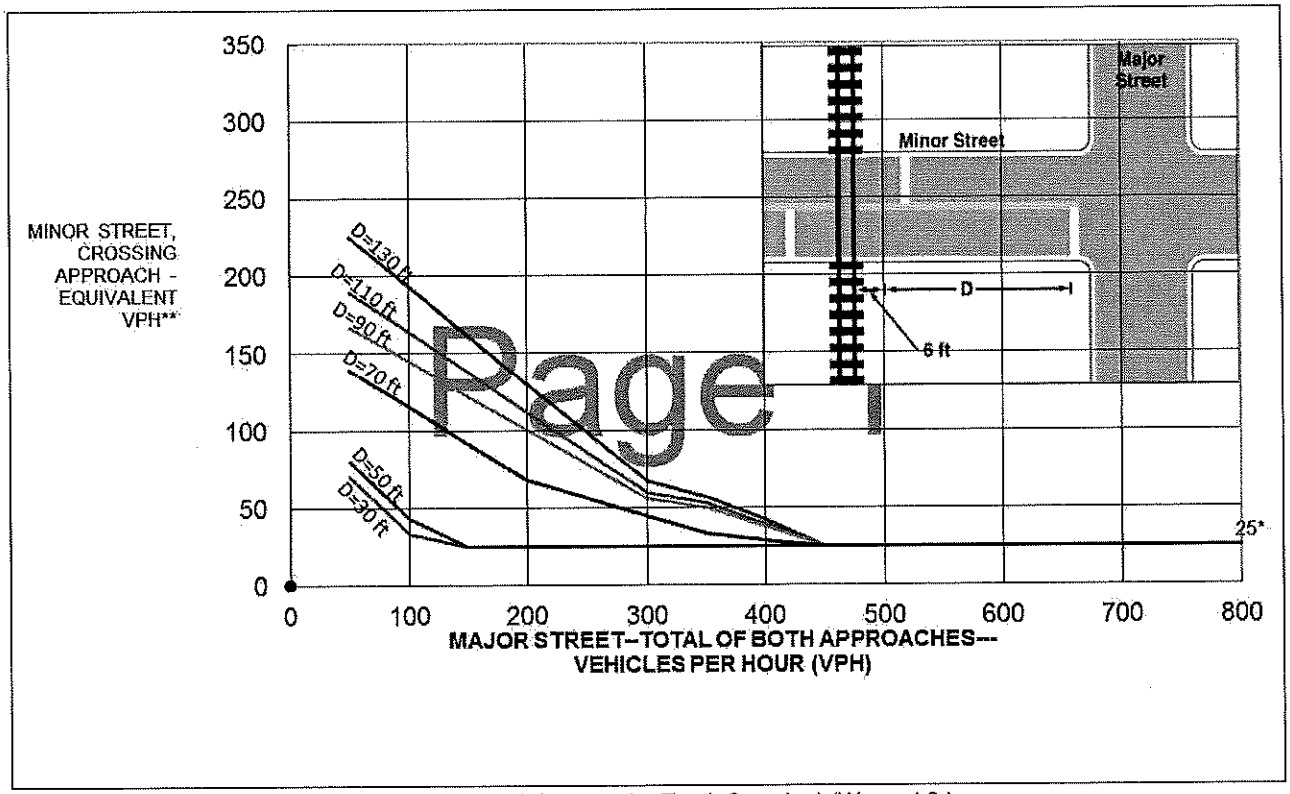

Figure 9. Railroad Grade Crossing (One Approach Lane at the Track Crossing) (Warrant 9.)

Warrant 9. Intersection Near a Grade Crossing (Two or More Approach Lanes at the Track Crossing) (Not Applicable)

☐ Yes ☐ No Meets one High Hour (Warrant 9 - see Figure 10.)

