Staff Report

TO: City Council

FROM: Jeff Hart, Director of Public Works

DATE July 21, 2020

SUBJECT: Update on the Highland Springs/I-10 Interchange Project

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Background and Analysis:

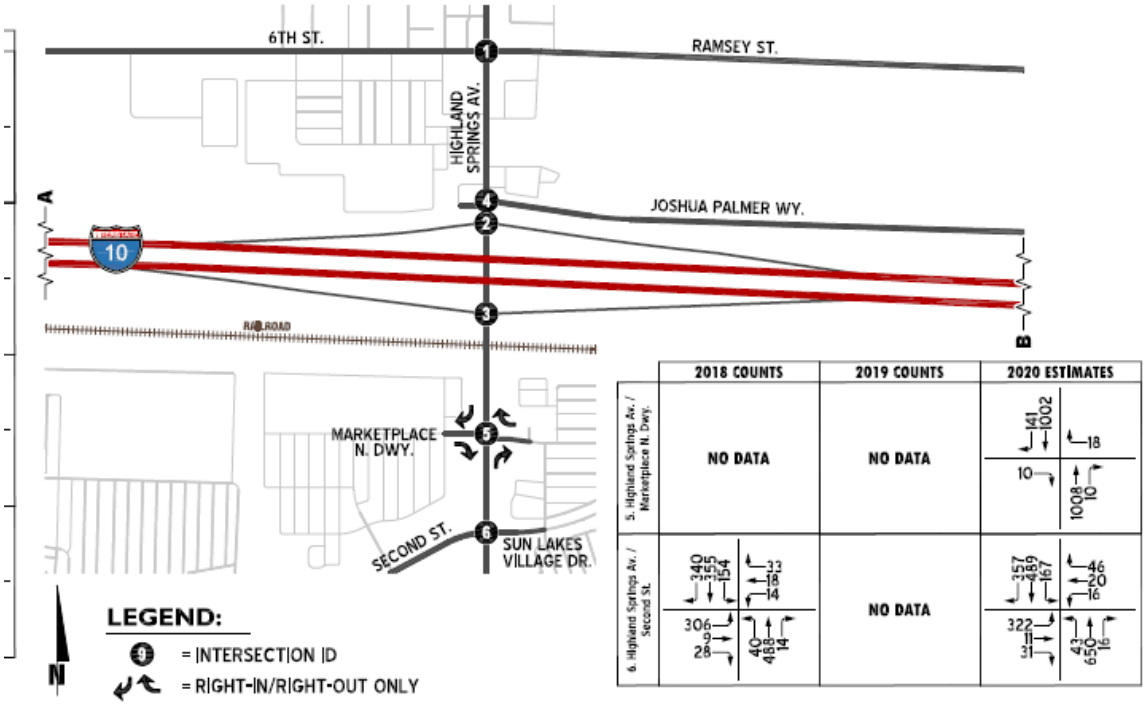
On September 17, 2019, the City Council approved a cooperative agreement between the Riverside County Transportation Commission (RCTC), the City of Banning, and the City of Beaumont for the preparation of a project study report (PSR) for the Highland Springs Interchange (Project). The Project is located adjacent to and within the jurisdictional boundaries of both the City of Banning and the City of Beaumont. Any of the alternatives that are currently being assessed will require improvements in both jurisdictions.

Staff has been actively working with design and traffic consultants for the project as well as staff from the City of Banning, RCTC, and Caltrans to develop the potential four alternatives for the Project moving forward. All four alternatives have been analyzed for level of service (LOS) delays at several key intersections. LOS is a qualitative description of traffic flow based on such factors as speed, travel time, delay, and freedom to maneuver. Six levels are defined from LOS “A”, representing completely free-flow conditions, to LOS “F”, representing breakdown in flow resulting in stop-and-go conditions. LOS “E” represents operations at or near capacity, an unstable level, where vehicles are operating with the minimum spacing for maintaining uniform flow.

Alternative 1 is for the Project to remain as-is in its current configuration with no improvements planned (i.e. “no-build”). Traffic analysis shows that in this alternative current peak hour delays at several key intersections will substantially increase by the year 2040. The delay at the intersection of Highland Springs/I-10 westbound ramps would increase from 21 seconds in the AM peak hour to 41 seconds by 2040. Delays at the intersections of Highland Springs/I-10 eastbound ramps would increase from 22 seconds in the AM peak hour to 41 seconds by 2040. The following figure shows the intersections that were studied in the draft project Traffic Forecasting and Operational

Analysis (TFOA) report (see Attachment A), as well as a graphic for the existing condition.

Studied Intersections



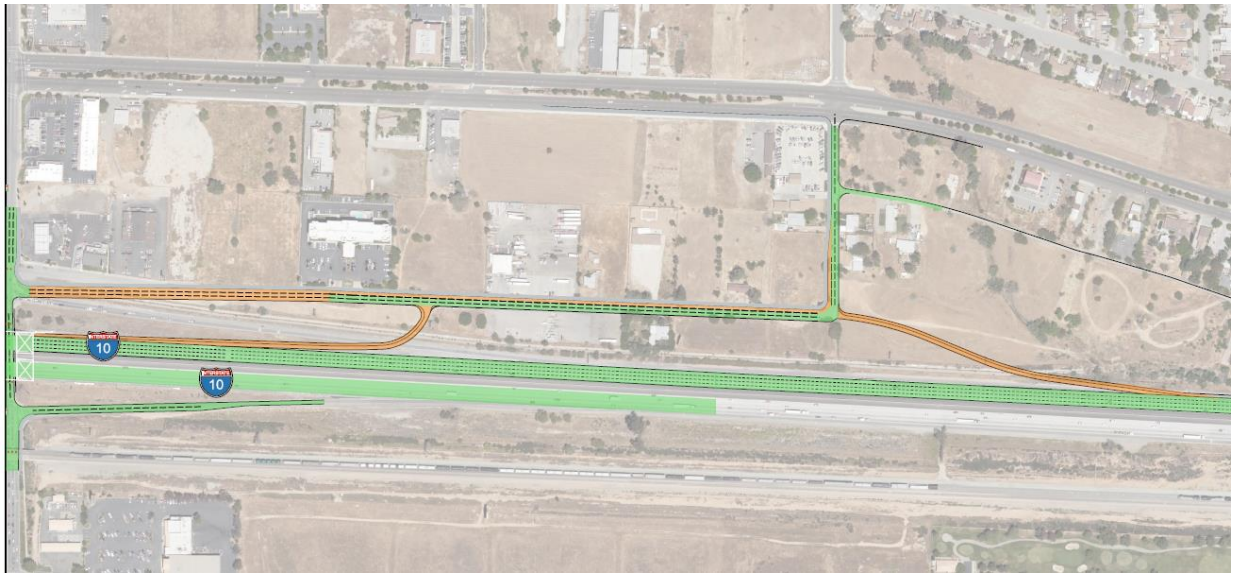
Alternative 1, No-Build

Alternative 2 would leave the westbound and eastbound on ramps as-is while reconfiguring the off ramps. Two options are currently being studied for Alternative 2, with the difference being the location of the westbound on ramp. Alternative 2, Option A would create a new westbound on ramp approximately ¼ mile east of Highland Springs Avenue, while Option B would create a new westbound on ramp approximately ½ mile east of Highland Springs (see following graphics). The new westbound off ramp would remain the same for either option. Both options would include a realignment of Joshua Palmer Avenue to align better with the existing westbound on ramp at Highland Springs Avenue. The realignment of Joshua Palmer Avenue will provide for a safer and more efficient operation of the signalized intersection.

Efficiency of Highland Springs Avenue improves significantly in 2040. The delay at the intersection of Highland Springs/I-10 westbound ramps would decrease from 41 seconds in the AM peak hour no build scenario to 11 seconds with the implementation of Alternative 2. Delays at the intersections of Highland Springs/I-10 eastbound ramps would decrease from 41 seconds in the AM peak hour no build scenario to 14 seconds with the implementation of Alternative 2.

Alternative 2, East Bound Off Ramp

Alternative 2, West Bound Ramps (Option A)



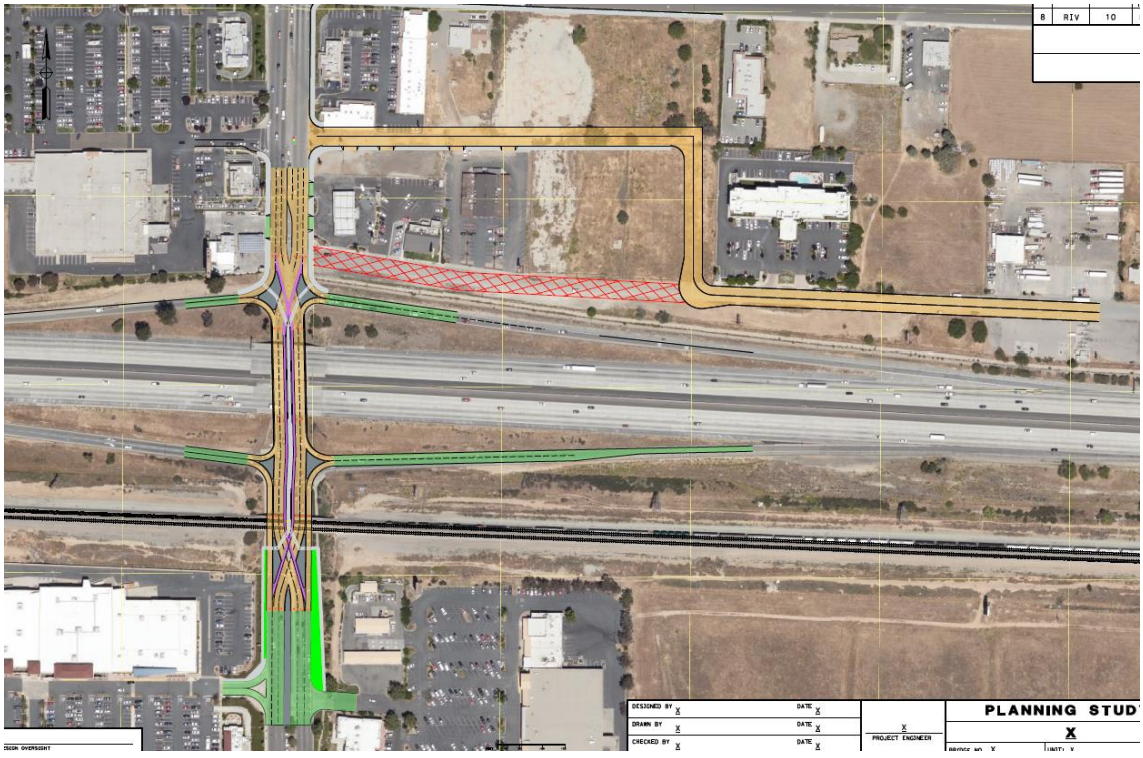
Alternative 2, West Bound Ramps (Option B)

Alternatives 3 and 4 both utilize what is called a diverging diamond interchange. A diverging diamond interchange is an interchange in which the two directions of traffic on the cross street (above or below the freeway) cross to the opposite side on both sides of the bridge at the freeway. For these alternatives, the westbound and eastbound ramps would remain largely the same, with modifications being made at their respective connection points to Highland Springs Avenue. The primary difference between Alternatives 3 and 4 is the point in which northbound and southbound traffic return to their normal operating side of the road. For Alternative 3, traffic switches back to their normal side of the road just south of the I-10 underpass, at the intersection of Highland Springs Avenue and the eastbound ramps (see following graphic).

Alternative 3

For Alternative 4, traffic switches back to their normal side of the road just south of the railroad underpass (see following graphic).

Alternative 4



Both Alternatives 3 and 4 would entail a revised alignment of Joshua Palmer Avenue at Highland Springs. The relocation of Joshua Palmer Avenue further north allows for a much more efficient operation of the interchange, and more specifically the intersection of the west bound ramps and I-10.

Efficiency of the interchange in 2040 for Alternatives 3 and 4 also improves greatly versus the no-build scenario. The delays for the I-10 west bound ramps/Highland Springs Avenue intersection would decrease from 41 seconds to 13 seconds in the AM peak hour. Delays for the I-10 east bound ramps/Highland Springs Avenue intersection would decrease from 41 seconds to 14 seconds in the AM peak hour.

As previously stated, the difference between Alternatives 3 and 4 is the point at which traffic returns to their respective normal state of operation. The primary benefit of Alternative 4 is the increased stack length of traffic, primarily under the I-10 undercrossing. LOS remains similar for both Alternatives 3 and 4, but LOS is only one metric for measuring traffic flow and congestions. Stack length can play a significant role in traffic efficiency and Alternative 4 allows for significantly more storage between the westbound ramps/I-10 intersection and the eastbound ramps/I-10 intersections, a significant source of current congestion and only exacerbated by the expected growth by the year 2045. The storage length for Alternative 3 versus Alternative 4 is increased by nearly 200 feet.

Next Steps

- Completion of the PSR – April 2021,
- Project Approval and Environmental Document (PA/ED) – April 2023,
- Plans, Specifications, and Estimates (PS&E) – October 2024, and
- Commence Constructions – February 2025.

Fiscal Impact:

The cost to prepare this staff report is estimated to be $750.

Recommended Action:

Receive and file the Highland Springs Interchange Update.

Interstate 10 (I-10) / Highland Springs Ave
Traffic Forecasting and Operational Analysis – Preliminary Scoping Materials
Urban Crossroads, Inc.
(June 10, 2020)

A preliminary Traffic Forecasting and Operational Analysis (TFOA) has been prepared by Urban Crossroads, Inc to support the design team review of alternatives for the I-10/Highland Springs Ave Improvement project. The TFOA utilizes available 2018 and 2019 peak period traffic counts to estimate 2020 baseline conditions.

The attached Exhibits 1 and 2 show the TFOA study area and 2020 peak hour volume estimates at intersection analysis locations for the Alternative 1 (existing/no build) scenario. The I-10/Highland Springs Ave interchange is affected by the configuration of at-grade intersections, peak hour intersections delays, queuing in the approach lanes, and off-ramp queuing during weekday peak hours.

Exhibits 3 and 4 illustrate the Alternative 2 (hook ramps) interchange configuration, with 2020 peak hour volumes redistributed to potential new interchange features.

Exhibits 5 and 6 depict the reconfiguration of interchange intersections with 2020 peak hour volumes reassigned to the potential Diverging Diamond Interchange (DDI) features incorporated into Alternatives 3 and 4. For Alternative 4, intersection #3 is approximately 200' north of Marketplace North Driveway.

The draft TFOA focuses on the following scenarios utilizing existing and future peak hour volumes:

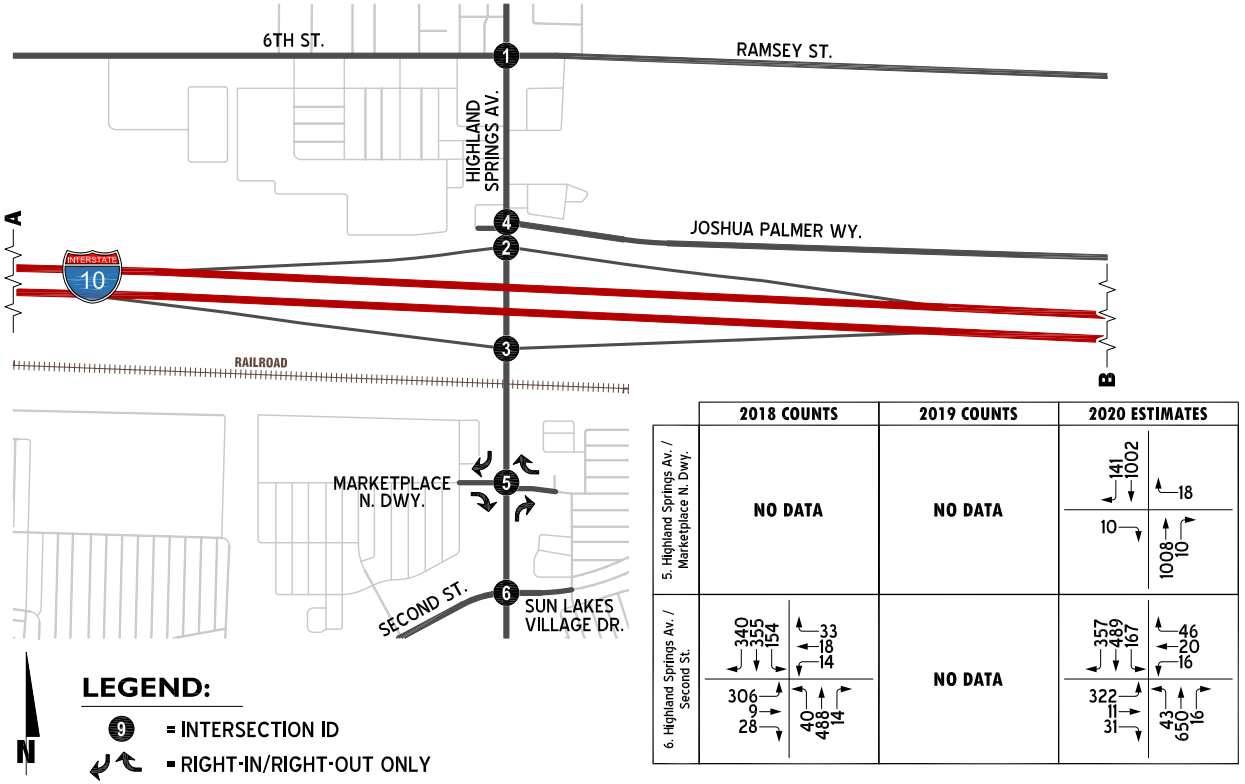
- *Alternative 1 (Existing Lane Geometry) and 2020 AM/PM Traffic Volumes*
- *Alternative 1 (Existing Lane Geometry) and 2040 AM/PM Traffic Volumes*
- *Alternative 1 (Existing Lane Geometry) and Post-2045 AM/PM Traffic Volumes*
- *Alternative 2 (Hook Ramps) Lane Geometry and 2020 AM/PM Traffic Volumes*
- *Alternative 2 (Hook Ramps) Lane Geometry and 2040 AM/PM Traffic Volumes*
- *Alternative 2 (Hook Ramps) Lane Geometry and Post-2045 AM/PM Traffic Volumes*
- *Alternatives 3 and 4 (DDI scenarios) Lane Geometry and 2020 AM/PM Traffic Volumes*
- *Alternatives 3 and 4 (DDI scenarios) Lane Geometry and 2040 AM/PM Traffic Volumes*
- *Alternatives 3 and 4 (DDI scenarios) Lane Geometry and Post-2045 AM/PM Traffic Volumes*

FORECASTING AND OPERATIONAL ANALYSIS METHODOLOGIES

Traffic projections for Horizon Year conditions were derived from the Riverside County Transportation Analysis Model (RivTAM) using accepted procedures for model forecast refinement and smoothing. The traffic forecasts reflect the area-wide growth anticipated between 2020 conditions and Horizon Year 2040 conditions. Post-2045 traffic forecasts are also provided in order to account for further growth between Horizon Year 2040 and buildout of General and Specific Plans in the vicinity.