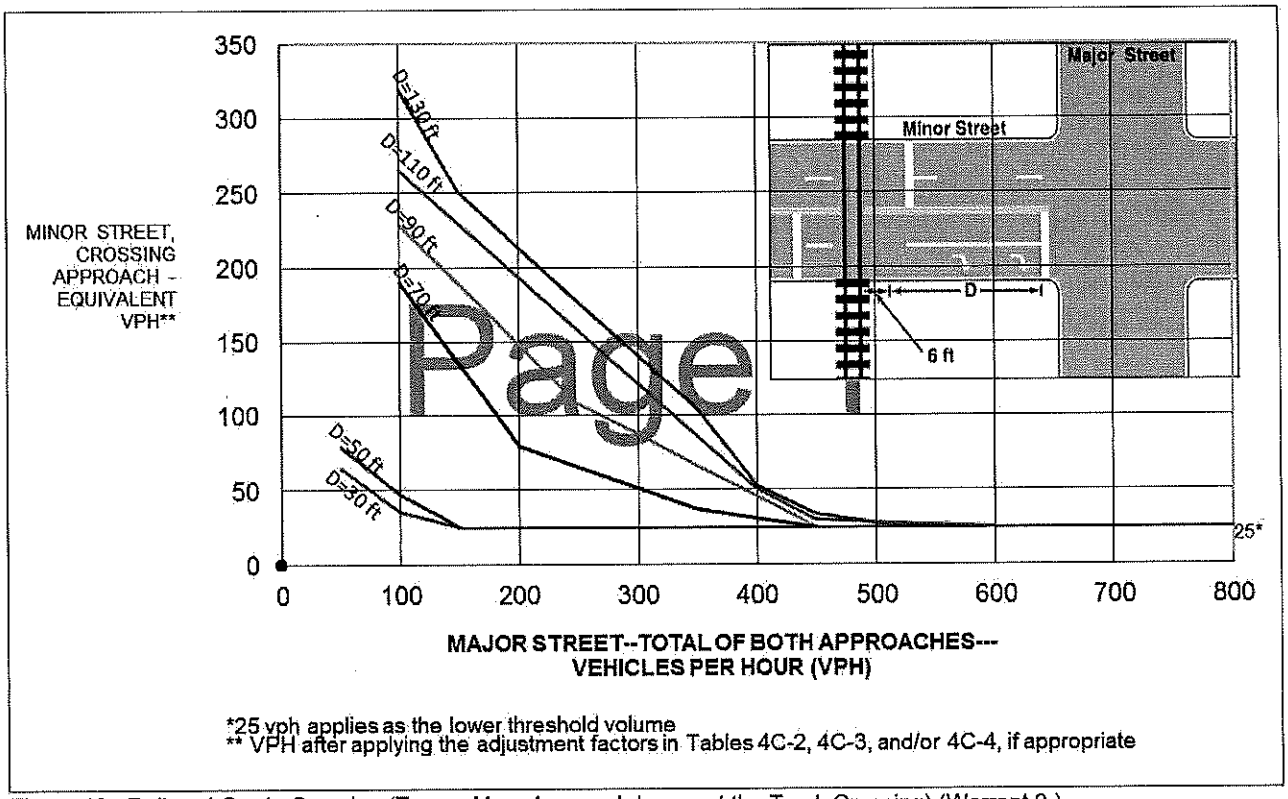

Figure 10. Railroad Grade Crossing (Two or More Approach Lanes at the Track Crossing) (Warrant 9.)

Table 4C-2. Warrant 9, Adjustment Factor for Daily Frequency of Rail Traffic

Rail Traffic per Day	Adjustment Factor
1	0.67
2	0.91
3 to 5	1.00
6 to 8	1.18
9 to 11	1.25
12 or more	1.33

Table 4C-3. Warrant 9, Adjustment Factor for Percentage of High-Occupancy Buses

% of High-Occupancy Buses* on Minor-Street Approach	Adjustment Factor
0%	1.00
2%	1.09
4%	1.19
6% or more	1.32

* A high-occupancy bus is defined as a bus occupied by at least 20 people.

Table 4C-4. Warrant 9, Adjustment Factor for Percentage of Tractor-Trailer Trucks

% of Tractor-Trailer Trucks on Minor-Street Approach	Adjustment Factor	
	D less than 70 feet	D of 70 feet or more
0% to 2.5%	0.50	0.50
2.6% to 7.5%	0.75	0.75
7.6% to 12.5%	1.00	1.00
12.6% to 17.5%	2.30	1.15
17.6% to 22.5%	2.70	1.35
22.6% to 27.5%	3.28	1.64
More than 27.5%	4.18	2.09

Remarks:

Appendix D

Intersection Photographs

Richmond Avenue at Hayes Road

Figure D1. Eastbound on Richmond Avenue approaching the intersection

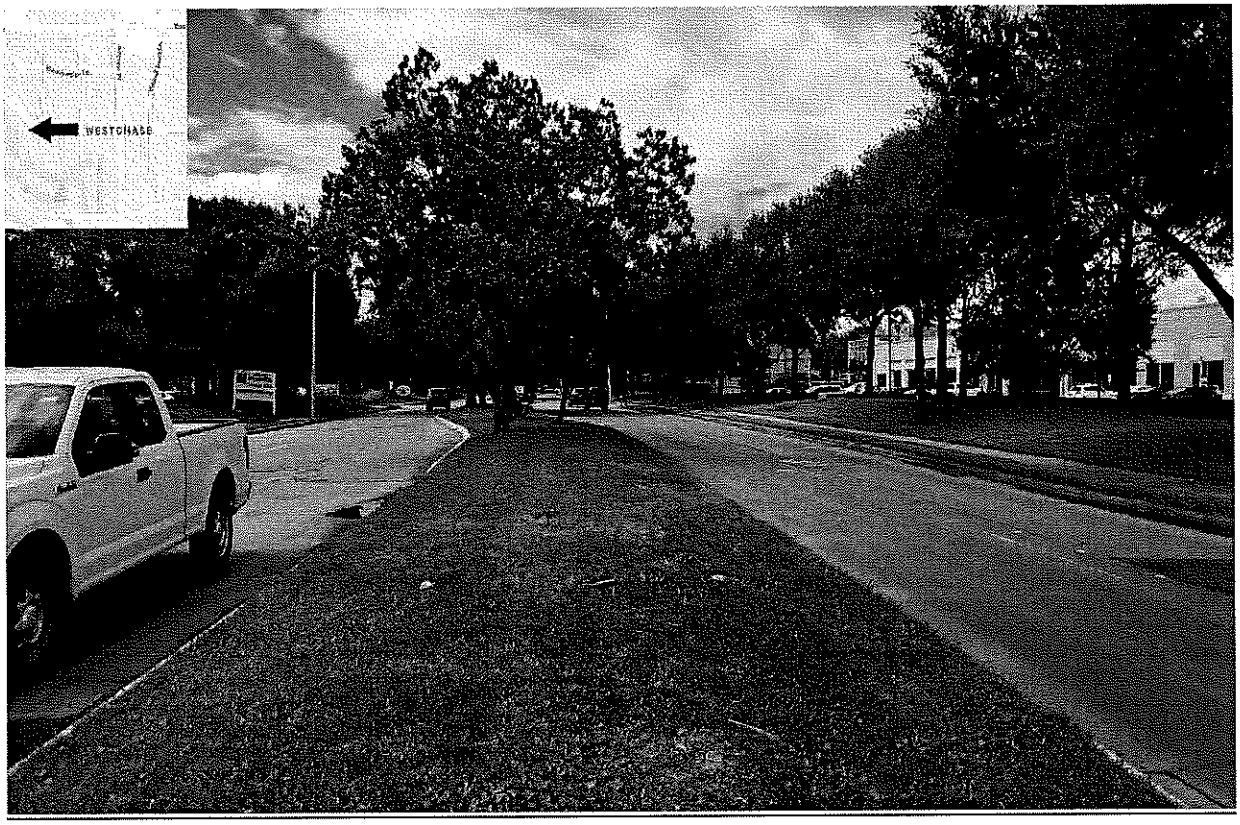

Figure D2. Westbound on Richmond Avenue away from the intersection

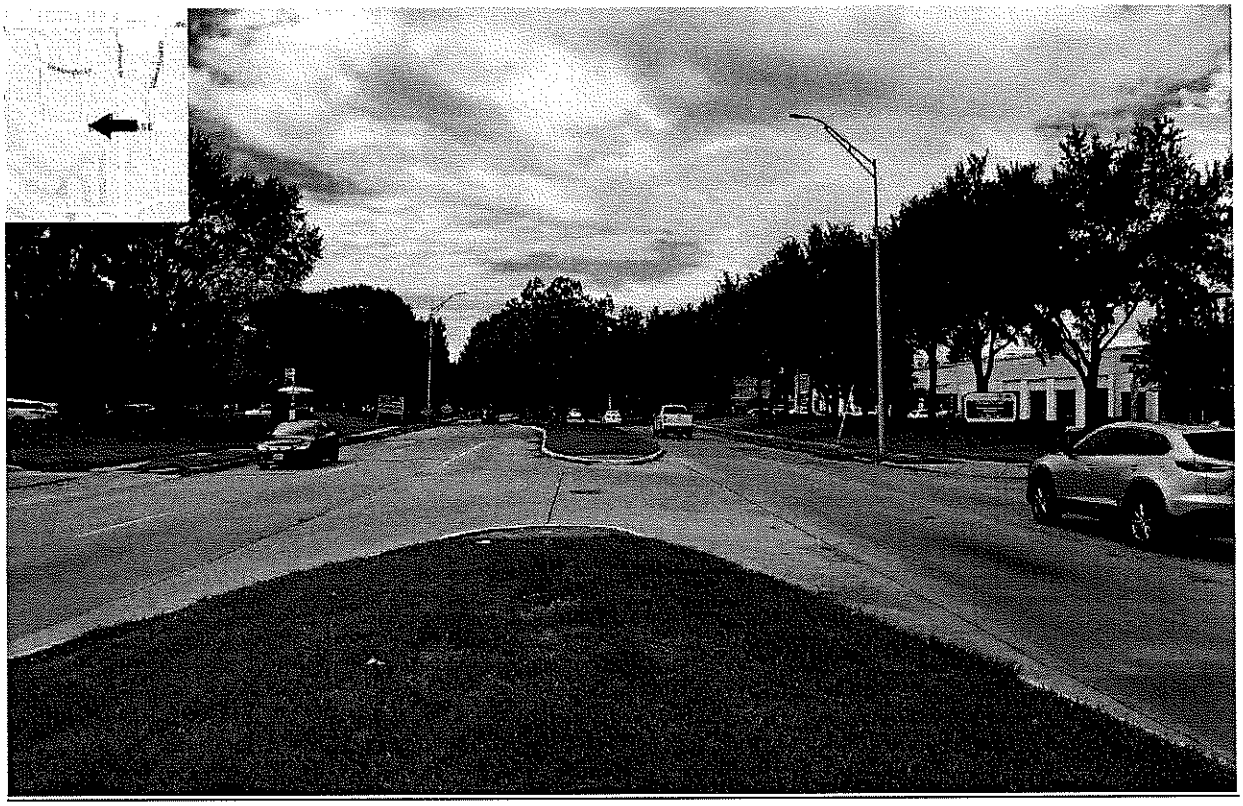

Figure D3. Westbound on Richmond Avenue approaching the intersection