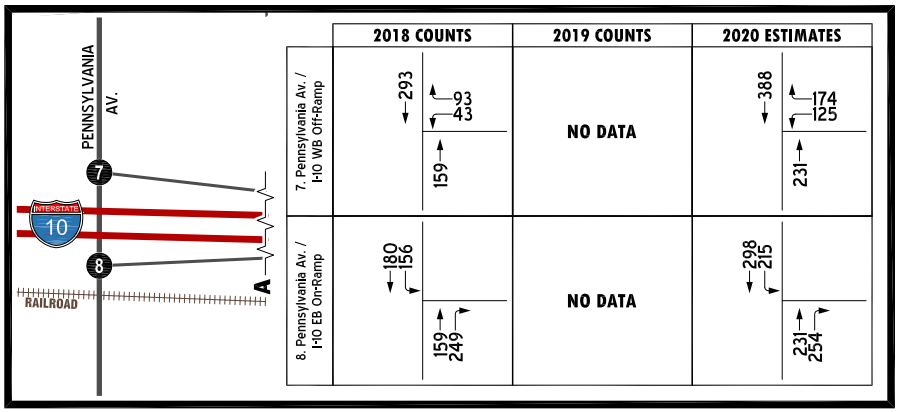
EXHIBIT 1: 2020 AM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVE 1 (EXISTING CONFIGURATION)

	2018 COUNTS	2019 COUNTS	2020 ESTIMATES
1. Highland Springs Av. / 6th St. - Ramsey St.	70 520 100 / 47 121 164 / 98 173 168 / 102 407 138	82 639 97 / 47 149 197 / 112 174 215 / 109 435 139	84 641 110 / 50 151 199 / 114 176 217 / 111 437 159
4. Highland Springs Av. / Joshua Palmer Wy.	805 16 / 8 50 / 0 0 0 / 724 28	NO DATA	1012 16 / 8 51 / 10 / 800 29
2. Highland Springs Av. / I-10 WB Ramps	270 585 / 135 5 176 / 261 617	326 733 / 143 4 203 / 274 653	338 735 / 145 4 205 / 276 684
3. Highland Springs Av. / I-10 EB Ramps	606 155 / 279 365 / 599 221	740 196 / 268 0 399 / 659 363	742 198 / 299 1 401 / 661 365



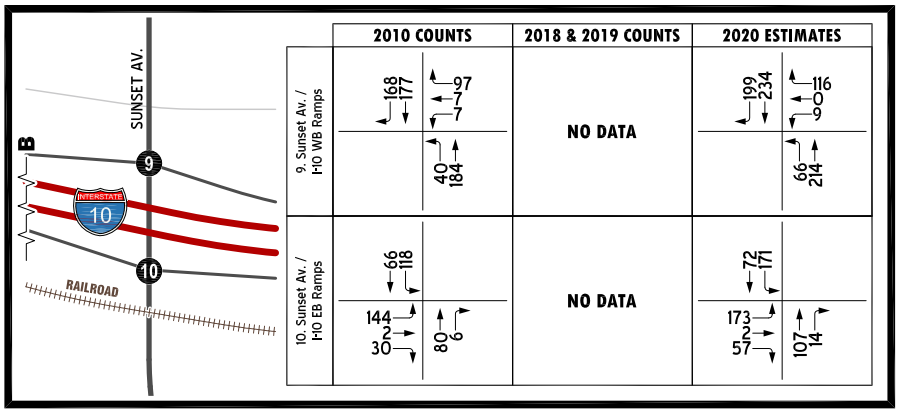
	2018 COUNTS	2019 COUNTS	2020 ESTIMATES
5. Highland Springs Av. / Marketplace N. Dwy.	NO DATA	NO DATA	141 1002 / 18 / 10 / 1008 10
6. Highland Springs Av. / Second St.	340 355 154 / 33 16 14 / 306 9 28 / 40 488 14	NO DATA	357 489 167 / 46 20 16 / 322 31 / 43 650 16

PENNSYLVANIA AV./I-10 INTERCHANGE AREA



	2018 COUNTS	2019 COUNTS	2020 ESTIMATES
7. Pennsylvania Av. / I-10 WB Off-Ramp	293 / 93 43 / 159	NO DATA	388 / 174 125 / 231
8. Pennsylvania Av. / I-10 EB On-Ramp	180 156 / 159 249	NO DATA	298 215 / 231 254

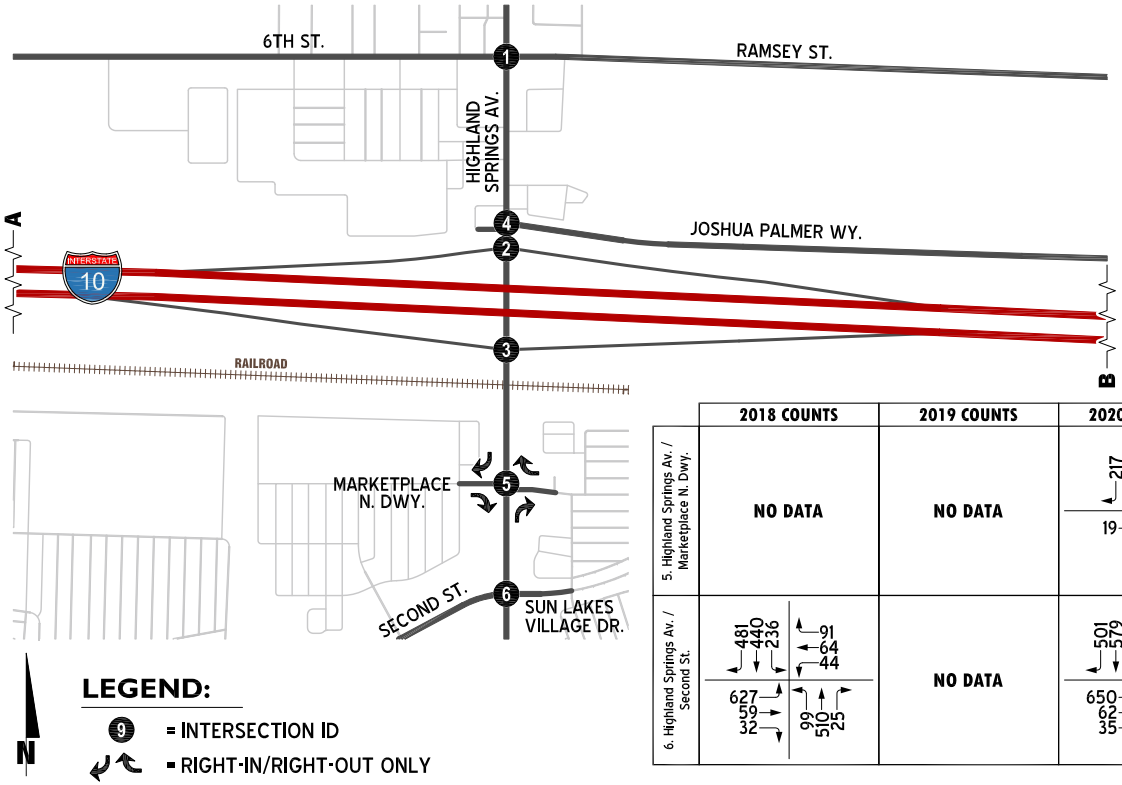
SUNSET AV./I-10 INTERCHANGE AREA



	2010 COUNTS	2018 & 2019 COUNTS	2020 ESTIMATES
9. Sunset Av. / I-10 WB Ramps	168 177 / 97 7 7 / 40 184	NO DATA	199 234 / 116 9 0 / 66 214
10. Sunset Av. / I-10 EB Ramps	66 118 / 144 2 30 / 80 6	NO DATA	72 171 / 173 2 57 / 107 14

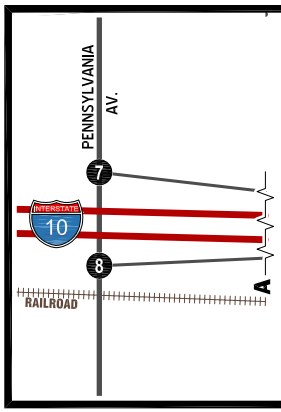
EXHIBIT 2: 2020 PM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVE 1 (EXISTING CONFIGURATION)

	2018 COUNTS	2019 COUNTS	2020 ESTIMATES
1. Highland Springs Av. / 6th St. - Ramsey St.	103 419 118 → 93 ← 251 292 ← 183 280 214 → 146 581 198 ←	94 500 68 → 80 ← 292 296 ← 195 318 192 → 207 645 140 ←	105 502 120 → 97 ← 294 298 ← 197 320 218 → 209 647 202 ←
4. Highland Springs Av. / Joshua Palmer Wy.	947 12 → 8 ← 52 0 0 0 → 1199 43 ←	NO DATA	1069 12 → 8 ← 53 10 → 1253 44 ←
2. Highland Springs Av. / I-10 WB Ramps	318 681 → 286 ← 3 352 323 956 ←	292 796 → 292 ← 6 323 319 933 ←	334 798 → 294 ← 6 359 329 1003 ←
3. Highland Springs Av. / I-10 EB Ramps	919 114 → 381 → 5 499 ← 898 401 ←	1003 116 → 311 → 1 522 ← 941 475 ←	1005 152 → 389 → 1 524 ← 943 477 ←



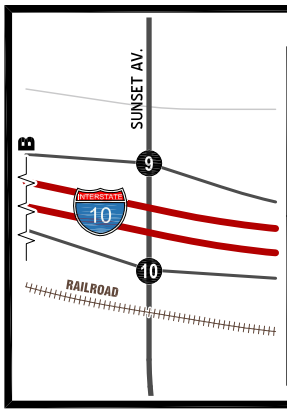
	2018 COUNTS	2019 COUNTS	2020 ESTIMATES
5. Highland Springs Av. / Marketplace N. Dwy.	NO DATA	NO DATA	217 1312 → 47 19 → 1373 10 ←
6. Highland Springs Av. / Second St.	481 440 236 → 91 ← 64 44 ← 627 59 32 → 99 510 25 ←	NO DATA	501 579 251 → 103 ← 67 47 ← 650 62 35 → 101 630 28 ←

PENNSYLVANIA AV./I-10 INTERCHANGE AREA



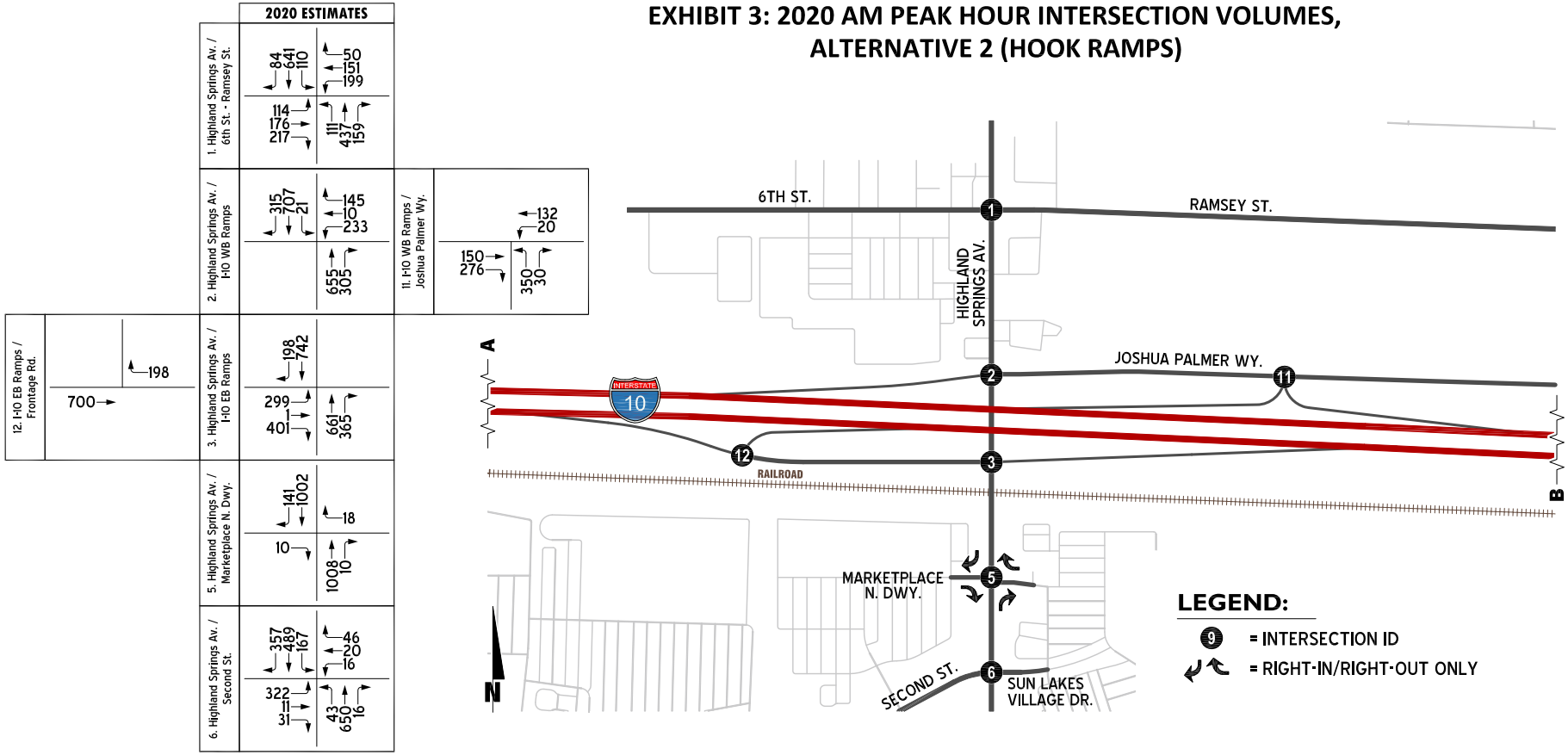
	2018 COUNTS	2019 COUNTS	2020 ESTIMATES
7. Pennsylvania Av. / I-10 WB Off-Ramp	488 → 218 ← 143 402 ←	NO DATA	498 → 265 ← 225 410 ←
8. Pennsylvania Av. / I-10 EB On-Ramp	445 186 → 402 ← 141	NO DATA	513 210 → 410 ← 144

SUNSET AV./I-10 INTERCHANGE AREA

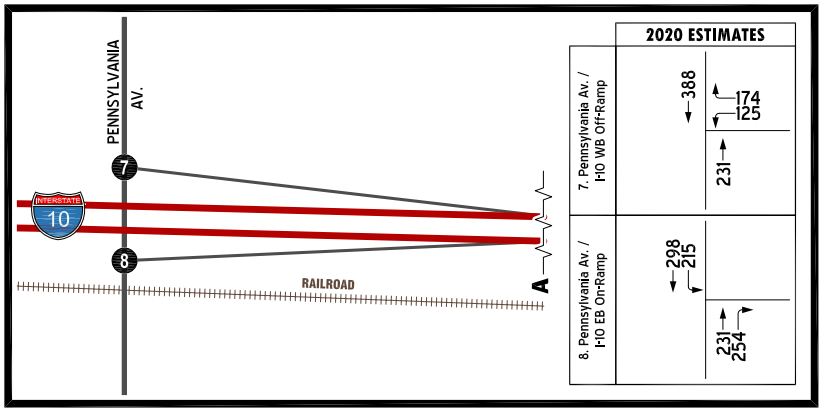


	2010 COUNTS	2018 & 2019 COUNTS	2020 ESTIMATES
9. Sunset Av. / I-10 WB Ramps	123 209 → 142 ← 15 6 ← 38 ← 276	NO DATA	194 257 → 181 ← 12 70 ← 369
10. Sunset Av. / I-10 EB Ramps	102 113 → 222 → 4 51 ← 92 ← 5	NO DATA	133 136 → 271 → 5 77 ← 168 ← 25

EXHIBIT 3: 2020 AM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVE 2 (HOOK RAMPS)



PENNSYLVANIA AV./I-10 INTERCHANGE AREA



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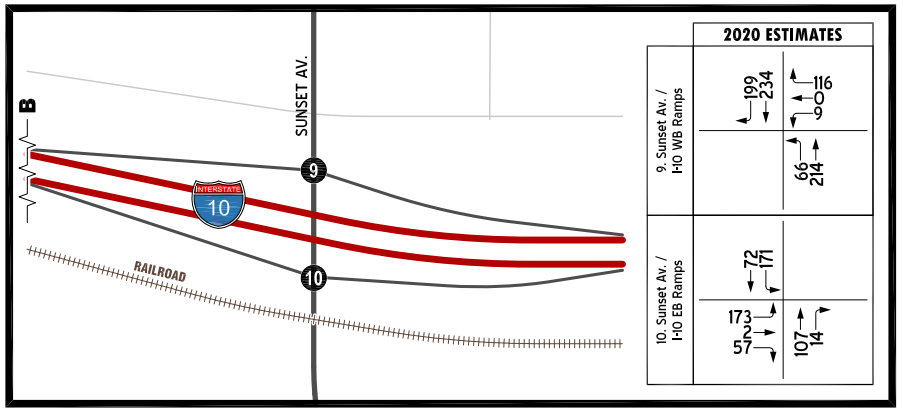
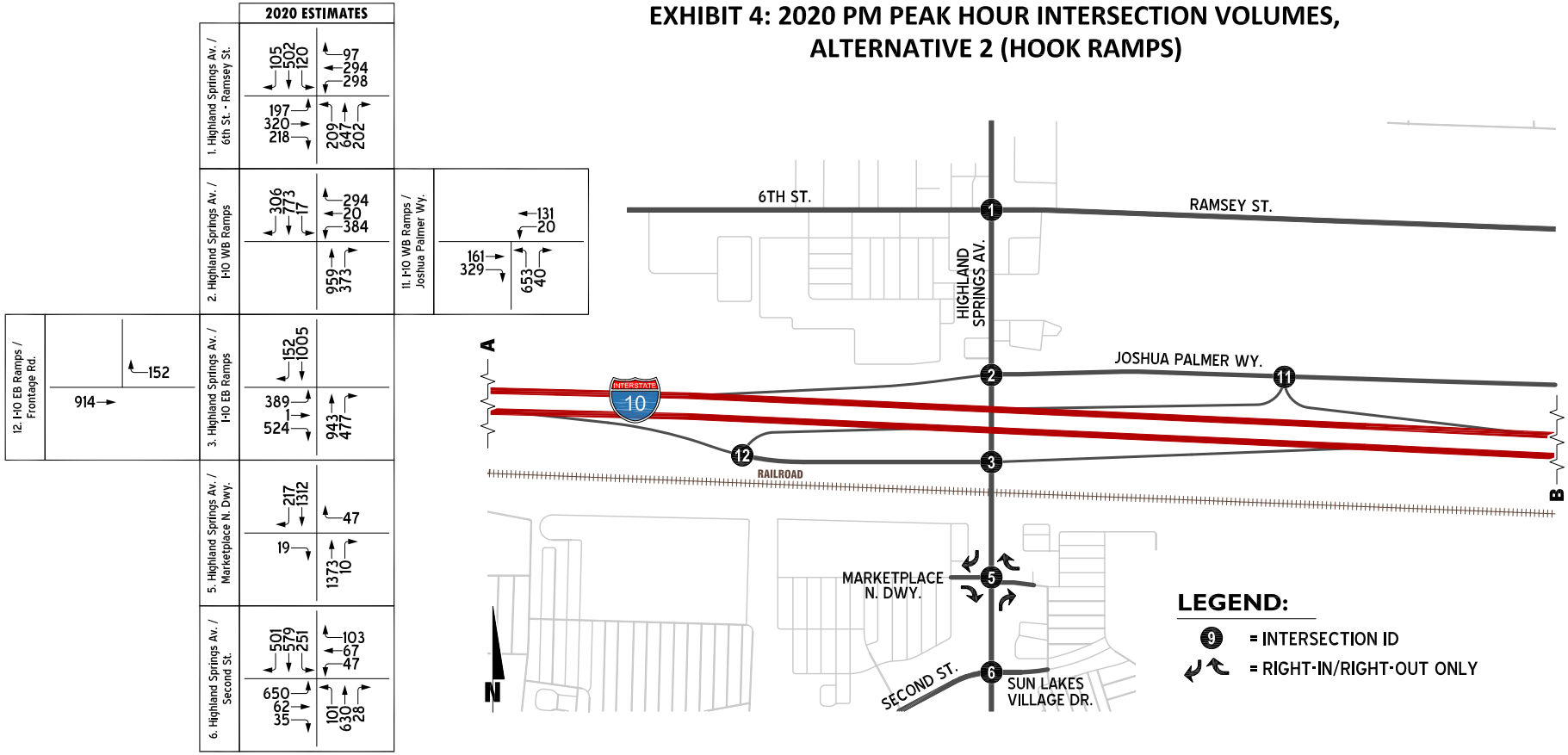
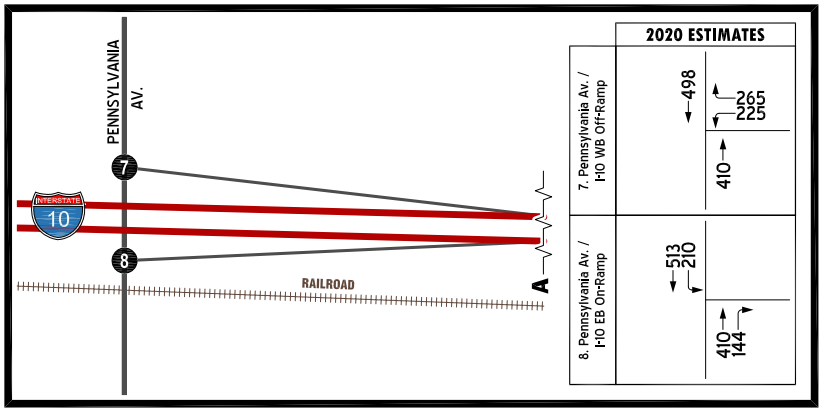


EXHIBIT 4: 2020 PM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVE 2 (HOOK RAMPS)



PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA

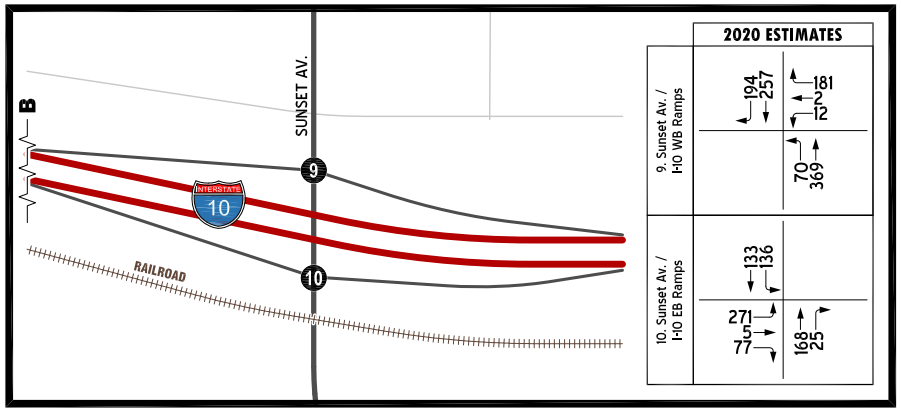
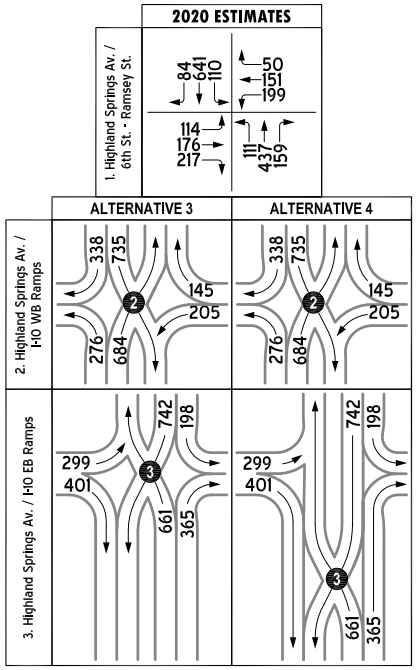
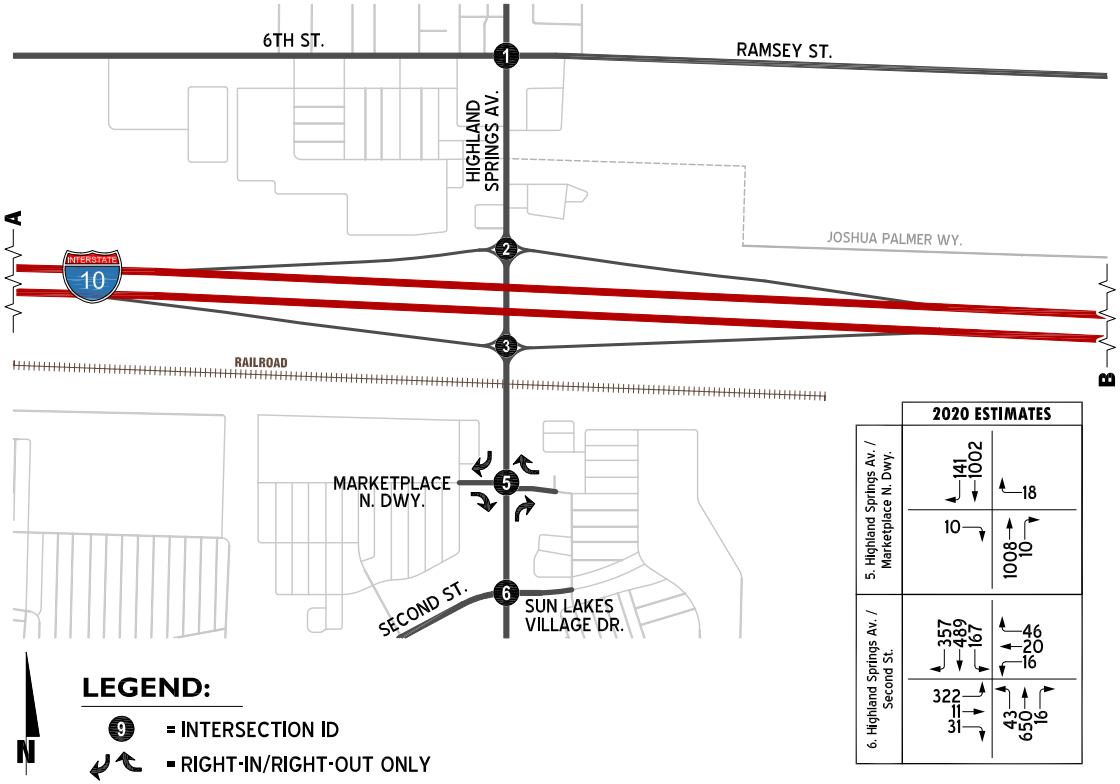


EXHIBIT 5: 2020 AM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVES 3 & 4 (DIVERGING DIAMOND INTERCHANGE)





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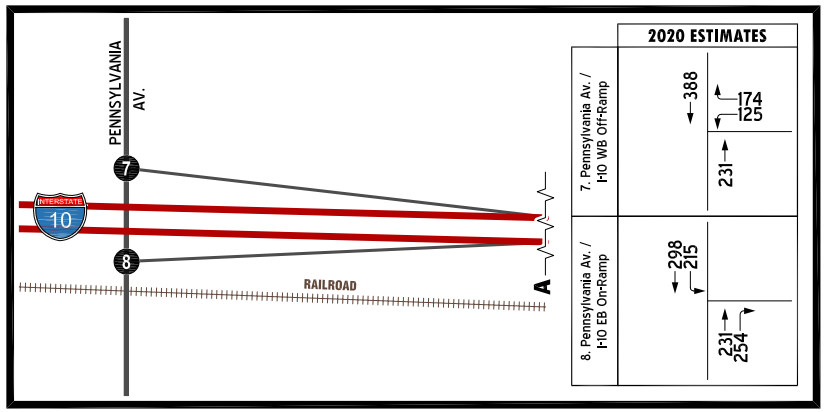

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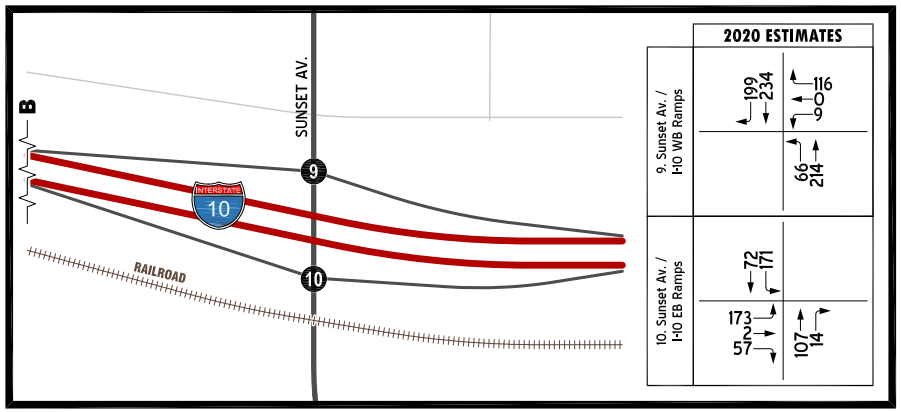

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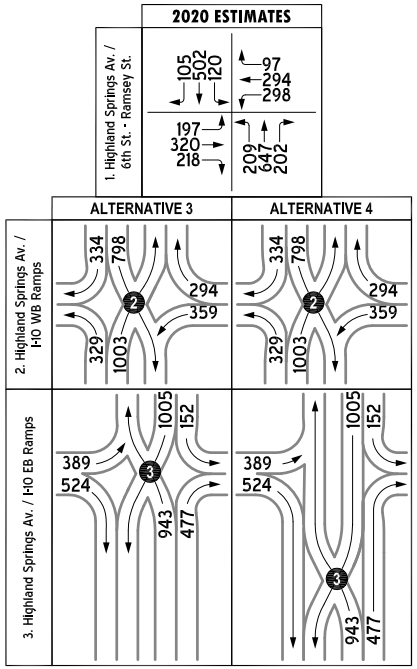
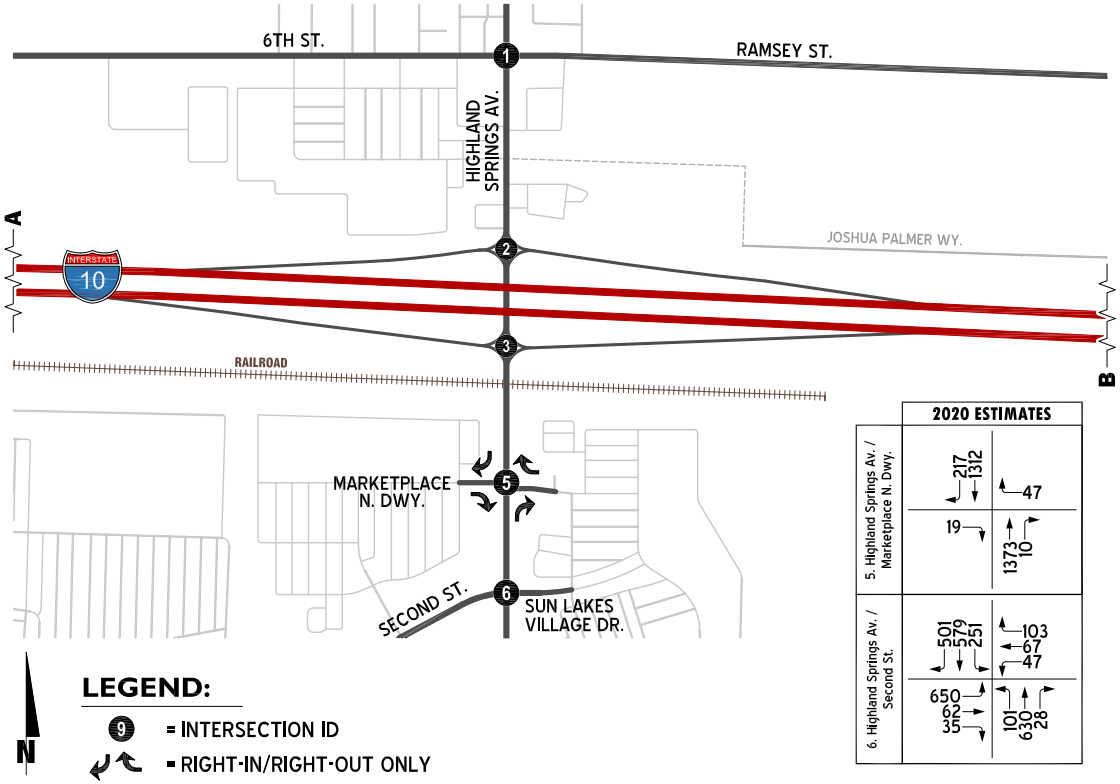
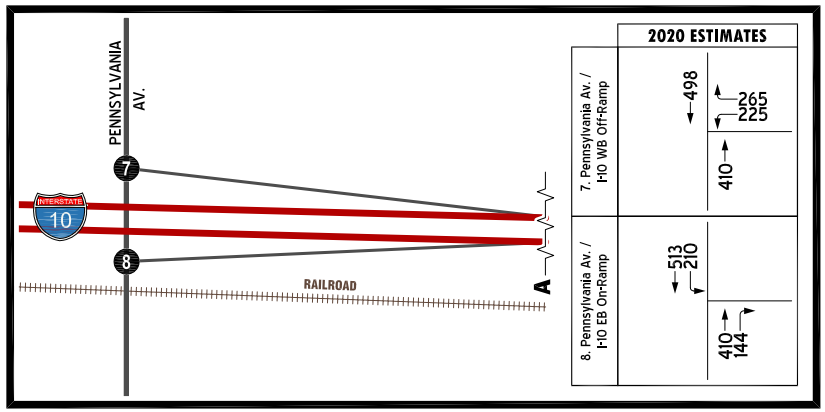
URBAN CROSSROADS

EXHIBIT 6: 2020 PM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVES 3 & 4 (DIVERGING DIAMOND INTERCHANGE)

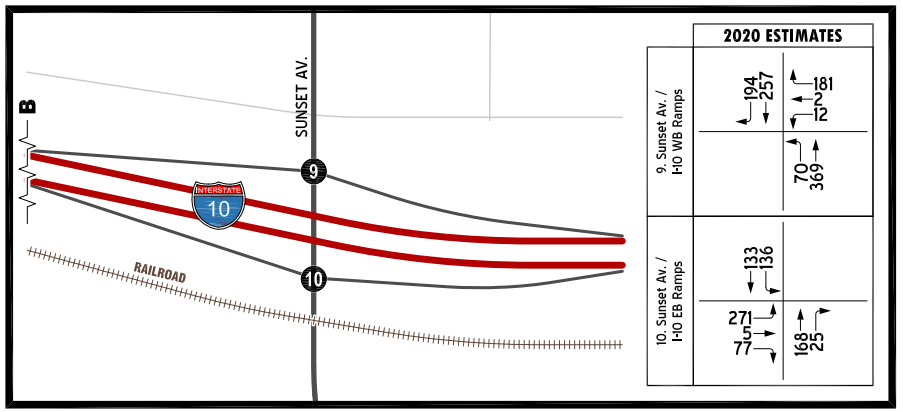




PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA



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URBAN CROSSROADS

In most instances the traffic model zone structure is not designed to provide accurate turning movements along arterial roadways unless refinement and reasonableness checking is performed. Therefore, the Horizon Year peak hour forecasts were refined using the model derived long-range forecasts along with existing peak hour traffic count data available at each analysis location.

A linear programming algorithm (from NCHRP Report 255) is used to calculate individual turning movements which match the known directional roadway segment forecast volumes derived from RivTAM. This program computes a likely set of intersection turning movements from intersection approach volumes and the initial turning proportions from each approach leg.

Typically, the model growth is prorated and is subsequently added to the existing (base validation) traffic volumes to represent Horizon Year traffic conditions. However, review of the initial model growth indicated negative values for several study area intersections. In an effort to conduct a conservative analysis, reductions to traffic forecasts from either the 2020 volume estimates or available interim year traffic conditions were not permitted as part of this analysis. Instead, additional growth has also been applied on a movement-by-movement basis, where applicable, to estimate reasonable Horizon Year and Post-2045 forecasts.

The future Horizon Year and Post-2045 peak hour turning movements were then reviewed by Urban Crossroads for reasonableness, and in some cases, were adjusted to achieve flow conservation, reasonable growth, and reasonable diversion between parallel routes. Flow conservation checks ensure that traffic flow between two closely spaced intersections, such as two freeway ramp locations, is verified in order to make certain that vehicles leaving one intersection are entering the adjacent intersection and that there is no unexplained loss of vehicles. The result of this traffic forecasting procedure is a series of traffic volumes which are suitable for traffic operations analysis.

For Post-2045 conditions, the Horizon Year 2040 traffic volumes and the following sources have been utilized:

- *Traffic Impact Analysis Butterfield Specific Plan (12/2010). Prepared by LSA.*
- *City of Banning Traffic Circulation (06/2011). General Plan Volumes prepared by LSA.*
- *Rancho San Gorgonio Specific Plan Traffic Impact Analysis (4/2016). Prepared by Kunzman Associates, Inc.*
- *City of Beaumont General Plan Traffic Study (12/2004). Prepared by Urban Crossroads, Inc.*
- *Final TIA Beaumont General Plan Update and Downtown Specific Plan (12/2019). Prepared by Fehr & Peers.*

Traffic operations of roadway facilities are described with the term "Level of Service" (LOS). LOS is a qualitative description of traffic flow based on such factors as speed, travel time, delay, and freedom to maneuver. Six levels are defined from LOS “A”, representing completely free-flow conditions, to LOS “F”, representing breakdown in flow resulting in stop-and-go conditions. LOS “E” represents operations at or near capacity, an unstable level, where vehicles are operating with the minimum spacing for maintaining uniform flow.

LOS delay ranges are summarized in Table A.1. Highway Capacity Manual 6th Edition (HCM 6) methodologies are applied to determine average delay values based upon existing, opening year, and design year peak hour traffic volumes.

TABLE A.1: HCM INTERSECTION DELAY LEVEL OF SERVICE RANGES

Level of Service (LOS)	Average Vehicle Delay Signalized	Average Vehicle Delay Unsignalized
A	0 - 10.00 seconds	0 - 10.00 seconds
B	10.01 - 20.00 seconds	10.01 - 15.00 seconds
C	20.01 - 35.00 seconds	15.01 - 25.00 seconds
D	35.01 - 55.00 seconds	25.01 - 35.00 seconds
E	55.01 - 80.00 seconds	35.01 - 50.00 seconds
F	Above 80.00 seconds	Above 50.00 seconds

Unsignalized intersections are evaluated using the methodology described in Chapter 20 of the HCM 6. The LOS rating is based on the weighted average control delay expressed in seconds per vehicle (see Table A.2). Note that for locations with volume in excess of capacity, overflow conditions lead to LOS "F" operations.

TABLE A.2: UNSIGNALIZED INTERSECTION DESCRIPTION OF LOS

Description	Average Control Delay Per Vehicle (Seconds)	Level of Service, V/C ≤ 1.0	Level of Service, V/C > 1.0
Little or no delays.	0 to 10.00	A	F
Short traffic delays.	10.01 to 15.00	B	F
Average traffic delays.	15.01 to 25.00	C	F
Long traffic delays.	25.01 to 35.00	D	F
Very long traffic delays.	35.01 to 50.00	E	F
Extreme traffic delays with intersection capacity exceeded.	> 50.00	F	F

At two-way or side-street stop-controlled intersections, LOS is calculated for each controlled movement and for the left turn movement from the major street, as well as for the intersection as a whole. For approaches composed of a single lane, the delay is computed as the average of all movements in that lane.

PEAK HOUR INTERSECTION OPERATIONS ANALYSIS

The traffic modeling and signal timing optimization software package Synchro plus SimTraffic (Version 10.1 Build 2 Revision 20 (10.1.2.20)) is utilized for analysis of vehicle delays and queues.

Synchro is a macroscopic traffic software program that is based on the signalized intersection capacity analysis as specified in the Chapter 19 of the HCM 6 and the unsignalized intersection capacity analysis as specified in Chapter 20 of the HCM 6.

2040 Volumes

The attached Exhibits 7 and 8 show the 2040 peak hour volume estimates at intersection analysis locations for the Alternative 1 (existing/no build) scenario.

Exhibits 9 and 10 illustrate the Alternative 2 (hook ramps) interchange configuration, with 2040 peak hour volumes redistributed to potential new interchange features.

Exhibits 11 and 12 depict the reconfiguration of interchange intersections with 2040 peak hour volumes reassigned to the potential Diverging Diamond Interchange (DDI) features incorporated into Alternatives 3 and 4.

Post 2045 Volumes

The attached Exhibits 13 and 14 show the Post-2045 peak hour volume estimates at intersection analysis locations for the Alternative 1 (existing/no build) scenario.

Exhibits 15 and 16 illustrate the Alternative 2 (hook ramps) interchange configuration, with Post-2045 peak hour volumes redistributed to potential new interchange features.

Exhibits 17 and 18 depict the reconfiguration of interchange intersections with Post-2045 peak hour volumes reassigned to the potential Diverging Diamond Interchange (DDI) features incorporated into Alternatives 3 and 4.

Peak Hour Delays

Macroscopic level models represent traffic in terms of aggregate measures for each movement at the study intersections. Equations are used to determine measures of effectiveness such as delay and queue length in Synchro.

The level of service (LOS) and capacity analysis performed by Synchro takes into consideration optimization and coordination of signalized intersections within a network.

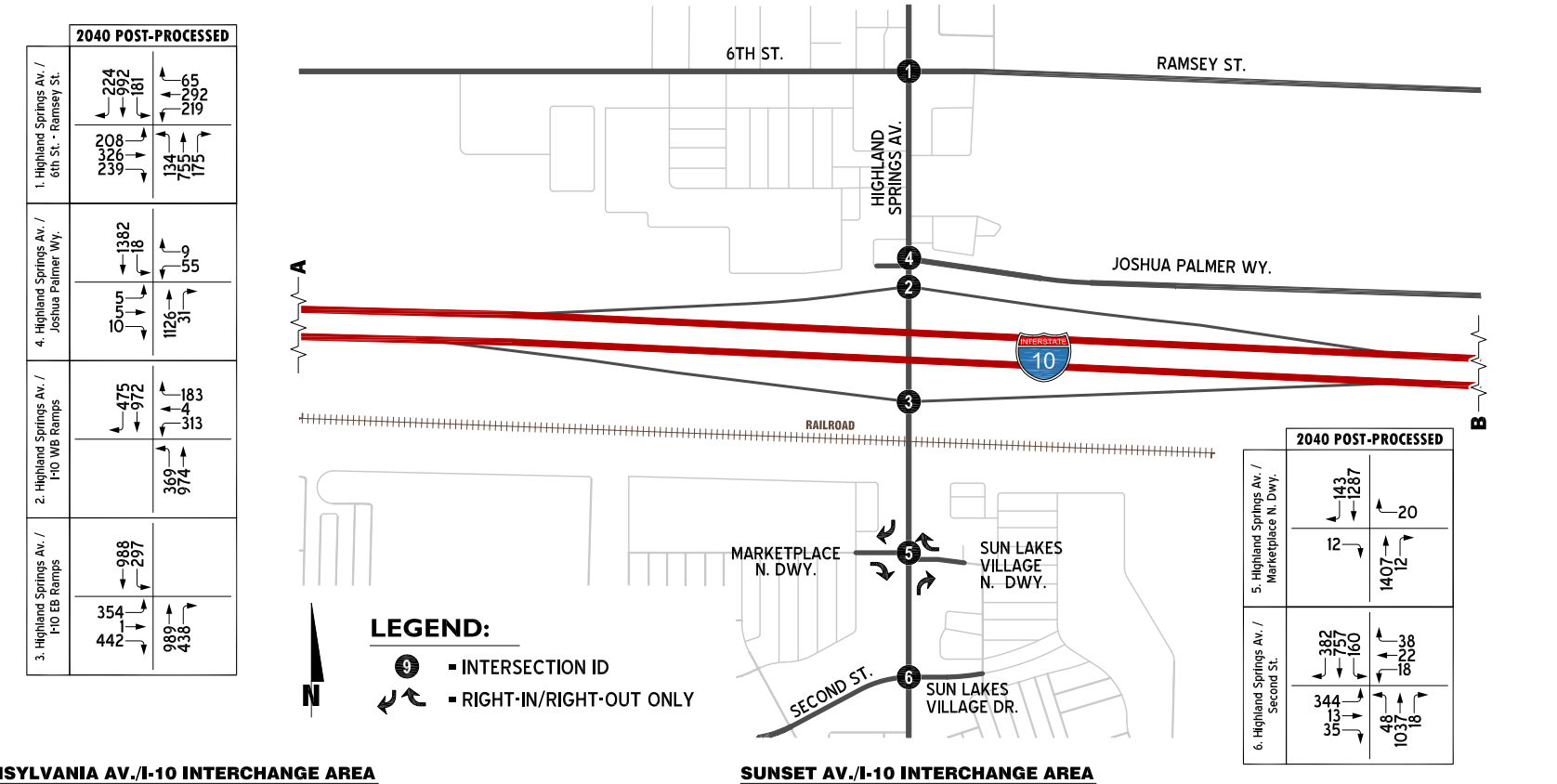
Years 2020, 2040, and Post-2045 intersection delay results are summarized in the attached Tables 1 through 3. These tables show LOS results at each study area intersection for Alternatives 1 through 4. Traffic operations calculation worksheets for Alternative 1 (existing/no build) are included in Attachment 1.