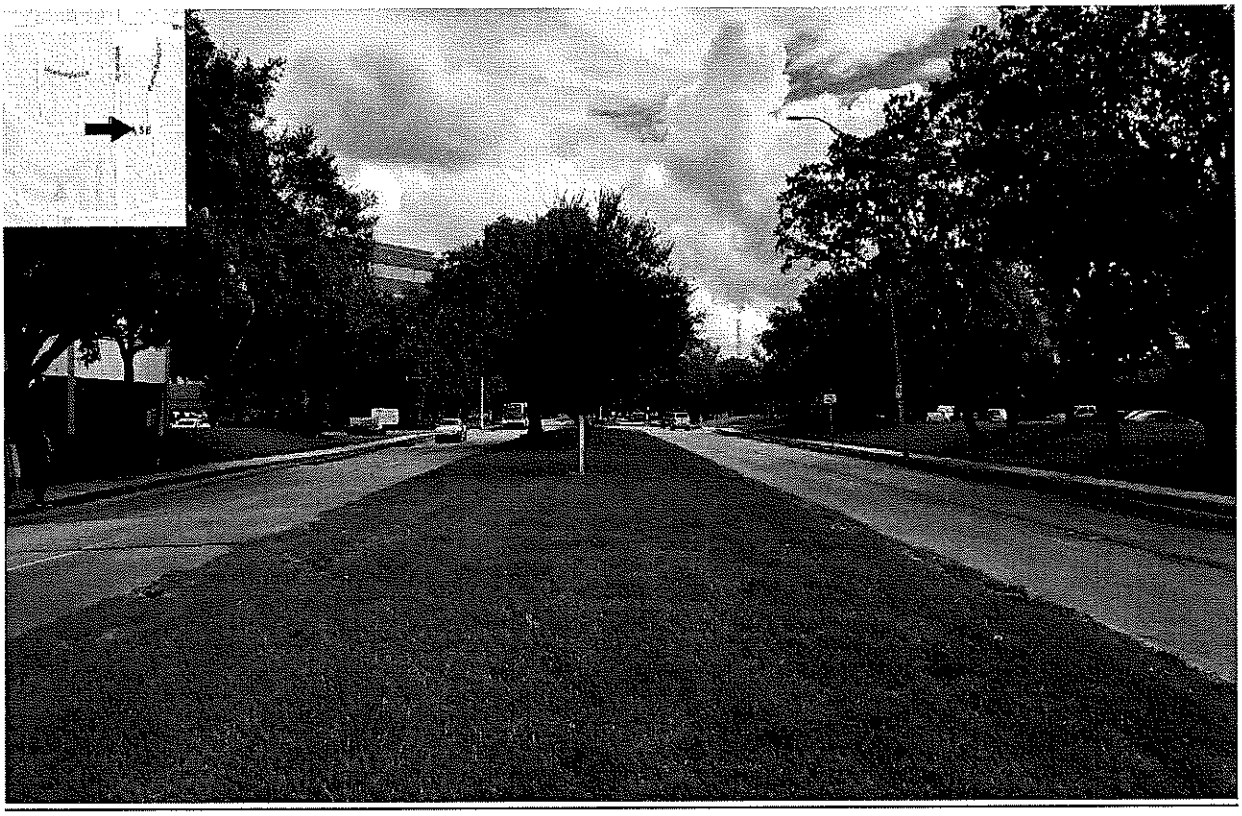

Figure D4. Eastbound on Richmond Avenue away from the intersection

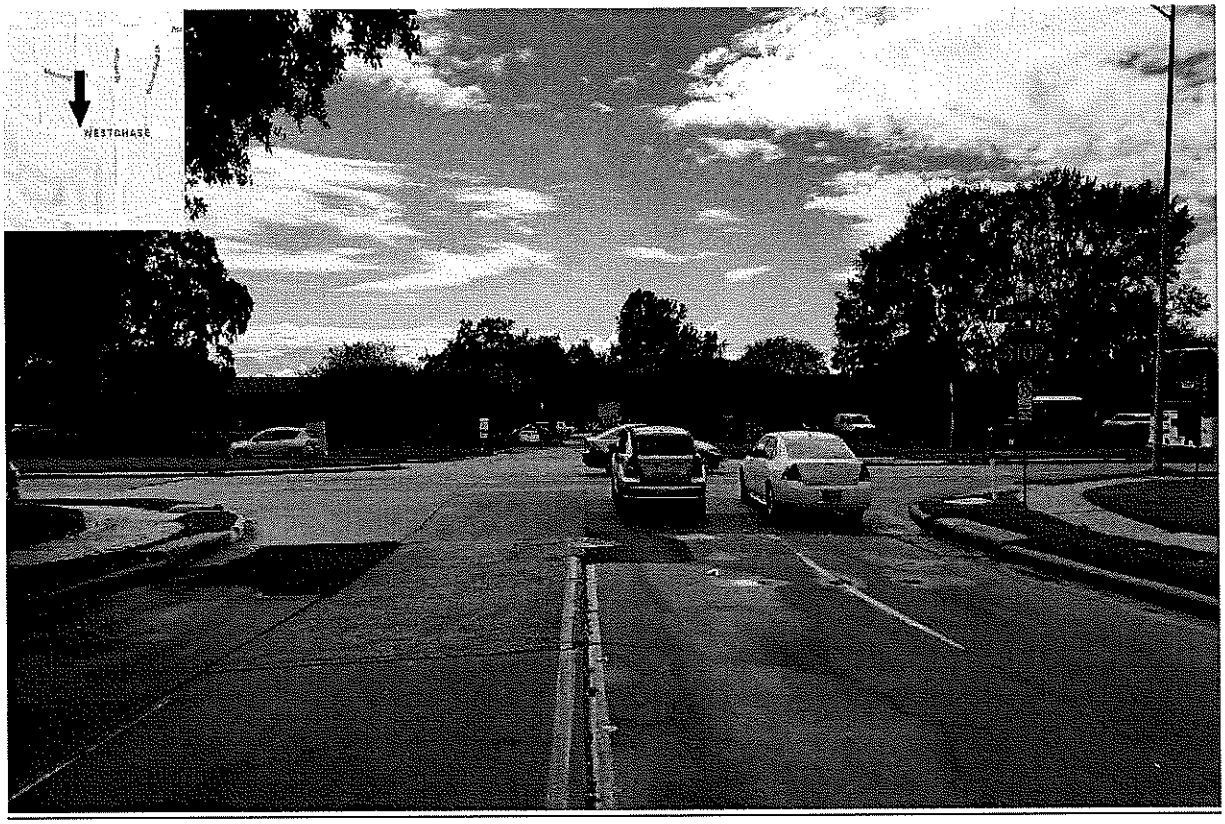

Figure D5. Southbound on Hayes Road approaching the intersection

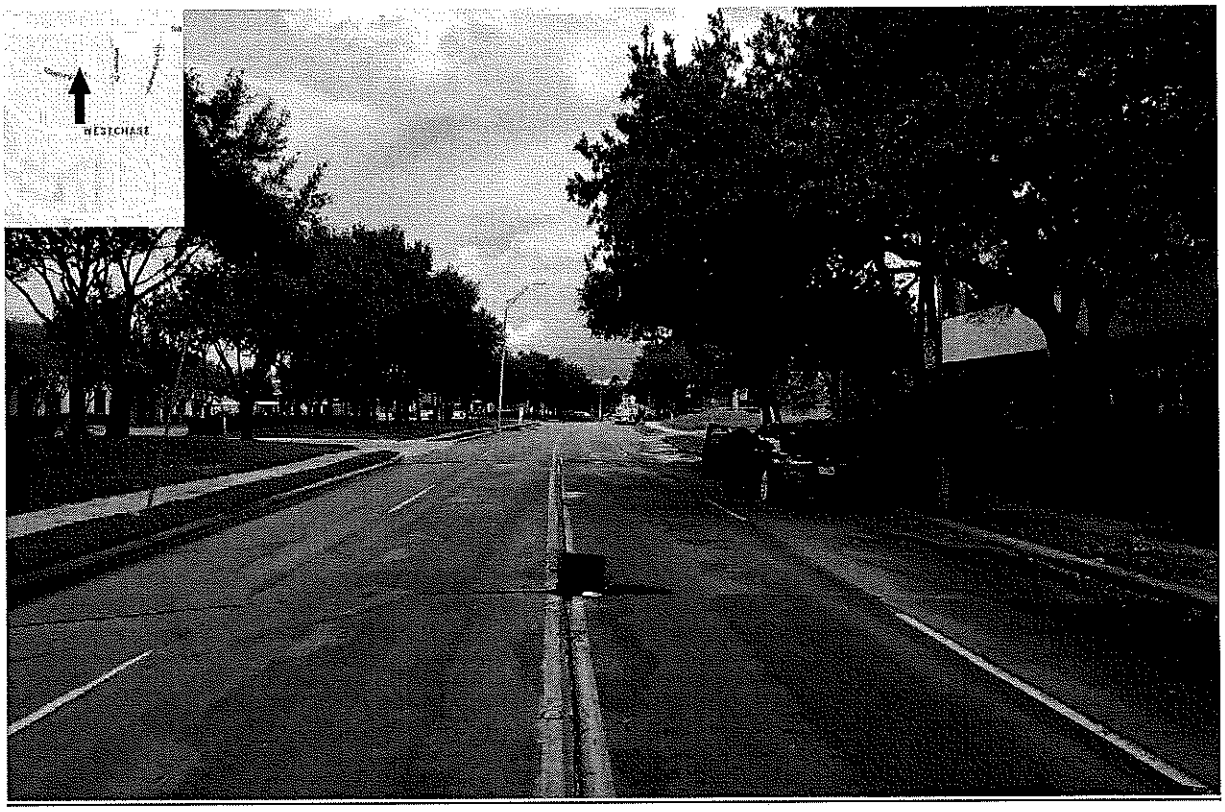

Figure D6. Northbound on Hayes Road away from the intersection

Figure D7. Northbound on Westchase Park Driveway approaching the intersection

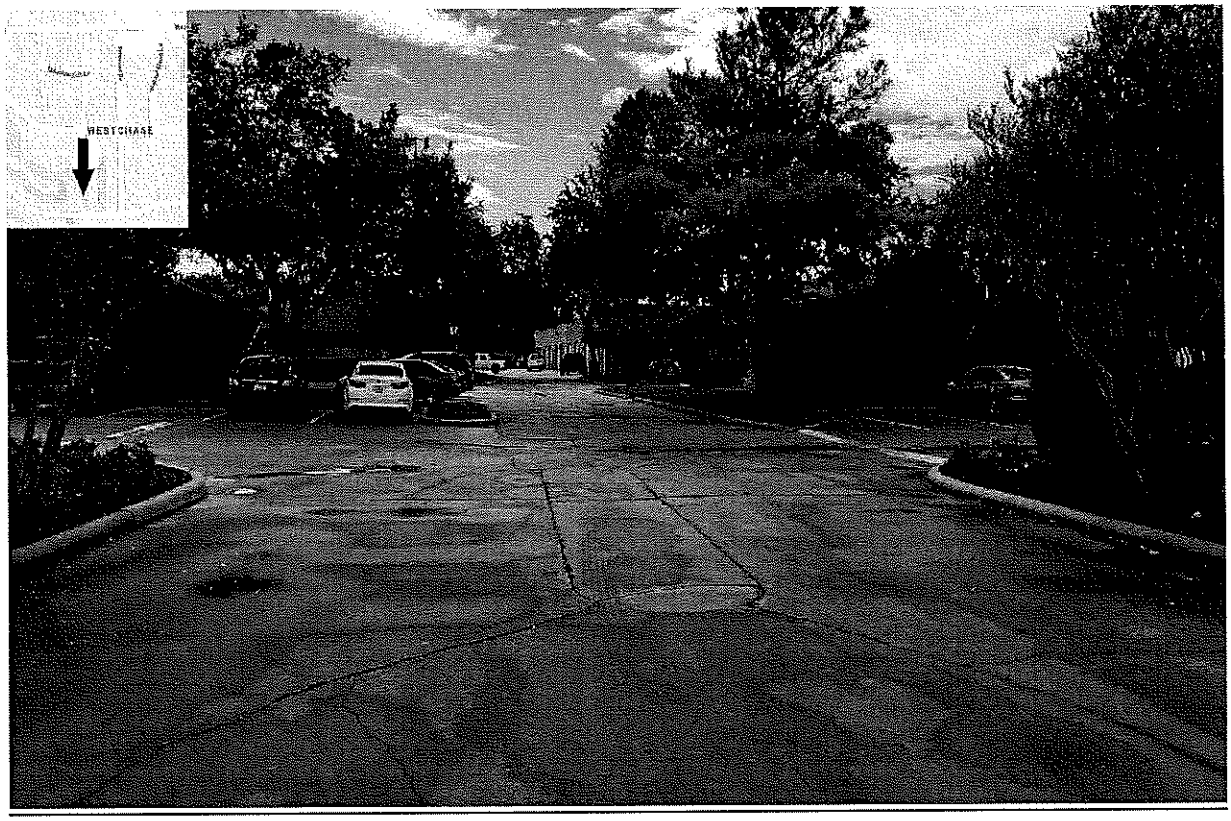

Figure D8. Southbound on Westchase Park Driveway away from the intersection

WESTCHASE DISTRICT

September 23, 2020

Ms. Carol Ellinger Haddock, P.E.
Director
City of Houston - Houston Public Works
611 Walker
Houston, TX 77002