Traffic operations calculation worksheets for Alternative 2 (hook ramps) are provided in Attachment 2. Traffic operations calculation worksheets for Alternatives 3 and 4 (DDI scenarios) are included in Attachment 3.

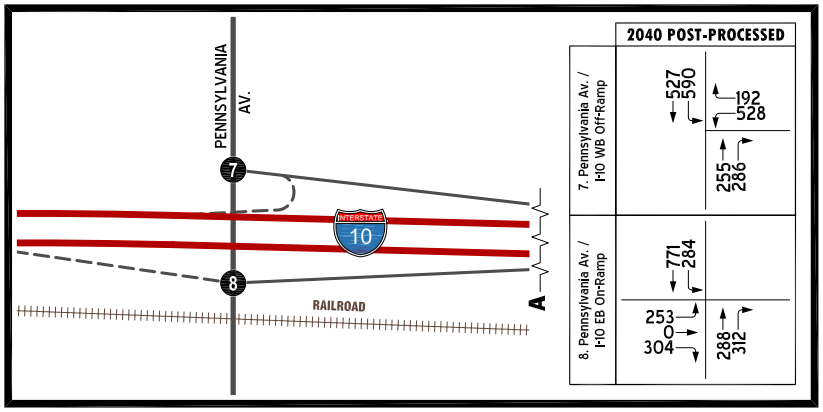
QUEUING ANALYSIS

Traffic signal progression analysis has been conducted for 2020, 2040, and Post-2045 conditions with each Alternative, to evaluate vehicular queuing by considering the signal timing and

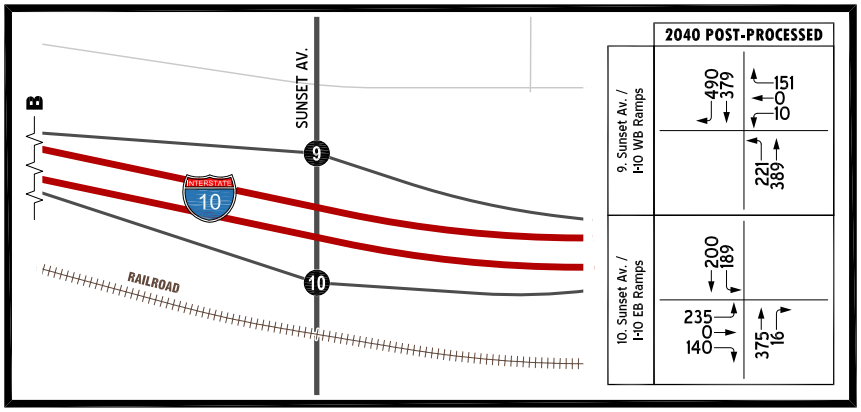
EXHIBIT 7: 2040 AM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVE 1 (EXISTING CONFIGURATION)



PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA



12522 - 01 - study area.dwg

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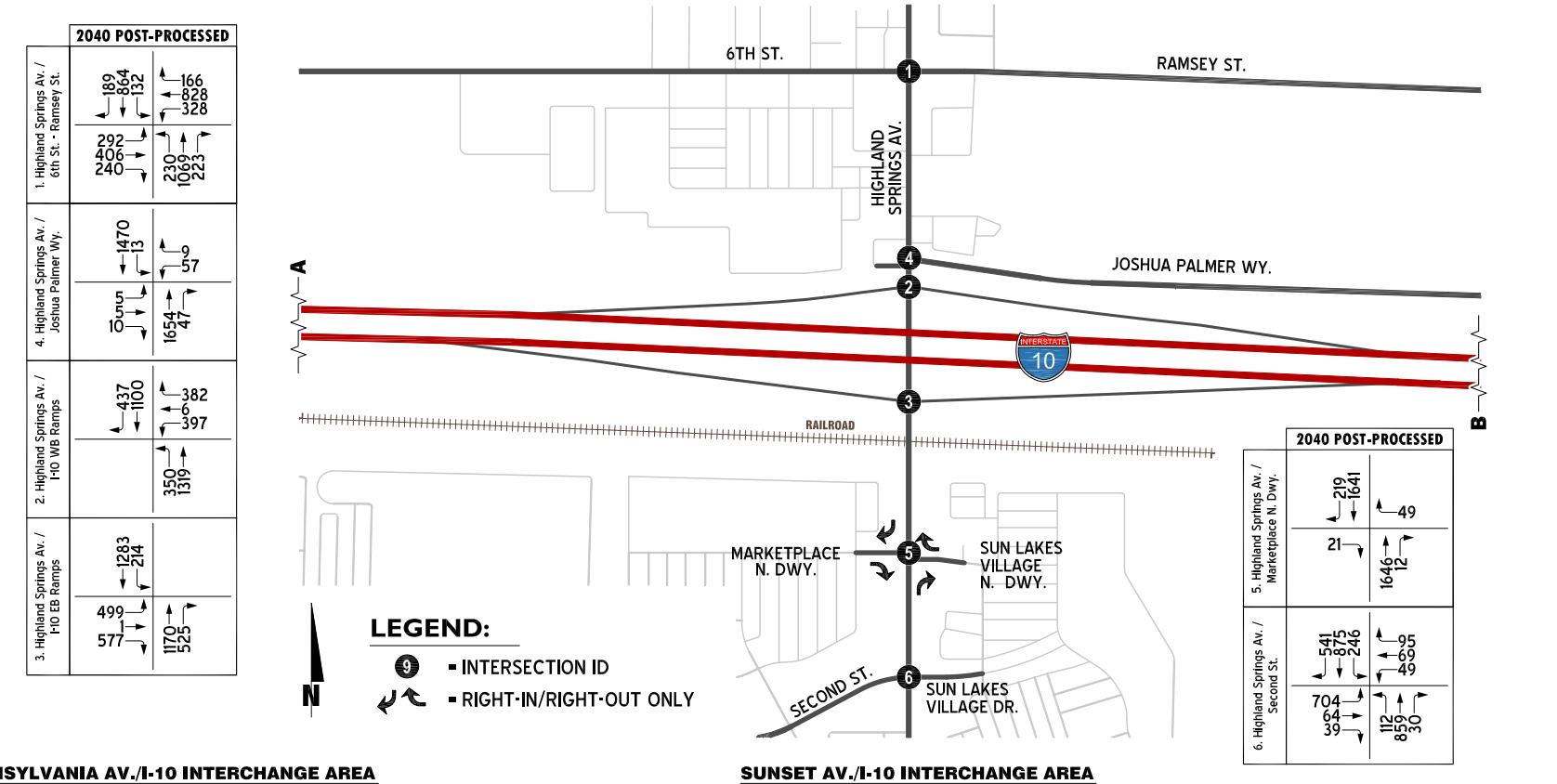
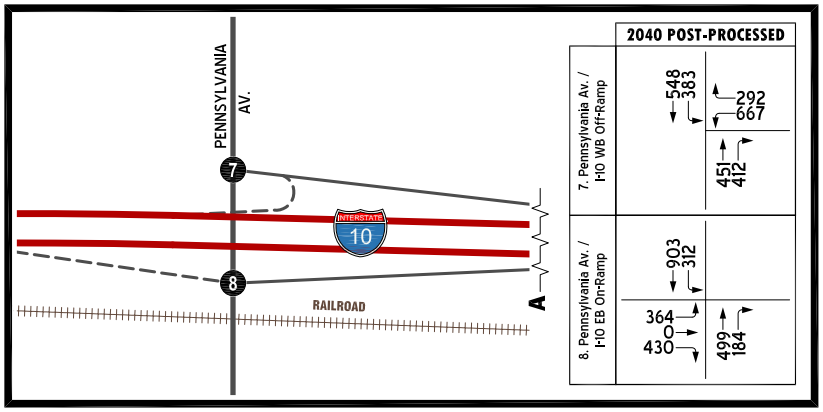
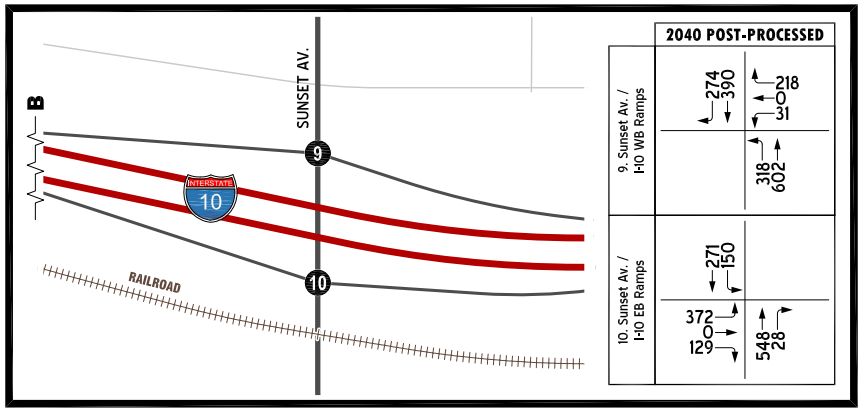
EXHIBIT 8: 2040 PM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVE 1 (EXISTING CONFIGURATION)



PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA



12522 - 01 - study area.dwg

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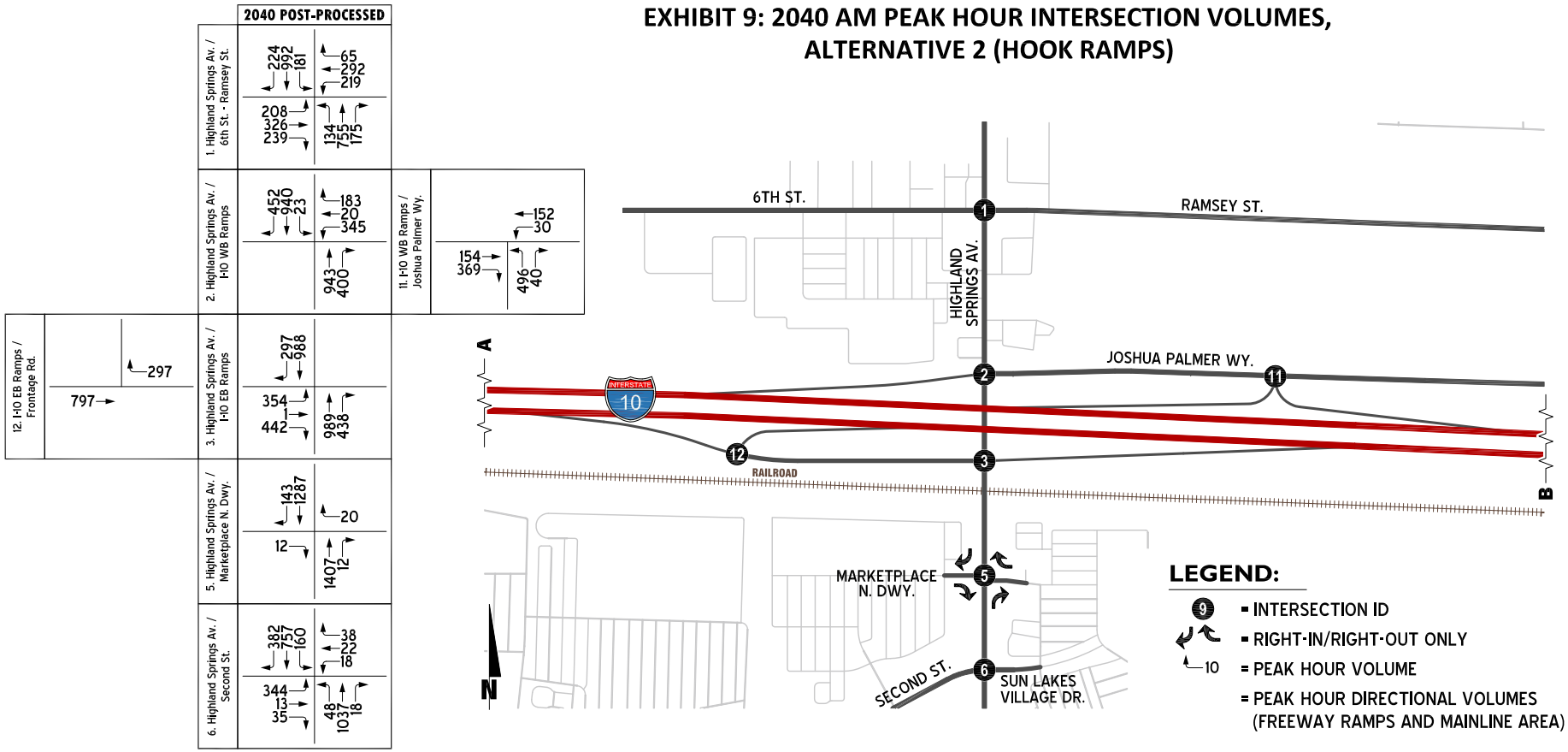
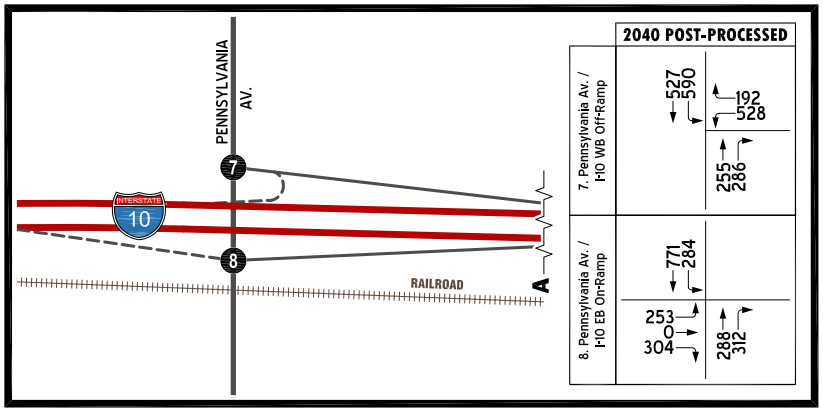
EXHIBIT 9: 2040 AM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVE 2 (HOOK RAMPS)



PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA

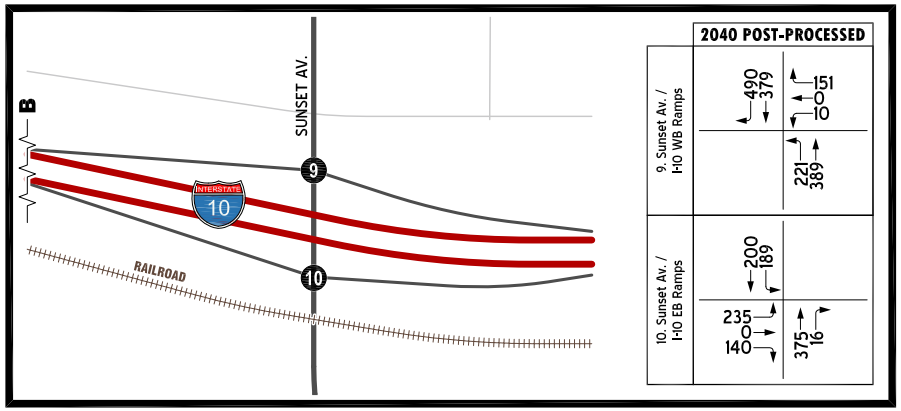
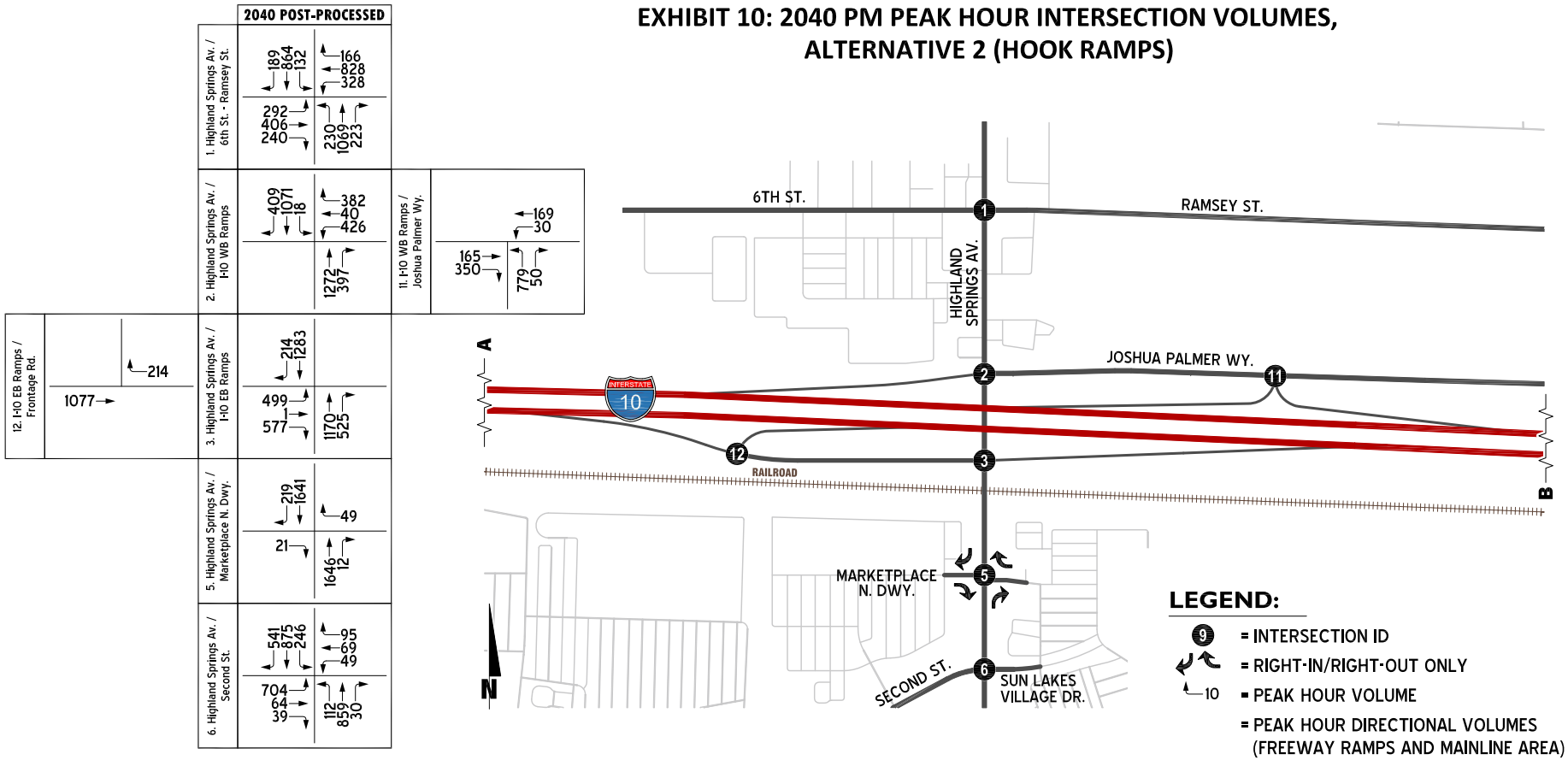
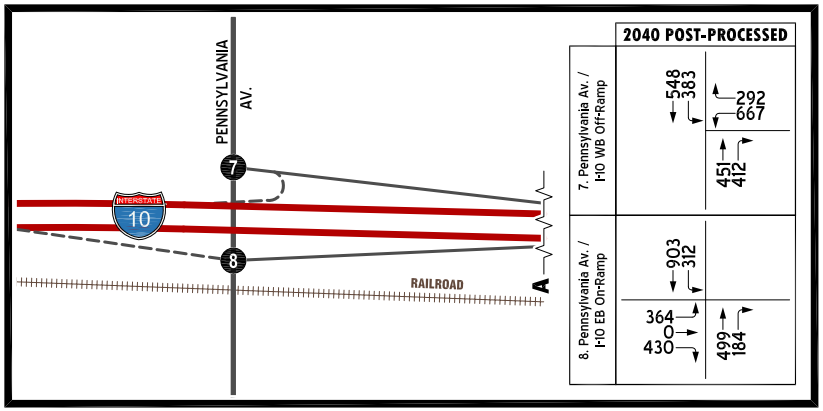


EXHIBIT 10: 2040 PM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVE 2 (HOOK RAMPS)



PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA

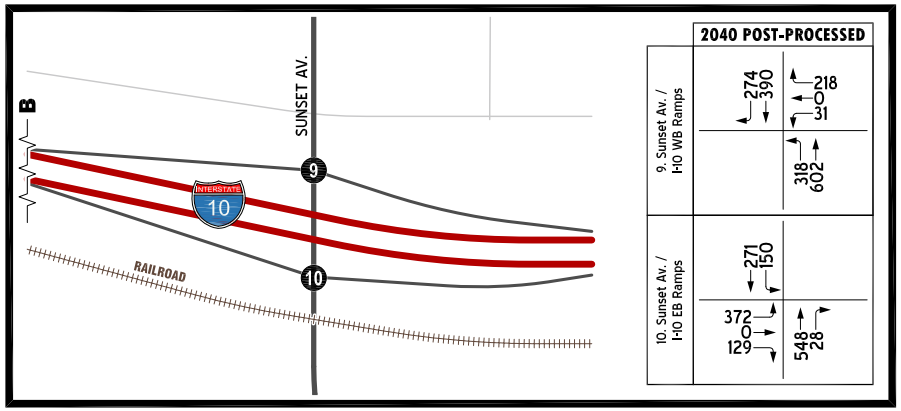
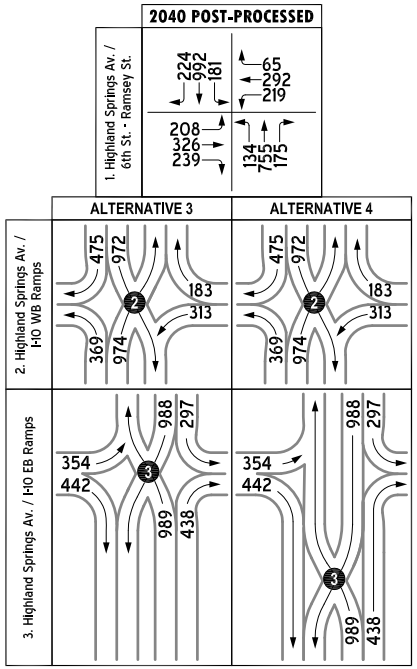
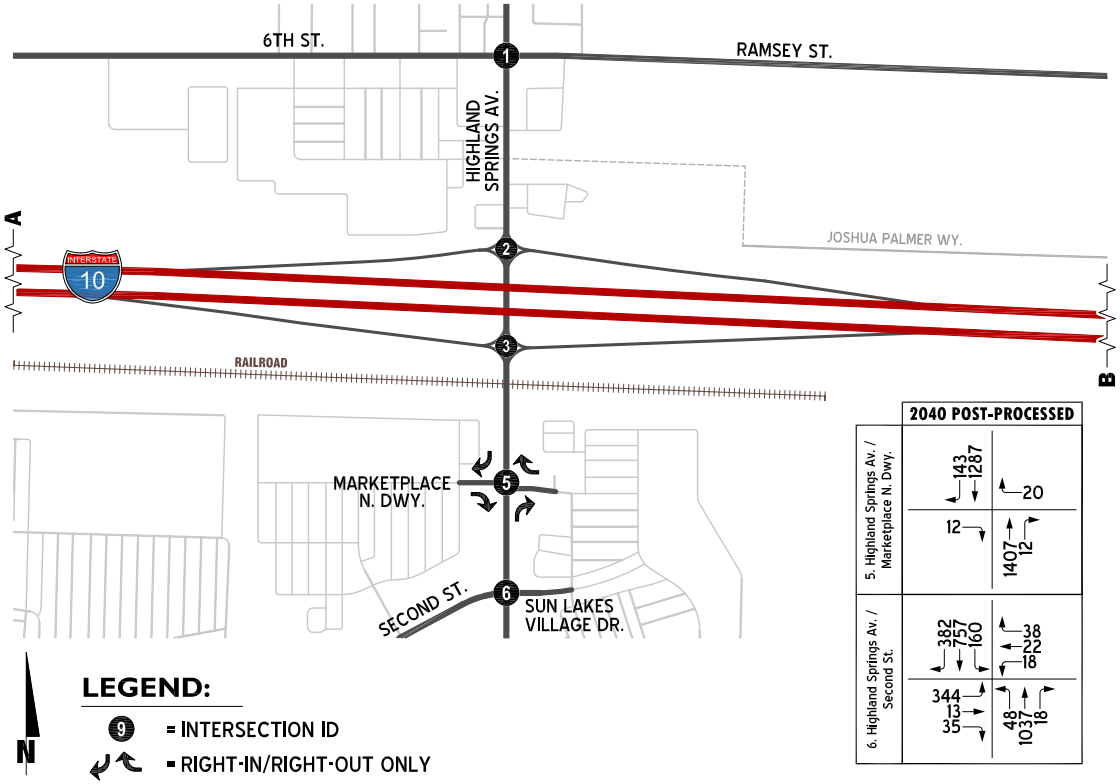
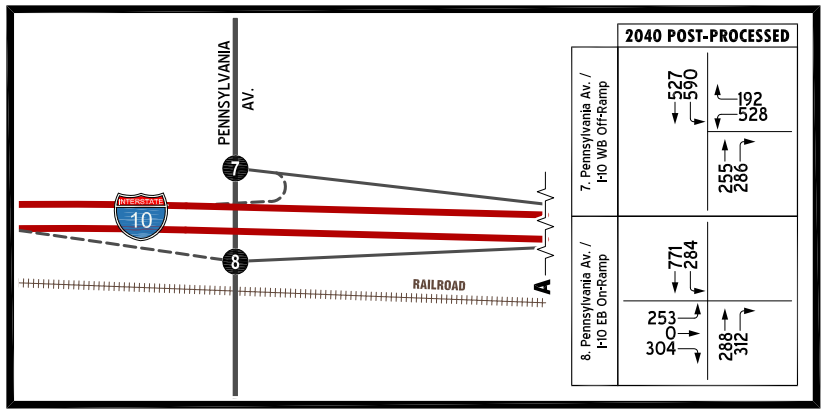


EXHIBIT 11: 2040 AM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVES 3 & 4 (DIVERGING DIAMOND INTERCHANGE)





PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA

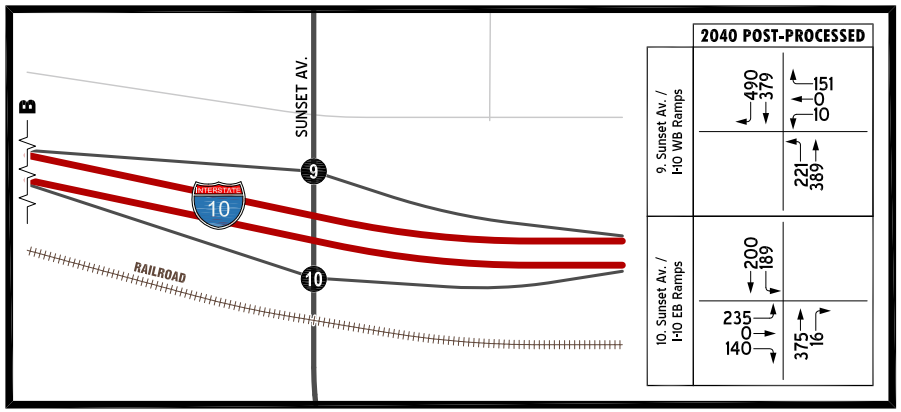
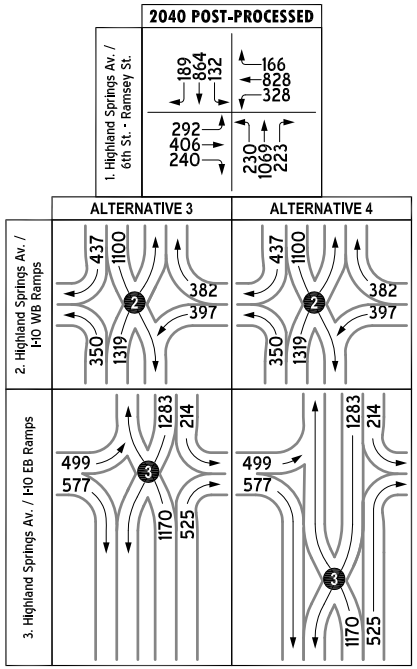
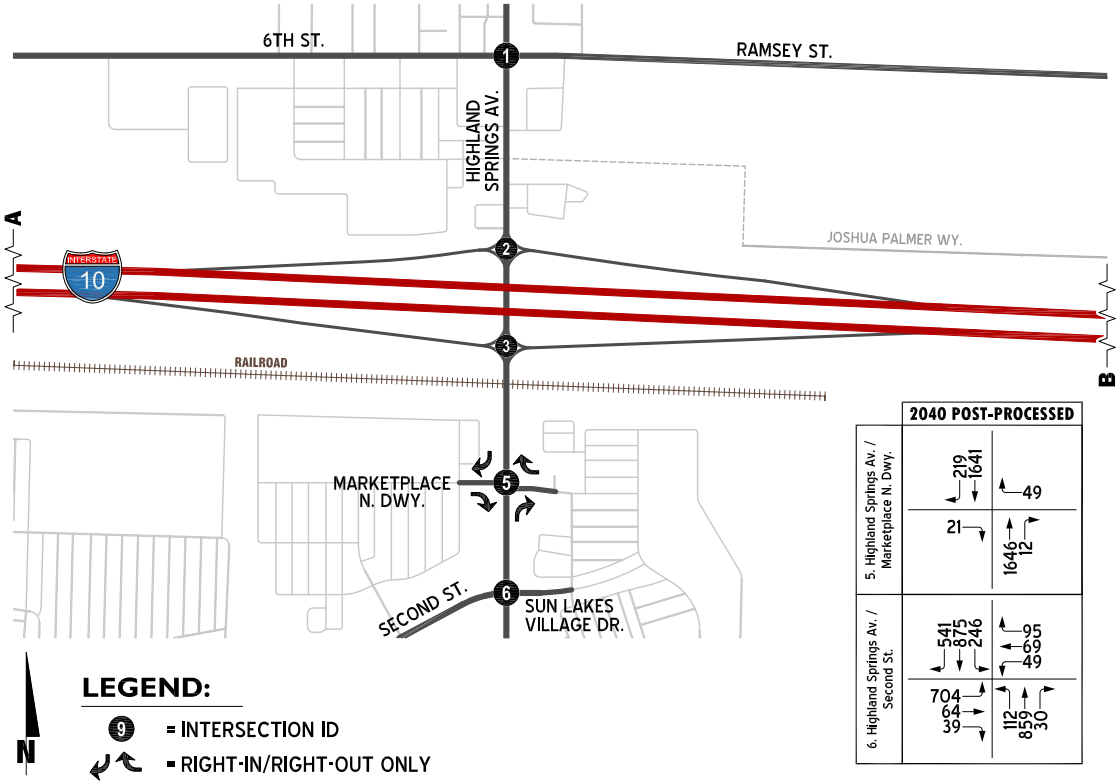
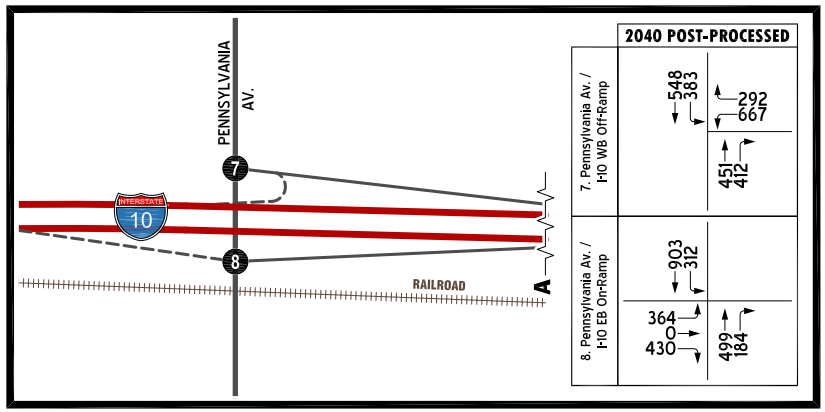


EXHIBIT 12: 2040 PM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVES 3 & 4 (DIVERGING DIAMOND INTERCHANGE)





PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA

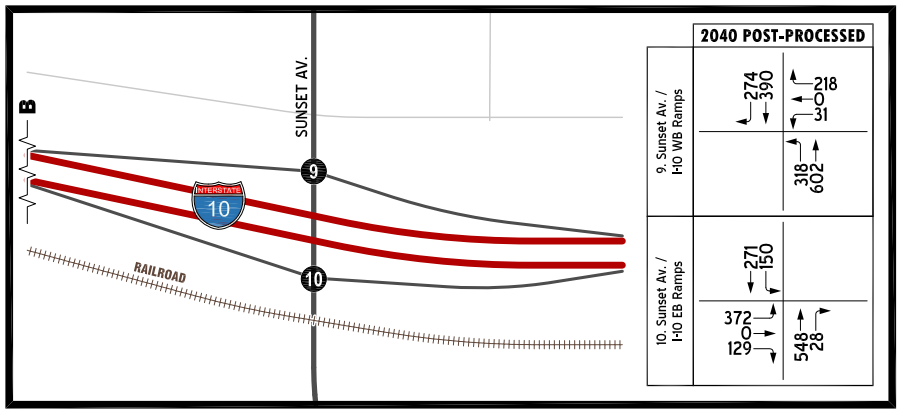
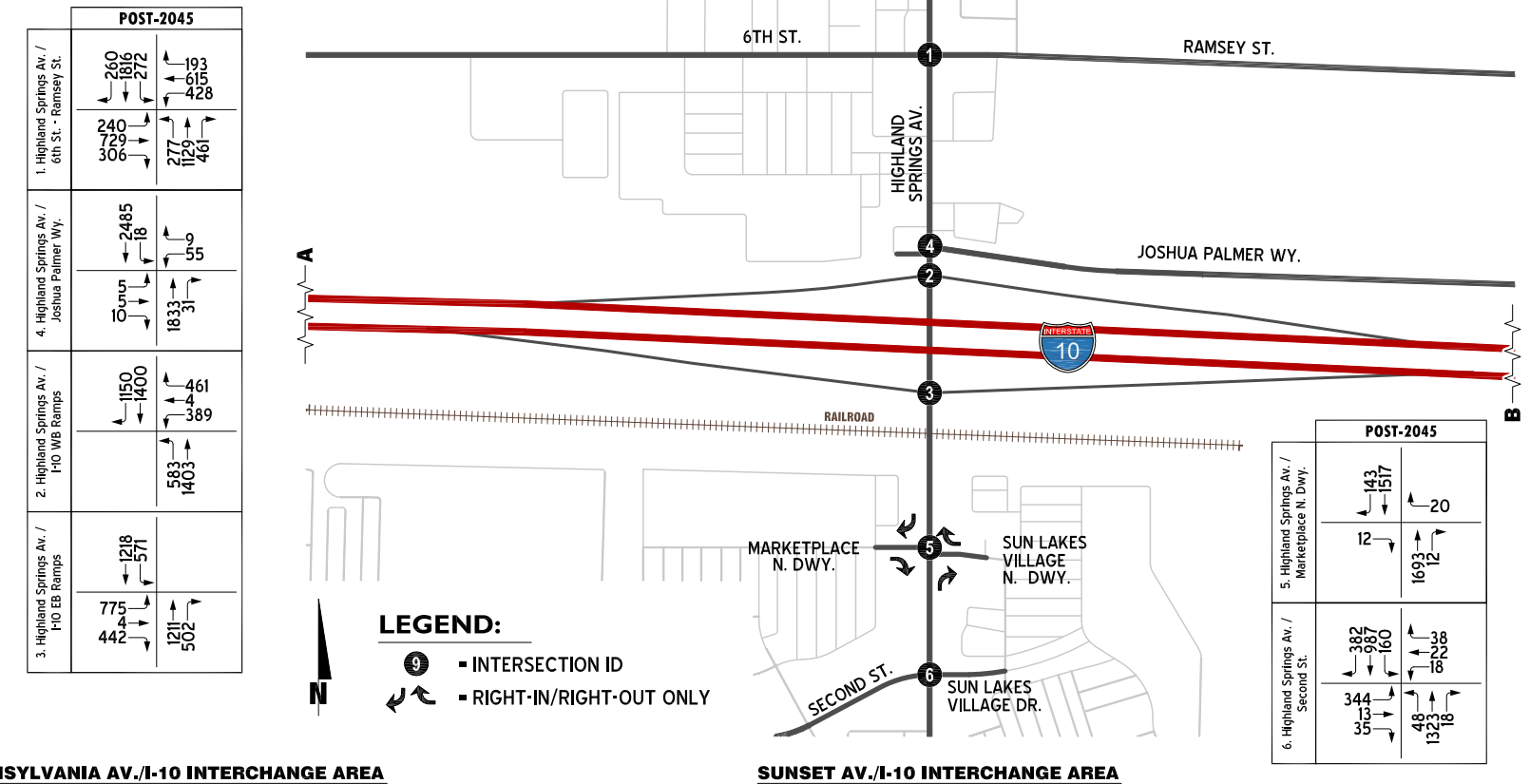
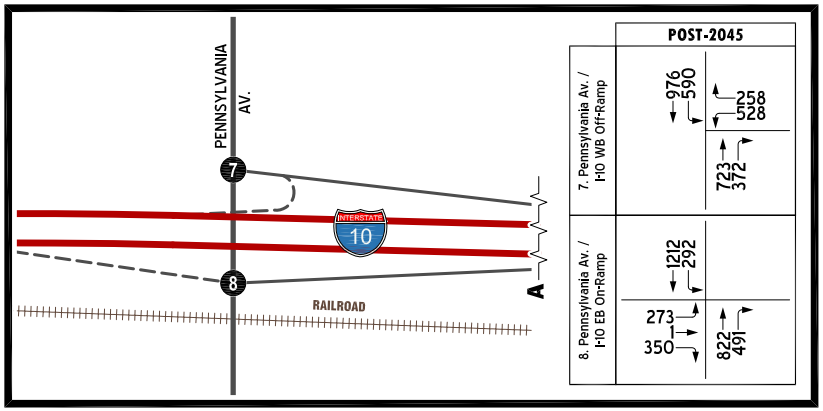


EXHIBIT 13: POST-2045 AM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVE 1 (EXISTING CONFIGURATION)



PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA

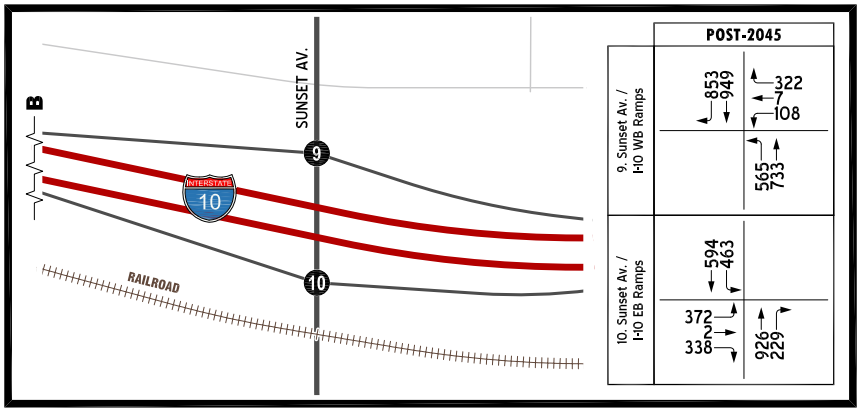
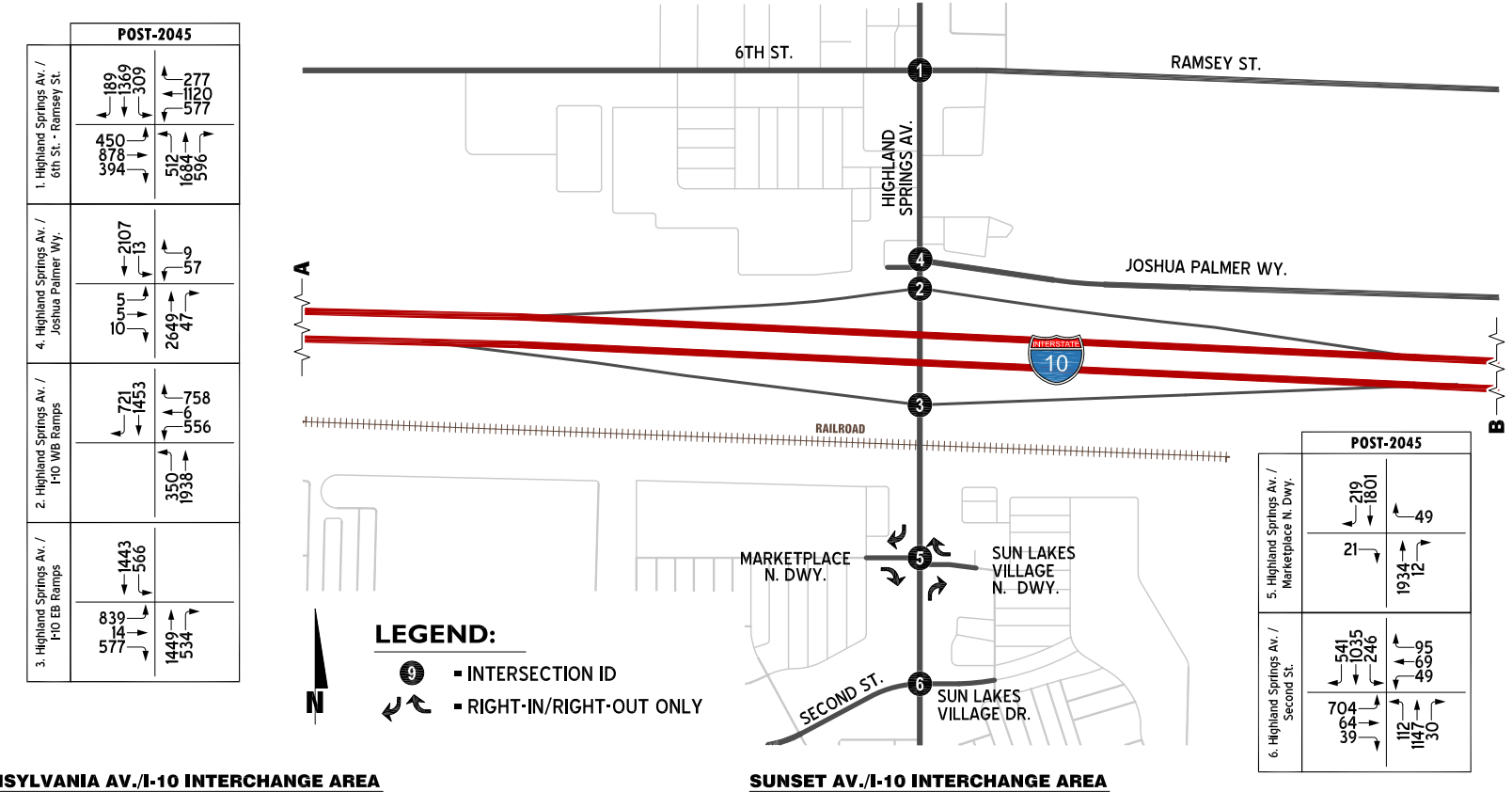
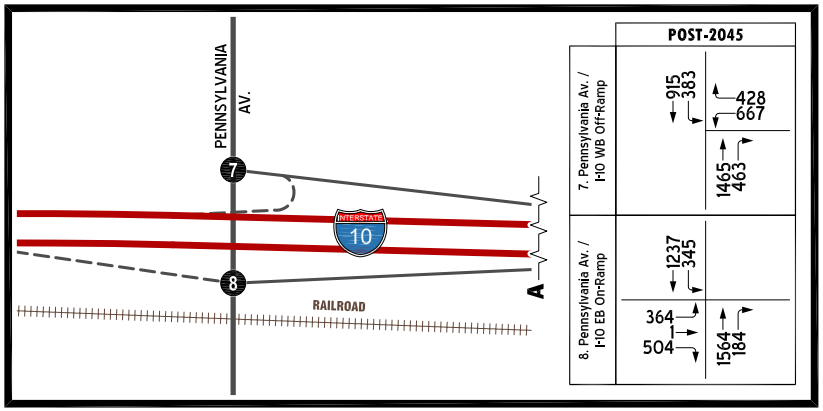


EXHIBIT 14: POST-2045 PM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVE 1 (EXISTING CONFIGURATION)



PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA

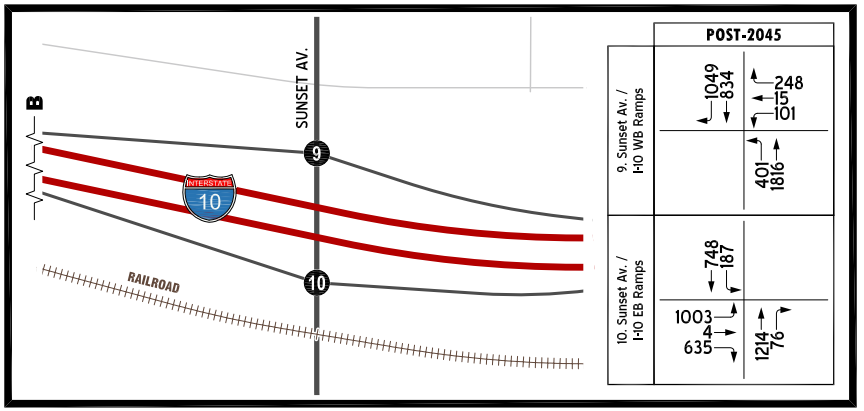
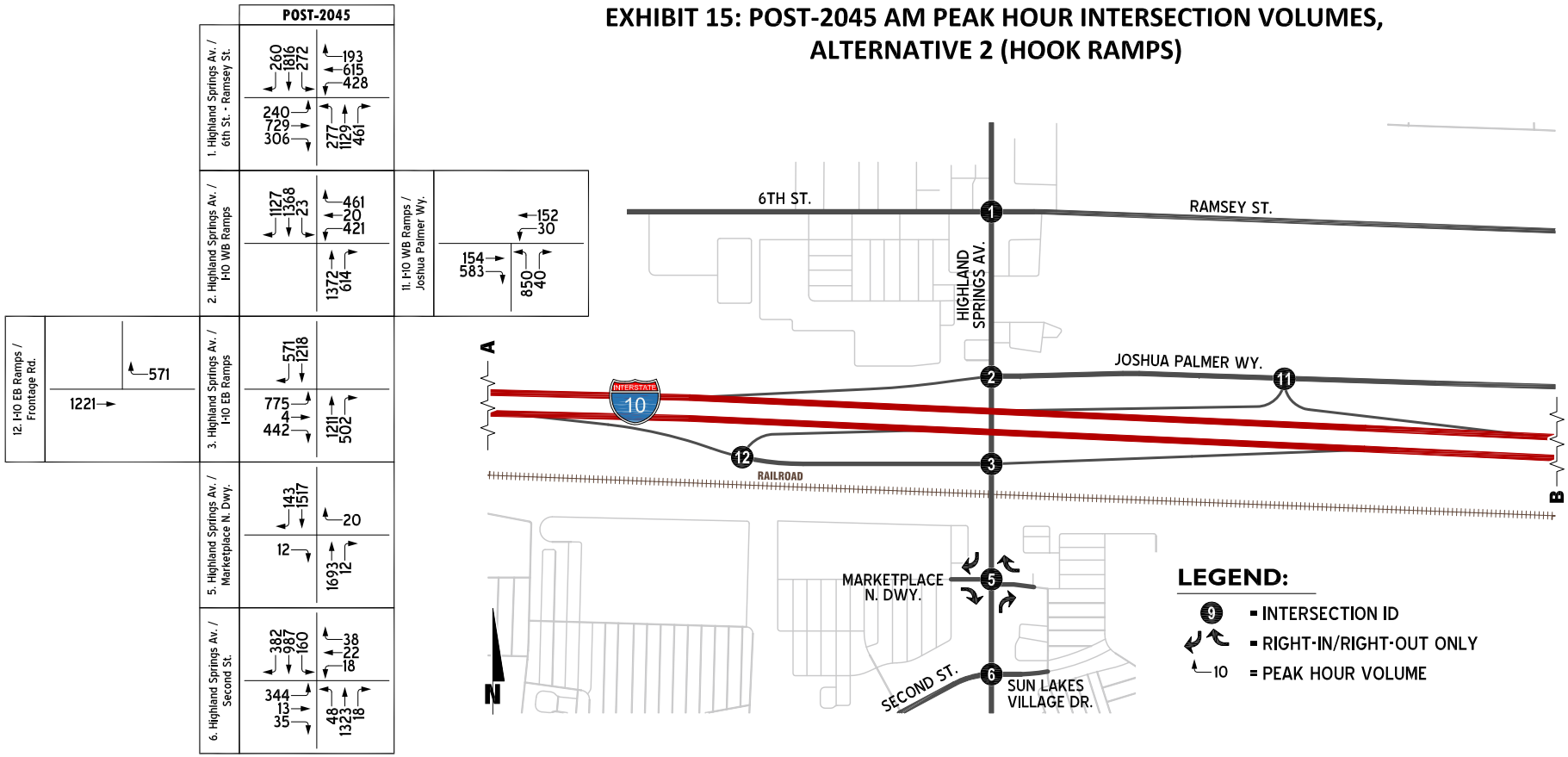
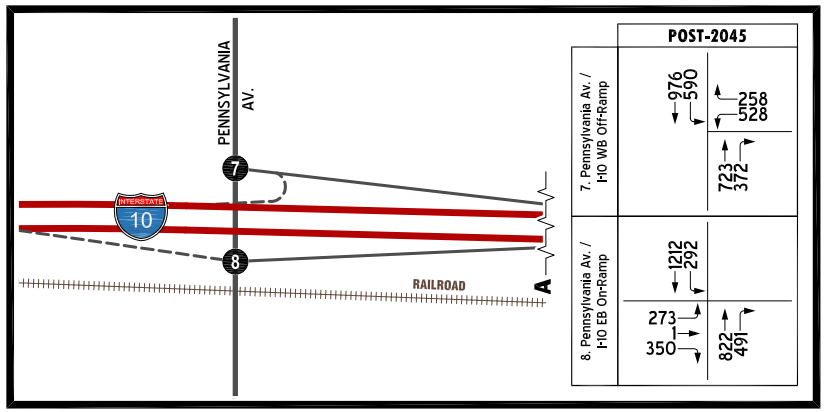


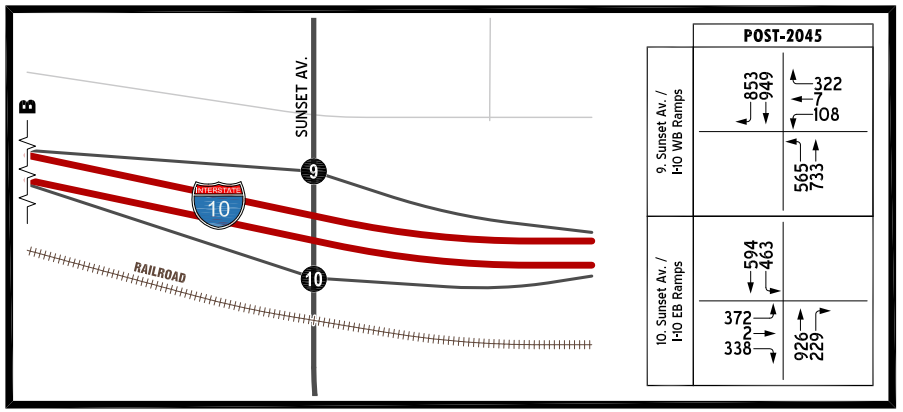
EXHIBIT 15: POST-2045 AM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVE 2 (HOOK RAMPS)



PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA



12522 - 01 - study area.dwg

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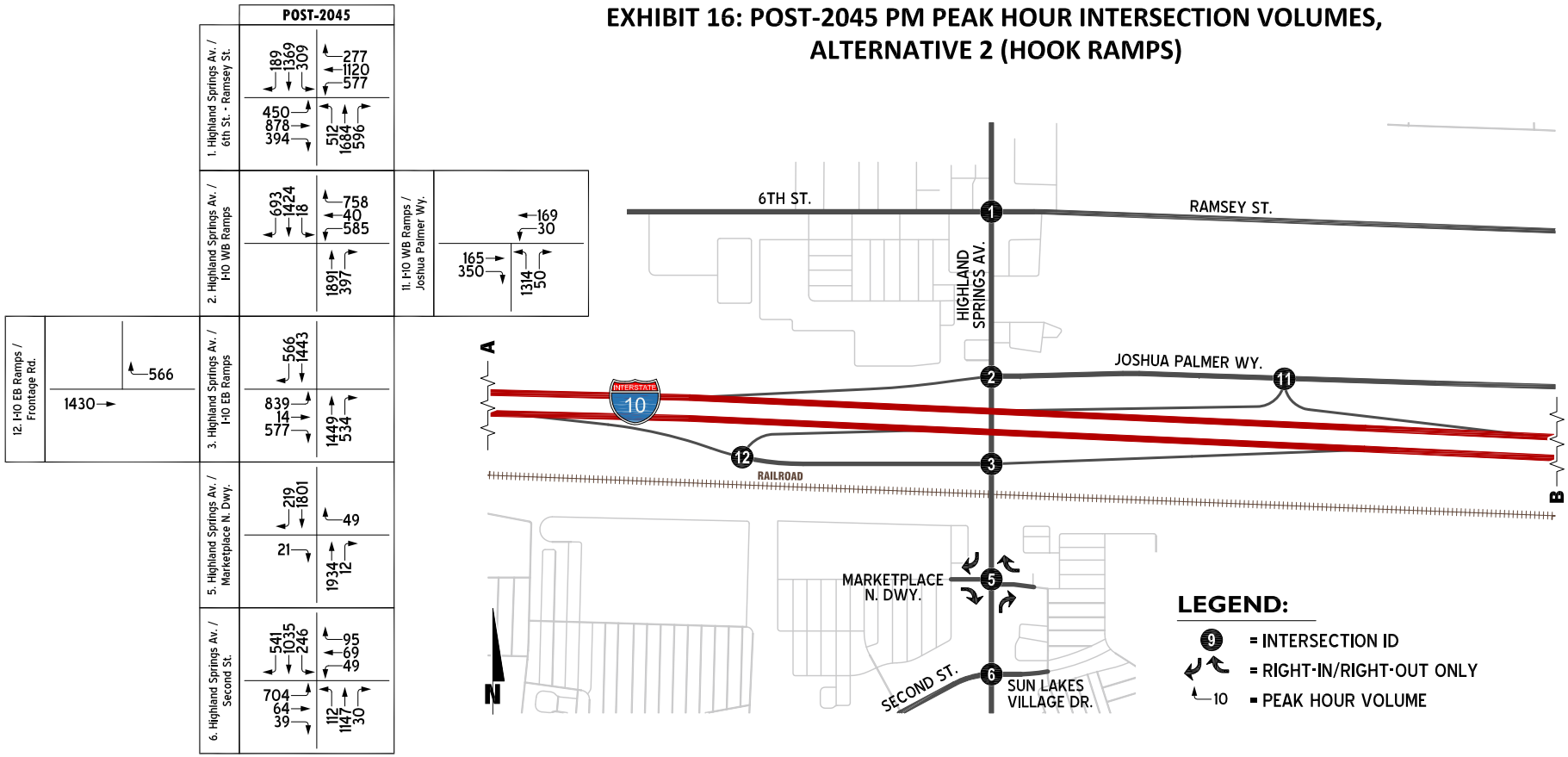
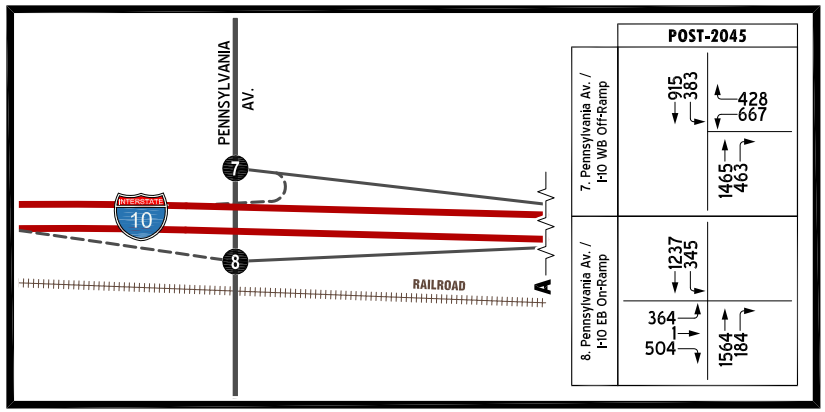
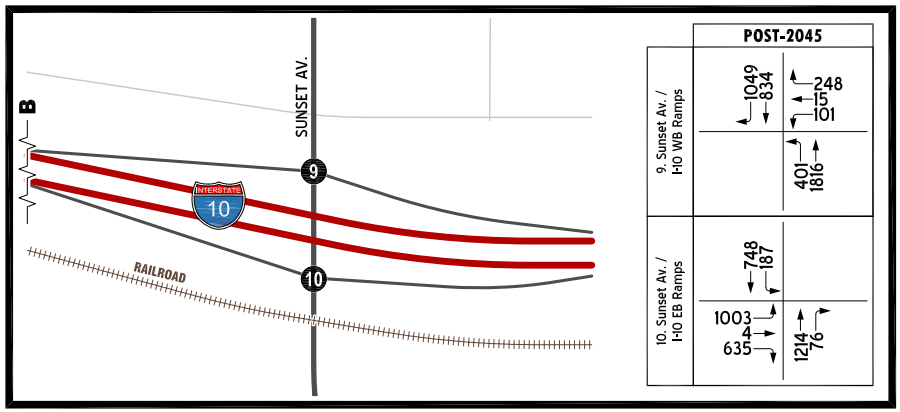
EXHIBIT 16: POST-2045 PM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVE 2 (HOOK RAMPS)



PENNSYLVANIA AV./I-10 INTERCHANGE AREA



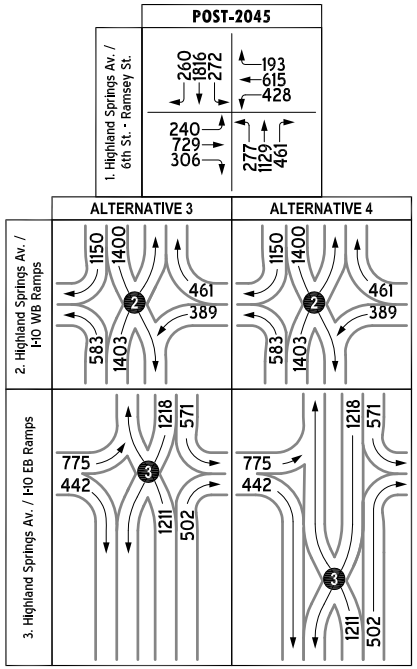
SUNSET AV./I-10 INTERCHANGE AREA

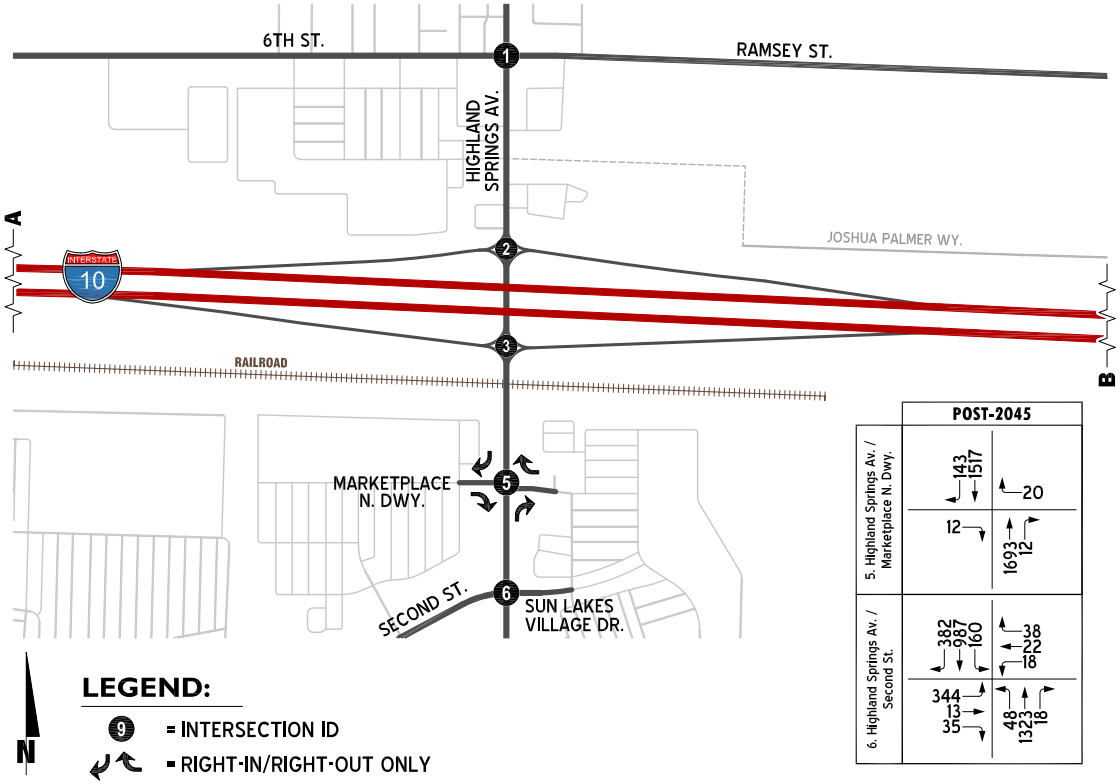


12522 - 01 - study area.dwg

URBAN CROSSROADS

EXHIBIT 17: POST-2045 AM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVES 3 & 4 (DIVERGING DIAMOND INTERCHANGE)