Re: Funding Commitment for 2020 HSIP Submittal of the Intersection of Richmond Avenue and Hayes Road Safety Project

Dear Ms. Haddock,

The intersection of Richmond Avenue and Hayes Road has a history of collisions that makes this location a candidate project for the 2020 Highway Safety Improvement Program (HSIP). A traffic signal warrant analysis conducted in January 2020, revealed the need for a signalized intersection. The proposed HSIP project consists of replacing the stop sign with a new traffic signal, and adding new ADA compliant sidewalk, ramps, and pavement markings per current City of Houston design standards. The new traffic signal will have three (3) signal heads, including one (1) left turn light, with an overhead street name sign. The signal pole will feature a countdown pedestrian signal and pedestrian push button stations for pedestrian and cyclist safety purposes.

Westchase District is committed to providing the 10% local match commitment for the project, per program requirements. The District will also provide the costs required for any project design and development activities and will be responsible for cost overruns associated with said improvements.

Thank you for submitting this project for funding on behalf of Westchase District.

Sincerely,

Irma H. Sanchez
Vice President of Projects
Westchase District

THE GOODMAN CORPORATION
TBPE NO. F-19990

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Suite 200
Houston, TX 77006

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CREATIVE MOBILITY SOLUTIONS

THEGOODMANCORP.COM

Westchase District
Intersection of Richmond Ave and Hayes Road
Highway Safety Improvement Program (HSIP) Candidate Project
August 2020

The intersection of Richmond Ave. and Hayes Rd. (See Figure 1) has a history of collisions that make this location a candidate project for the 2020 Highway Safety Improvement Program (HSIP). The HSIP aims to reduce fatalities, incapacitating and non-incapacitating injuries on all public roads. Using the required data from CRIS, this intersection has been evaluated to determine project eligibility.

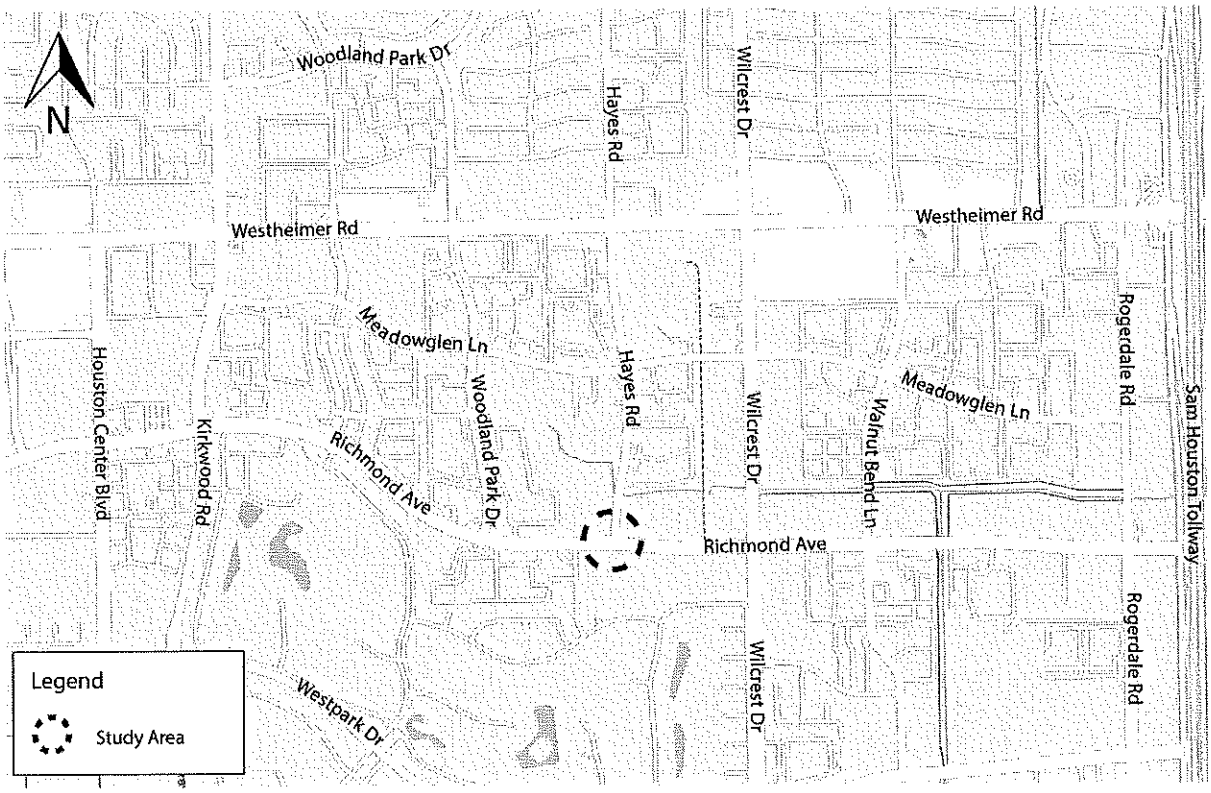

Figure 1. Study area location map

CRIS data from 2017 to 2019 indicated a total of 19 intersection related crashes at the intersection of Richmond Ave and Hayes St. Of these 19 crashes, 9 (47%) were stop sign related crashes[1], 7 out of 9 crashes were classified as drivers failing to yield to stop sign right of way, and the remining 2 crashes were drivers disregard stop signs. One incapacitating injury crash occurred in 2018. It can be inferred that the high rate of stop sign related crashes are occurring due to drivers failing to yield the right of way.