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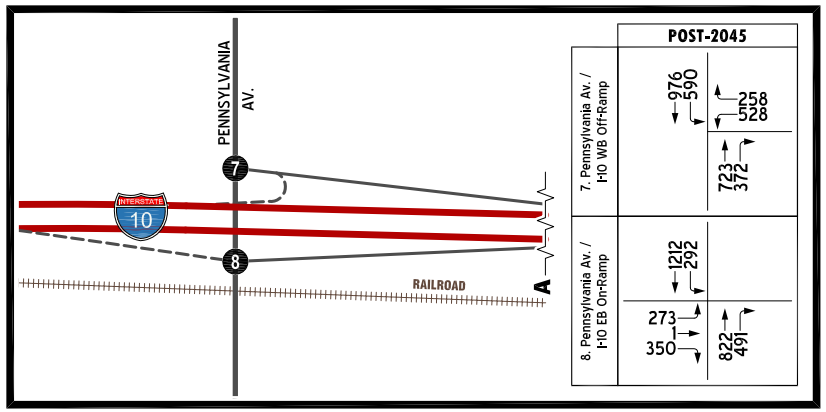
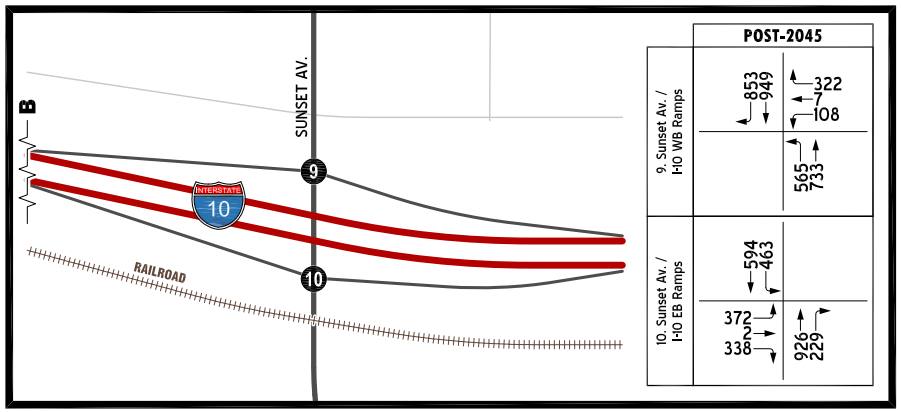


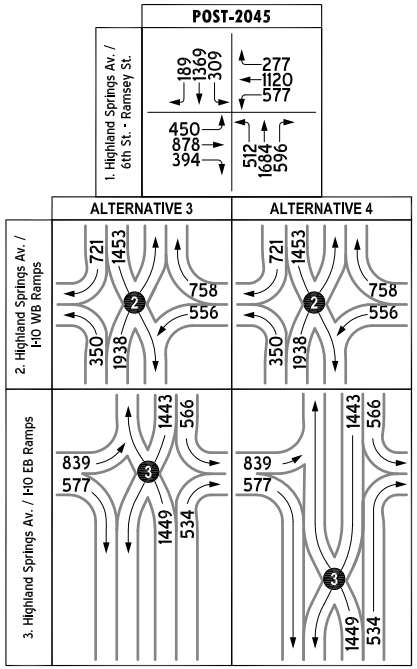
SUNSET AV./I-10 INTERCHANGE AREA

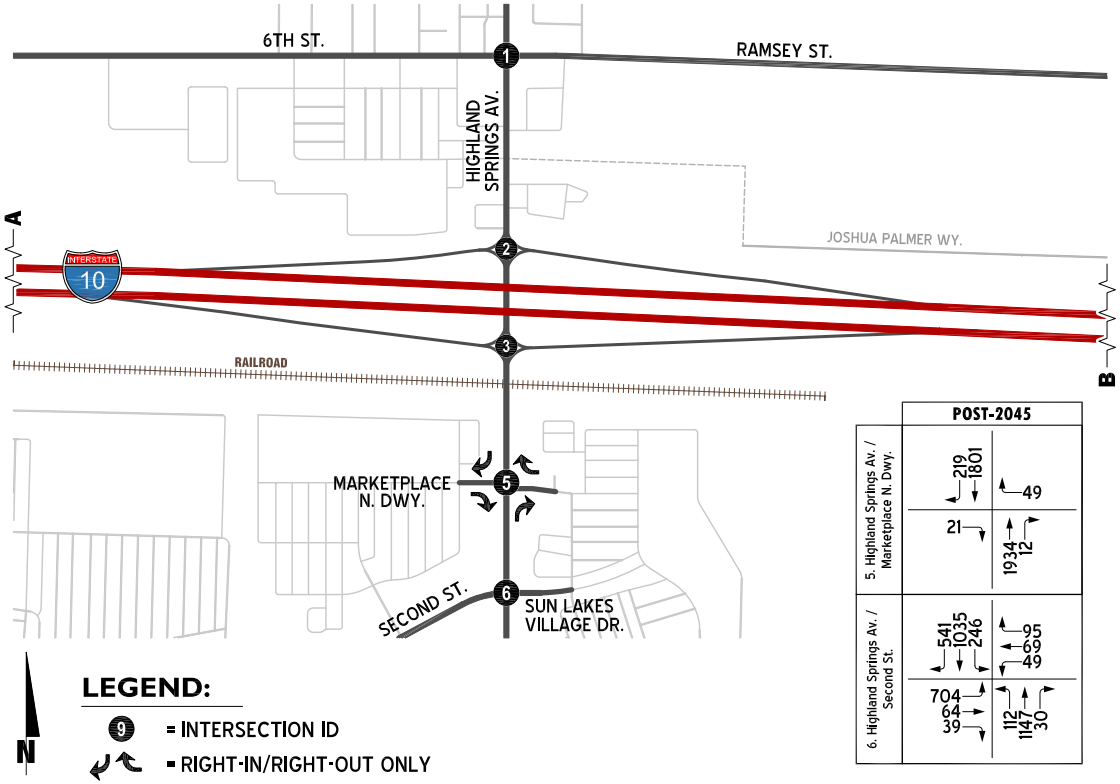


12522 - 01 - study area.dwg

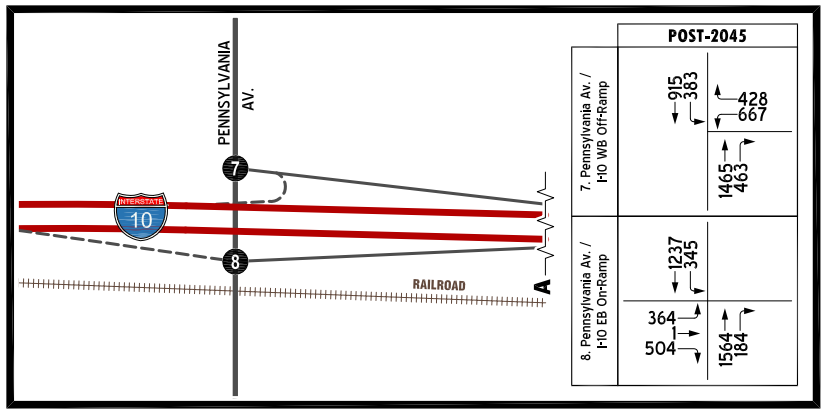
URBAN CROSSROADS

EXHIBIT 18: POST-2045 PM PEAK HOUR INTERSECTION VOLUMES, ALTERNATIVES 3 & 4 (DIVERGING DIAMOND INTERCHANGE)





PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA

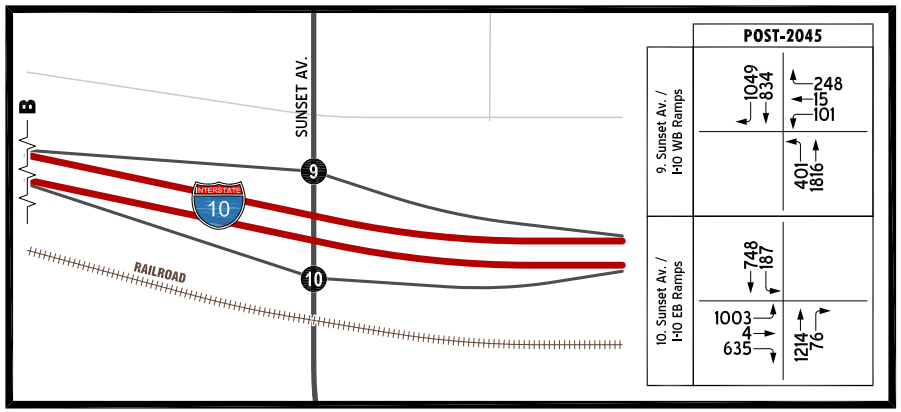


TABLE 1: INTERSECTION ANALYSIS FOR 2020 CONDITIONS

#	Intersection	Traffic Control[3]	Intersection Approach Lanes[1]												Delay[2] (Secs)		Level of Service[2]	
			Northbound			Southbound			Eastbound			Westbound						
			L	T	R	L	T	R	L	T	R	L	T	R	AM	PM	AM	PM
1	Highland Springs Av. / 6th St.-Ramsey St.	TS	1	2	1	1	2	1	1	2	1	1	2	d	26.3	35.0	C	C
2	Highland Springs Av. / I-10 WB Ramps																	
	- Alternative 1 (Existing Configuration)	TS	1	2	0	0	2	1	0	0	0	0.5	0.5	1	20.8	29.7	C	C
	- Alternative 2 (Hook Ramps)	TS	0	2	0	1	2	1	0	0	0	**1.5**	**0.5**	**1**	10.3	13.0	B	B
	- Alternatives 3 & 4 (Diverging Diamond)	TS	0	**2**	0	0	**2**	**1>>**	0	0	0	0	0	0	12.6	13.8	B	B
	▪ I-10 WB Off-Ramp (Right Turns)	**CFR**	0	**2**	0	0	**2**	0	0	0	0	0	0	**1>>**	0.0	0.0	A	A
	▪ I-10 WB Off-Ramp (Left Turns)[4]	**CSS**	0	**2**	0	0	**2**	0	0	0	0	**1**	0	0	10.0	13.1	A	B
3	Highland Springs Av. / I-10 EB Ramps																	
	- Alternative 1 (Existing Configuration)	TS	0	2	1	1	2	0	0.5	0.5	1	0	0	0	21.8	22.7	C	C
	- Alternative 2 (Hook Ramps)	TS	0	2	1	0	2	0	0.5	0.5	1	0	0	0	13.7	15.4	B	B
	- Alternatives 3 & 4 (Diverging Diamond)	TS	0	**2**	**1>>**	0	**2**	0	0	0	0	0	0	0	9.8	14.3	A	B
	▪ I-10 EB Off-Ramp (Right Turns)	**CFR**	0	**2**	0	0	**2**	0	0	0	**1>>**	0	0	0	0.0	0.0	A	A
	▪ I-10 EB Off-Ramp (Left Turns)[4]	**CSS**	0	**2**	0	0	**2**	0	**1**	0	0	0	0	0	13.4	29.5	B	D
4	Highland Springs Av. / Joshua Palmer Wy.																	
	- Existing Lane Configuration	TS	0	2	0	1	2	0	0	1!	0	0	1!	0	7.5	6.2	A	A
	- Alternative Lane Configurations		N/A												-	-	-	-
5	Highland Springs Av. / Marketplace N. Dwy.	CSS	0	3	0	0	3	d	0	0	1	0	0	1	14.0	18.6	B	C
6	Highland Springs Av. / Second St.	TS	1	3	0	1	3	d	2	1!	0	1	1	0	17.8	**39.0**	B	**D**
7	Pennsylvania Av. / I-10 WB Off-Ramp	CSS	0	1	0	0	1	0	0	0	0	0	1!	0	18.9	**>80**	C	**F**
8	Pennsylvania Av. / I-10 EB On-Ramp	CSS	0	1	0	0.5	0.5	0	0	0	0	0	0	0	9.5	9.8	A	A
9	Sunset Av. / I-10 WB Ramps	TS	1	2	0	0	2	0	0	0	0	0	1!	0	18.7	19.0	B	B
10	Sunset Av. / I-10 EB Ramps	TS	0	2	0	1	2	0	0	1!	0	0	0	0	43.7	36.2	D	D
11	I-10 WB Ramps / Joshua Palmer Wy.																	
	- Alternative 2 Interchange Configuration	**TS**	**1**	0	**1**	0	0	0	0	1	**1**	**1**	1	0	11.5	23.0	B	C
12	I-10 EB Ramps / Frontage Rd.																	
	- Alternative 2 Interchange Configuration	UNC	0	0	0	0	0	0	0	**1**	0	0	0	**1**	0.0	0.0	A	A

[1] When a right turn is designated, the lane can either be striped or unstriped. To function as a right turn lane there must be sufficient width for right turning vehicles to travel outside the through lanes.

L = Left; T = Through; R = Right; 0.5 = Shared Lane; 1! = Shared Left/Through/Right Lane; d = Defacto Right Turn Lane; >> = Free-Right Turn Lane; **1** = Improvement

[2] Per the Highway Capacity Manual 6th Edition (HCM6), overall average intersection delay and level of service are shown for intersections with a traffic signal or all way stop control. For intersections with cross street stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown. Delay and level of service is calculated using Synchro 10.1 analysis software.

BOLD = LOS does not meet the applicable jurisdictional requirements (i.e., unacceptable LOS).

[3] TS = Traffic Signal; CSS = Cross-street Stop; UNC = Uncontrolled; CFR = Channelized Free Right

[4] Delay is calculated using SimTraffic software.

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TABLE 2: INTERSECTION ANALYSIS FOR 2040 CONDITIONS

#	Intersection	Traffic Control[3]	Intersection Approach Lanes[1]												Delay[2] (Secs)		Level of Service[2]	
			Northbound			Southbound			Eastbound			Westbound						
			L	T	R	L	T	R	L	T	R	L	T	R	AM	PM	AM	PM
1	Highland Springs Av. / 6th St.-Ramsey St.	TS	1	2	1	1	2	1	1	2	1	1	2	d	35.0	54.6	C	D
2	Highland Springs Av. / I-10 WB Ramps																	
	- Alternative 1 (Existing Configuration)	TS	1	2	0	0	2	1	0	0	0	0.5	0.5	1	40.5	43.4	D	D
	- Alternative 2 (Hook Ramps)	TS	0	2	0	1	2	1	0	0	0	**1.5**	**0.5**	**1**	11.1	17.9	B	B
	- Alternatives 3 & 4 (Diverging Diamond)	TS	0	**2**	0	0	**2**	**1>>**	0	0	0	0	0	0	15.7	23.4	B	C
	▪ I-10 WB Off-Ramp (Right Turns)	**CFR**	0	**2**	0	0	**2**	0	0	0	0	0	0	**1>>**	0.0	0.0	A	A
	▪ I-10 WB Off-Ramp (Left Turns)[4]	**CSS**	0	**2**	0	0	**2**	0	0	0	0	**1**	0	0	12.9	16.5	B	C
3	Highland Springs Av. / I-10 EB Ramps																	
	- Alternative 1 (Existing Configuration)	TS	0	2	1	1	2	0	0.5	0.5	1	0	0	0	41.2	30.8	D	C
	- Alternative 2 (Hook Ramps)	TS	0	2	1	0	2	0	0.5	0.5	1	0	0	0	13.8	18.2	B	B
	- Alternatives 3 & 4 (Diverging Diamond)	TS	0	**2**	**1>>**	0	**2**	0	0	0	0	0	0	0	14.6	23.4	B	C
	▪ I-10 EB Off-Ramp (Right Turns)	**CFR**	0	**2**	0	0	**2**	0	0	0	**1>>**	0	0	0	0.0	0.0	A	A
	▪ I-10 EB Off-Ramp (Left Turns)[4]	**CSS**	0	**2**	0	0	**2**	0	**1**	0	0	0	0	0	25.8	**49.5**	D	**E**
4	Highland Springs Av. / Joshua Palmer Wy.																	
	- Existing Lane Configuration	TS	0	2	0	1	2	0	0	1!	0	0	1!	0	8.9	6.6	A	A
	- Alternative Lane Configurations		N/A												-	-	-	-
5	Highland Springs Av. / Marketplace N. Dwy.	CSS	0	3	0	0	3	d	0	0	1	0	0	1	17.7	22.9	C	C
6	Highland Springs Av. / Second St.																	
6	Highland Springs Av. / Second St.	TS	1	3	0	1	3	d	2	1!	0	1	1	0	18.6	42.3	B	D
7	Pennsylvania Av. / I-10 WB Off-Ramp																	
	- With Reconfigured Interchange	**TS**	0	1	**1**	**1**	1	0	0	0	0	**1**	0	1	50.7	52.9	D	D
8	Pennsylvania Av. / I-10 EB On-Ramp																	
	- With Reconfigured Interchange	**TS**	0	1	0	**1**	1	0	**1**	0	**1**	0	0	0	35.6	42.6	D	D
9	Sunset Av. / I-10 WB Ramps	TS	1	2	0	0	2	0	0	0	0	0	1!	0	22.3	26.0	C	C
10	Sunset Av. / I-10 EB Ramps	TS	0	2	0	1	2	0	0	1!	0	0	0	0	47.1	38.0	D	D
11	I-10 WB Ramps / Joshua Palmer Wy.																	
	- Alternative 2 Interchange Configuration	**TS**	**1**	0	**1**	0	0	0	0	1	**1**	**1**	1	0	13.5	33.6	B	C
12	I-10 EB Ramps / Frontage Rd.																	
	- Alternative 2 Interchange Configuration	UNC	0	0	0	0	0	0	0	**1**	0	0	0	**1**	0.0	0.0	A	A

[1] When a right turn is designated, the lane can either be striped or unstriped. To function as a right turn lane there must be sufficient width for right turning vehicles to travel outside the through lanes.

L = Left; T = Through; R = Right; 0.5 = Shared Lane; 1! = Shared Left/Through/Right Lane; d = Defacto Right Turn Lane; >> = Free-Right Turn Lane; **1** = Improvement

[2] Per the Highway Capacity Manual 6th Edition (HCM6), overall average intersection delay and level of service are shown for intersections with a traffic signal or all way stop control. For intersections with cross street stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown. Delay and level of service is calculated using Synchro 10.1 analysis software.

BOLD = LOS does not meet the applicable jurisdictional requirements (i.e., unacceptable LOS).

[3] TS = Traffic Signal; CSS = Cross-street Stop; UNC = Uncontrolled; CFR = Channelized Free Right

[4] Delay is calculated using SimTraffic software.