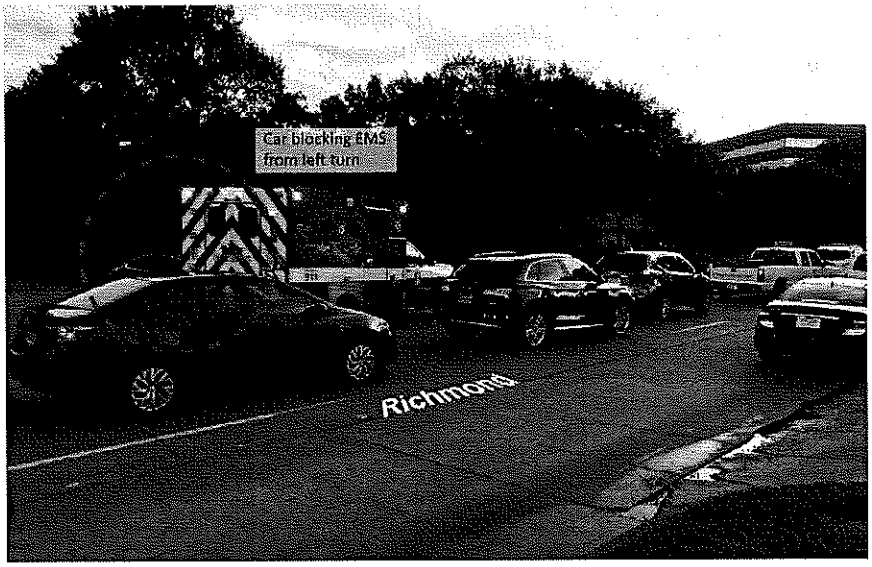

Figure 2. Richmond Ave. and Hayes Rd. intersection

Drivers disregarding the stop sign may not only cause crashes, but they may also block vehicles turning left at the median, as with the emergency vehicle in Figure 2. Additionally, this median opening at this T-intersection, allows for multiple turning movements and has numerous conflict points (See Figure 3).

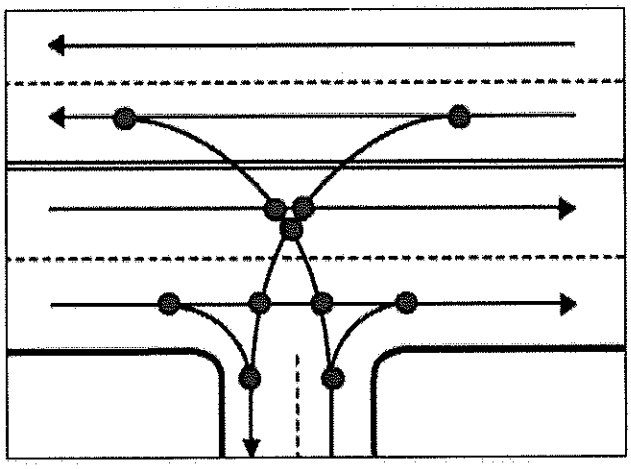

Figure 3. Conflict points at the typical median opening intersection[2]

[1] Stop Sign related crashes: crashes that disregard stop sign or light; crashes that failed to yield right of way - stop sign.

[2] 2014 MEDIAN HANDBOOK. (n.d.). STATE OF FLORIDA DEPARTMENT OF TRANSPORTATON. Retrieved August 12, 2020, from https://www.fdot.gov/docs/default-source/PLANNING/systems/programs/sm/accman/pdfs/FDOT-Median-Handbook-Sept-2014.pdf.

Proposed Solution

A traffic signal warrant analysis for this intersection was completed in January 2020. It corresponds with the need for a signalized intersection. The City of Houston (COH) provided 'tentative approval' for the warrant analysis but at that time expressed interest in evaluating other median modifications adjacent to the project area (See Figure 4). These improvements can be considered with this package dependent upon how the City would want to move forward on this HSIP submittal. Alternatively, the City may determine that the signalization improvements can move forward through the HSIP process with evaluation of the other median modifications occurring at a later date.

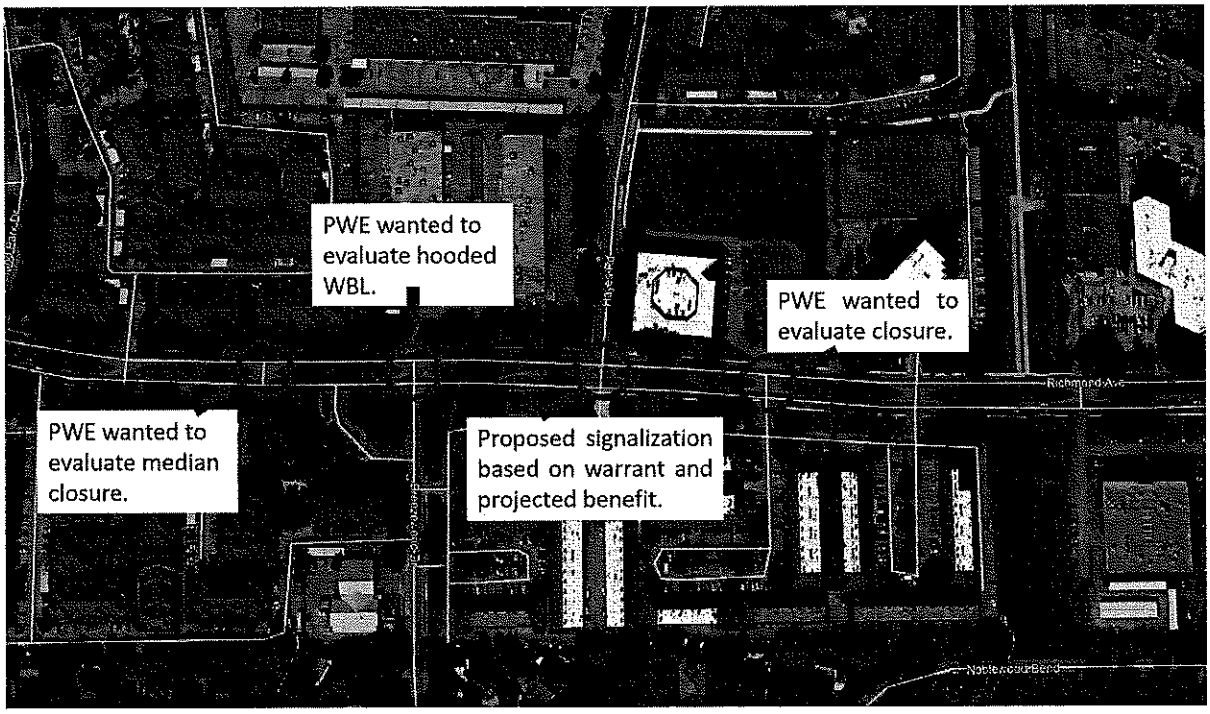

Figure 4. Other Improvements Suggested by PWE in January 2020

Due to the high rates of stop sign related crashes, the proposed solution is new traffic signals, per current COH design standards. The new traffic signal will be at least 20 feet tall with a mast arm length of a least 25 feet. It will have 3 signal heads, including 1 left turn light, with an overhead street name sign. The signal pole will feature a countdown pedestrian signal and pedestrian push button stations for pedestrian and cyclist safety purposes (see Figure 5). New ADA compliant sidewalk, ramps and pavement markings are also proposed, and will be constructed according to COH standards.

According to Highway Safety Improvement Program (HSIP), installing traffic signals (Work Code 107) has a reduction factor of 35% on eligible crashes with 10 years of service life.

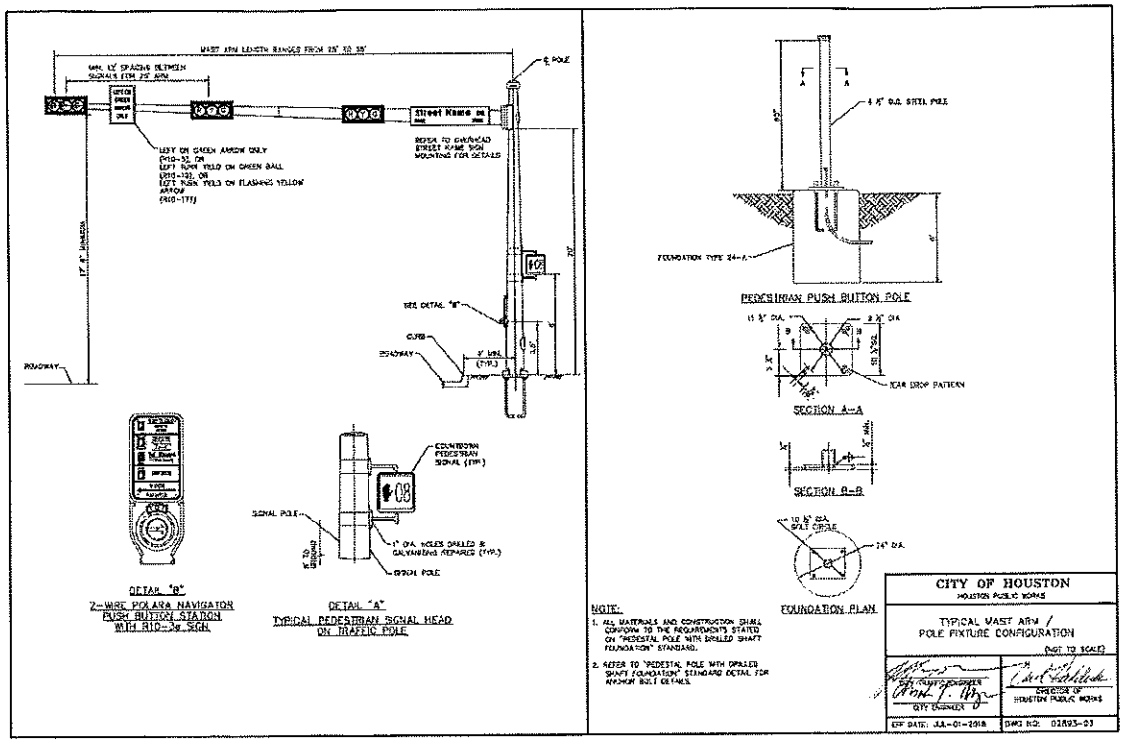

Figure 5: Typical Mast/Arm Pole Fixture Configuration

Project Cost

The project is anticipated to have a construction cost of approximately $535,000 (see attachment A) with annual maintenance of $3,900. These costs would be pursued on a 90/10 basis through the TxDOT HSIP program. The cost to design the project would be paid for by the District.

Project Benefit per HSIP Criteria

The analysis was conducted from 2017 to 2019. There was a total of 18 eligible crashes with no fatal crashes, 1 incapacitating crash and 3 non-capacitating crashes. The cost benefit for this period is 9.40. This project is eligible for the HSIP off-system call for projects and can be implemented per the program timeline requirements.