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TABLE 3: INTERSECTION ANALYSIS FOR POST-2045 CONDITIONS *(1 of 2)*

#	Intersection	Traffic Control[3]	Intersection Approach Lanes[1]												Delay[2] (Secs)		Level of Service[2]	
			Northbound			Southbound			Eastbound			Westbound						
			L	T	R	L	T	R	L	T	R	L	T	R	AM	PM	AM	PM
1	Highland Springs Av. / 6th St.-Ramsey St.																	
	- Without Improvements	TS	1	2	1	1	2	1	1	2	1	1	2	d	**187.8**	**216.2**	**F**	**F**
	- With Improvements	TS	**2**	**3**	**1>**	**2**	**3**	1	**2**	**3**	0	**2**	**3**	0	50.0	54.4	D	D
2	Highland Springs Av. / I-10 WB Ramps																	
	- Alternative 1 (Existing Configuration)	TS	1	2	0	0	2	1	0	0	0	0.5	0.5	1	**133.3**	**86.5**	**F**	**F**
	- With Improvements	TS	**2**	**3**	0	0	2	1	0	0	0	**2**	0	**2**	48.3	17.2	D	B
	- Alternative 2 (Hook Ramps)	TS	0	2	0	1	2	1	0	0	0	**1.5**	**0.5**	**1**	**58.9**	**85.4**	**E**	**F**
	- With Additional Improvements	TS	0	**3**	0	1	2	1	0	0	0	**1.5**	**0.5**	**1**	54.4	41.1	D	D
	- Alternatives 3 & 4 (Diverging Diamond)	TS	0	**2**	0	0	**2**	**1>>**	0	0	0	0	0	0	28.0	**102.1**	C	**F**
	- With Additional Improvements	TS	0	**3**	0	0	**2**	**1>>**	0	0	0	0	0	0	21.4	27.0	C	C
	▪ I-10 WB Off-Ramp (Right Turns)	**CFR**	0	**2**	0	0	**2**	0	0	0	0	0	0	**1>>**	0.0	0.0	A	A
	- With Additional Improvements	**CFR**	0	**3**	0	0	**2**	0	0	0	0	0	0	**1>>**	0.0	0.0	A	A
	▪ I-10 WB Off-Ramp (Left Turns)[4]	**CSS**	0	**2**	0	0	**2**	0	0	0	0	**1>>**	0	0	13.9	**75.2**	B	**F**
	- With Additional Improvements[4]	**UNC**	0	**3**	0	0	**2**	0	0	0	0	**1>>**	0	0	1.0	1.7	A	A
3	Highland Springs Av. / I-10 EB Ramps																	
	- Alternative 1 (Existing Configuration)	TS	0	2	1	1	2	0	0.5	0.5	1	0	0	0	**86.9**	**110.9**	**F**	**F**
	- With Improvements	TS	0	**3**	1	**2**	2	0	**1**	1!	1	0	0	0	28.8	30.3	C	C
	- Alternative 2 (Hook Ramps)	TS	0	2	1	0	2	0	0.5	0.5	1	0	0	0	31.5	39.4	C	D
	- Alternatives 3 & 4 (Diverging Diamond)	TS	0	**2**	**1>>**	0	**2**	0	0	0	0	0	0	0	14.2	32.3	B	C
	▪ I-10 EB Off-Ramp (Right Turns)	**CFR**	0	**2**	0	0	**2**	0	0	0	**1>>**	0	0	0	0.0	0.0	A	A
	▪ I-10 EB Off-Ramp (Left Turns)[4]	**CSS**	0	**2**	0	0	**2**	0	**1**	0	0	0	0	0	34.3	**206.2**	D	**F**
	- With Additional Improvements[4]	**UNC**	0	**2**	0	0	**2**	0	**1>>**	0	0	0	0	0	19.8	22.3	C	C
4	Highland Springs Av. / Joshua Palmer Wy.																	
	- Existing Lane Configuration	TS	0	2	0	1	2	0	0	1!	0	0	1!	0	31.5	39.1	C	D
	- With City of Banning GPBO Improvements	TS	0	**3**	0	1	2	0	0	1!	0	0	1!	0	30.1	10.6	C	B
	- Alternative Lane Configurations		N/A												-	-	-	-
5	Highland Springs Av. / Marketplace N. Dwy.	CSS	0	3	0	0	3	d	0	0	1	0	0	1	21.3	24.8	C	C
6	Highland Springs Av. / Second St.	TS	1	3	0	1	3	d	2	1!	0	1	1	0	19.5	43.9	B	D
7	Pennsylvania Av. / I-10 WB Off-Ramp																	
	- With Reconfigured Interchange	**TS**	0	1	**1**	**1**	1	0	0	0	0	**1**	0	1	**90.4**	**192.4**	**F**	**F**
	- With Additional Interchange Improvements	**TS**	0	**2**	**1**	**1**	1	0	0	0	0	**1**	1!	**1**	37.6	33.2	D	C
8	Pennsylvania Av. / I-10 EB On-Ramp																	
	- With Reconfigured Interchange	**TS**	0	1	0	**1**	1	0	**1**	0	**1**	0	0	0	**166.4**	**221.6**	**F**	**F**
	- With Additional Interchange Improvements	**TS**	0	**2**	**1**	**1**	**2**	0	**1**	**1!**	**1**	0	0	0	22.5	46.6	C	D
9	Sunset Av. / I-10 WB Ramps																	
	- Without Improvements	TS	1	2	0	0	2	0	0	0	0	0	1!	0	**134.9**	**86.3**	**F**	**F**
	- With Improvements	TS	1	2	0	0	2	**1>>**	0	0	0	0	1!	0	52.5	24.0	D	C

TABLE 3: INTERSECTION ANALYSIS FOR POST-2045 CONDITIONS *(2 of 2)*

#	Intersection	Traffic Control[3]	Intersection Approach Lanes[1]												Delay[2] (Secs)		Level of Service[2]	
			Northbound			Southbound			Eastbound			Westbound						
			L	T	R	L	T	R	L	T	R	L	T	R	AM	PM	AM	PM
10	Sunset Av. / I-10 EB Ramps																	
	- Without Improvements	TS	0	2	0	1	2	0	0	1!	0	0	0	0	**98.6**	**303.9**	**F**	**F**
	- With Improvements	TS	0	2	0	1	2	0	**1**	1!	**1**	0	0	0	39.4	50.9	D	D
11	I-10 WB Ramps / Joshua Palmer Wy.																	
	- Alternative 2 Interchange Configuration	**TS**	**1**	0	**1**	0	0	0	0	1	**1**	**1**	1	0	**73.6**	**88.3**	**E**	**F**
	- With Additional Improvements	**TS**	**1**	**1!**	0	0	0	0	0	1	**1**	**1**	1	0	19.1	22.4	B	C
12	I-10 EB Ramps / Frontage Rd.																	
	- Alternative 2 Interchange Configuration	UNC	0	0	0	0	0	0	0	**1**	0	0	0	**1**	0.0	0.0	A	A

[1] When a right turn is designated, the lane can either be striped or unstriped. To function as a right turn lane there must be sufficient width for right turning vehicles to travel outside the through lanes.

L = Left; T = Through; R = Right; 0.5 = Shared Lane; 1! = Shared Left/Through/Right Lane; d = Defacto Right Turn Lane; >> = Free Turn Lane; **1** = Improvement

[2] Per the Highway Capacity Manual 6th Edition (HCM6), overall average intersection delay and level of service are shown for intersections with a traffic signal or all way stop control. For intersections with cross street stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown. Delay and level of service is calculated using Synchro 10.1 analysis software.

BOLD = LOS does not meet the applicable jurisdictional requirements (i.e., unacceptable LOS).

[3] TS = Traffic Signal; CSS = Cross-street Stop; UNC = Uncontrolled; CFR = Channelized Free Right

[4] Delay is calculated using SimTraffic software.

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physical spacing of intersections. Tables 4 through 6 summarize the results of the queuing analysis for 2020, 2040, and Post-2045 conditions, respectively.

Table 4 summarizes the longest 95th percentile queue length at each location under 2020 peak hour conditions for Alternatives 1 through 4.

Table 5 summarizes the 95th percentile queue length at each location under 2040 peak hour conditions for Alternatives 1 through 4.

Table 6 summarizes the 95th percentile queue length at each location under Post-2045 peak hour conditions for Alternatives 1 through 4.

HCM and SimTraffic queuing analysis calculation worksheets are included in Attachments 1 to 3.

Based upon both 2020, 2040, and Post-2045 peak hour volumes, Tables 4, 5, and 6 indicate that peak hour left turn queues exceed the storage lengths provided on Highland Springs Avenue between the I-10 ramp intersections for Alternative 1 (existing/no build) conditions. This queue length issue illuminates the existing traffic operational issues at the interchange.

TRAFFIC CONTROLS AND INTERSECTION LANE GEOMETRY

Alternative 1

The attached Exhibit 19 shows the intersection traffic control and approach lanes for Alternative 1 (existing/no build).

Exhibit 20 shows the potential additional intersection improvements needed for Post-2045 conditions for Alternative 1 (existing/no build).

Alternative 2

Exhibit 21 illustrates the Alternative 2 (hook ramps) intersection traffic controls and approach lanes. The alignment of Joshua Palmer Way is proposed to be modified and connect directly opposite the existing westbound on-ramp. This is an important feature because it consolidates/corrects the awkward existing off-set intersection at Joshua Palmer/Highland Springs. The existing WB off-ramp is relocated easterly and intersects Joshua Palmer in a hook ramp configuration. In addition, a new westbound on-ramp is provided from Joshua Palmer Way east of Highland Spring Avenue. The eastbound off-ramp is also reconfigured to provide a new EB on-ramp access west of Highland Springs Avenue.

Exhibit 22 shows potential additional intersection improvements needed for Post-2045 conditions for Alternative 2 (hook ramps).

Alternatives 3 and 4

Exhibit 23 depicts the intersection traffic controls and approach lanes with the potential Diverging Diamond Interchange (DDI) features incorporated into Alternatives 3 and 4. The DDI is an alternative which significantly reduces the number of vehicle-to-vehicle conflict points compared to a conventional diamond interchange.

TABLE 4: QUEUING ANALYSIS SUMMARY FOR 2020 CONDITIONS

ID	Intersection	Turning Movement Lane	Storage Length Provided[2] (feet)	95th Percentile Queue Length[1] Per Lane (feet)	
				AM	PM
ALTERNATIVE 1 (EXISTING CONFIGURATION)					
2	Highland Springs Av. / I-10 WB Ramps				
		NBL	125	**225**	**220**
		WBL/T	500	455	>500
		WBR	350	400	**512**
3	Highland Springs Av. / I-10 EB Ramps				
		NBR	440	150	179
		SBL	125	**212**	**187**
		EBL/T	500	273	336
		EBR	640	204	304
ALTERNATIVE 2 (HOOK RAMPS)					
2	Highland Springs Av. /				
	I-10 WB Ramps - Joshua Palmer Wy.	SBL	**125**	35	43
		SBR	**150**	102	91
		WBL	**300**	167	128
		WBR	**300**	211	229
3	Highland Springs Av. / I-10 EB Ramps				
		NBR	440	136	187
		EBL/T	500	346	417
		EBR	500	289	314
11	I-10 WB Ramps / Joshua Palmer Wy.				
		NBL	**300**	106	102
		NBR	**300**	38	34
		EBR	**150**	68	97
		WBL	**150**	34	45
ALTERNATIVE 3 (DIVERGING DIAMOND INTERCHANGE)					
2	Highland Springs Av. / I-10 WB Ramps				
		NBT	**300**	127	111
		SBT	**300**	66	46
		WBL	500	100	117
3	Highland Springs Av. / I-10 EB Ramps				
		NBT	**480**	140	198
		SBT	**300**	160	166
		EBL	500	119	120
ALTERNATIVE 4 (MODIFIED DIVERGING DIAMOND INTERCHANGE)					
2	Highland Springs Av. / I-10 WB Ramps				
		NBT	**525**	124	127
		SBT	**300**	46	46
		WBL	500	110	129
3	Highland Springs Av. / I-10 EB Ramps				
		NBT	**280**	189	191
		SBT	**525**	200	249
		EBL	500	126	121

[1] Queue length calculated using SimTraffic.

BOLD = 95th percentile exceeds available storage length.

[2] 100 = Existing; **100** = Proposed length of storage

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TABLE 5: QUEUING ANALYSIS SUMMARY FOR 2040 CONDITIONS

ID	Intersection	Turning Movement Lane	Storage Length Provided[2] (feet)	95th Percentile Queue Length[1] Per Lane (feet)	
				AM	PM
ALTERNATIVE 1 (EXISTING CONFIGURATION)					
2	Highland Springs Av. / I-10 WB Ramps				
		NBL	125	**202**	**237**
		WBL/T	500	>500	>500
		WBR	350	**>500**	**491**
3	Highland Springs Av. / I-10 EB Ramps				
		NBR	440	**460**	**458**
		SBL	125	**193**	**159**
		EBL/T	500	338	>500
		EBR	640	217	337
ALTERNATIVE 2 (HOOK RAMPS)					
2	Highland Springs Av. / I-10 WB Ramps - Joshua Palmer Wy.	SBL	**125**	58	85
		SBR	**150**	133	144
		WBL	**300**	165	273
		WBR	**300**	176	318 [3]
3	Highland Springs Av. / I-10 EB Ramps				
		NBR	440	273	286
		EBL/T	500	406	>500
		EBR	500	299	285
11	I-10 WB Ramps / Joshua Palmer Wy.				
		NBL	**300**	103	114
		NBR	**300**	38	31
		EBR	**150**	117	104
		WBL	**150**	58	57
ALTERNATIVE 3 (DIVERGING DIAMOND INTERCHANGE)					
2	Highland Springs Av. / I-10 WB Ramps				
		NBT	**300**	130	135
		SBT	**300**	46	49
		WBL	500	133	250
3	Highland Springs Av. / I-10 EB Ramps				
		NBT	**480**	193	184
		SBT	**300**	169	183
		EBL	500	206	432
ALTERNATIVE 4 (MODIFIED DIVERGING DIAMOND INTERCHANGE)					
2	Highland Springs Av. / I-10 WB Ramps				
		NBT	**525**	186	212
		SBT	**300**	49	62
		WBL	500	131	173
3	Highland Springs Av. / I-10 EB Ramps				
		NBT	**280**	205	179
		SBT	**525**	220	225
		EBL	500	311	400

[1] Queue length calculated using SimTraffic.

BOLD = 95th percentile exceeds available storage length.

[2] 100 = Existing; **100** = Proposed length of storage

[3] Excess in queue can be accommodated within transition lane.

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TABLE 6: QUEUING ANALYSIS SUMMARY FOR POST-2045 CONDITIONS

ID	Intersection	Turning Movement Lane	Storage Length Provided[2] (feet)	95th Percentile Queue Length[1] Per Lane (feet)	
				AM	PM
ALTERNATIVE 1 (EXISTING CONFIGURATION)					
2	Highland Springs Av. / I-10 WB Ramps				
		NBL	125	**169**	**209**
		WBL	500	176	>500
		WBR	350	**438**	**478**
3	Highland Springs Av. / I-10 EB Ramps				
		NBR	440	318	375
		SBL	125	**194**	**188**
		EBL	500	375	400
		EBR	640	322	362
ALTERNATIVE 2 (HOOK RAMPS)					
2	Highland Springs Av. /				
	I-10 WB Ramps - Joshua Palmer Wy.	SBL	**125**	30	55
		SBR	**150**	134	130
		WBL	**300**	309 [3]	252
		WBR	**300**	337 [3]	272
3	Highland Springs Av. / I-10 EB Ramps				
		NBR	440	437	145
		EBL/T	500	>500	>500
		EBR	500	349	270
11	I-10 WB Ramps / Joshua Palmer Wy.				
		NBL	**300**	82	114
		NBL/R	**300**	127	31
		EBR	**150**	108	104
		WBL	**150**	56	57
ALTERNATIVE 3 (DIVERGING DIAMOND INTERCHANGE)					
2	Highland Springs Av. / I-10 WB Ramps				
		NBT	**300**	98	103
		SBT	**300**	65	64
		WBL	500	21	149
3	Highland Springs Av. / I-10 EB Ramps				
		NBT	**480**	184	180
		SBT	**300**	180	143
		EBL	500	177	175
ALTERNATIVE 4 (MODIFIED DIVERGING DIAMOND INTERCHANGE)					
2	Highland Springs Av. / I-10 WB Ramps				
		NBT	**525**	115	115
		SBT	**300**	51	74
		WBL	500	10	238
3	Highland Springs Av. / I-10 EB Ramps				
		NBT	**280**	191	181
		SBT	**525**	109	229
		EBL	500	279	184

[1] Queue length calculated using SimTraffic.

BOLD = 95th percentile exceeds available storage length.

[2] 100 = Existing; **100** = Proposed length of storage

[3] Excess in queue can be accommodated within transition lane.

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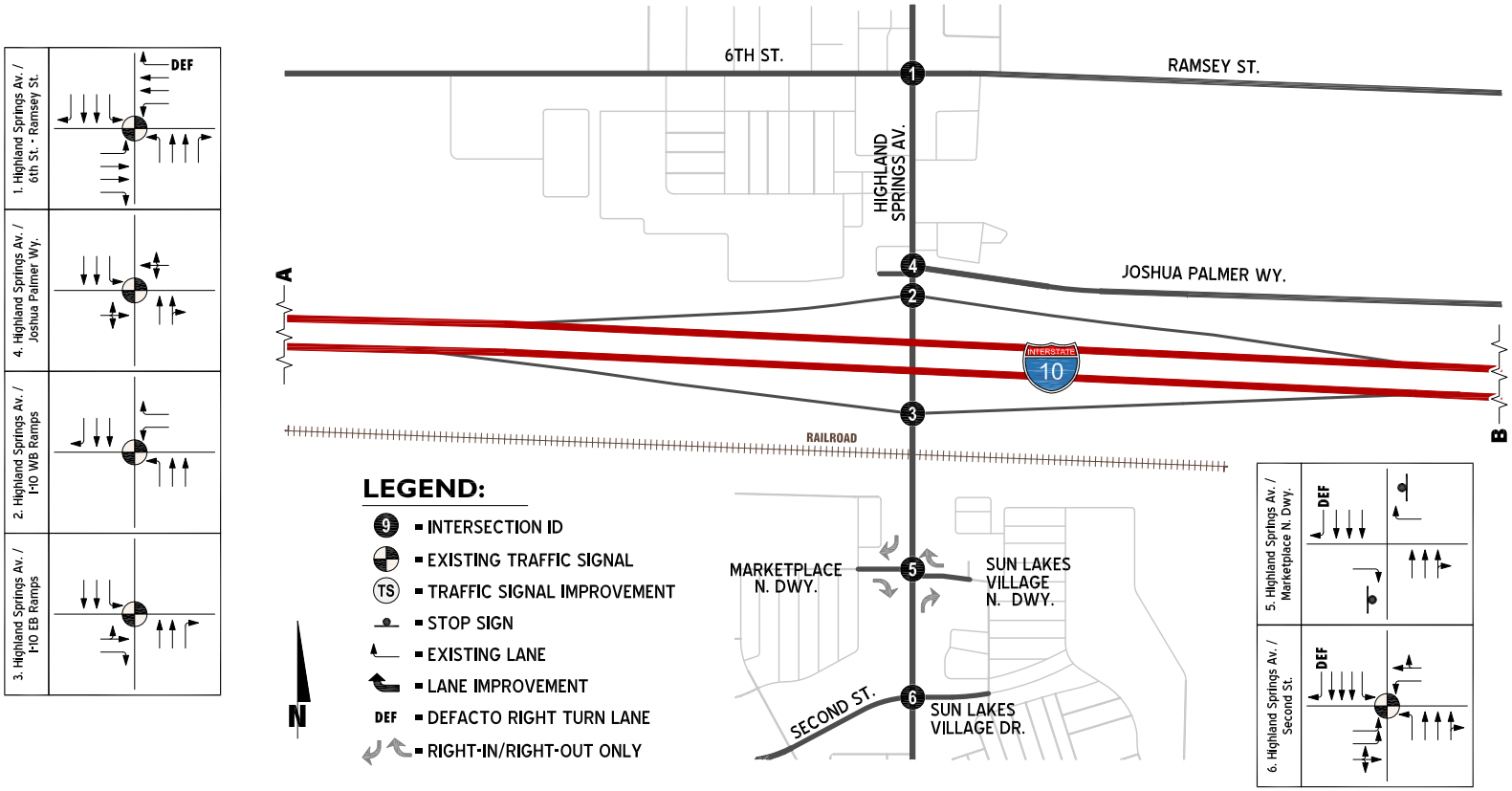
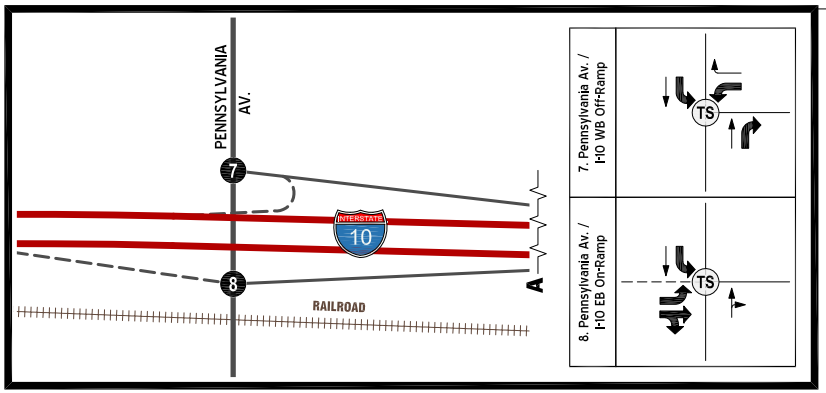
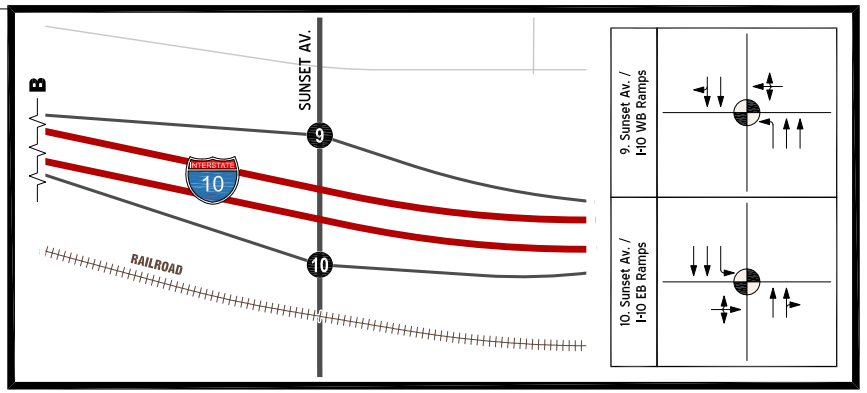
EXHIBIT 19: ALTERNATIVE 1 (EXISTING CONFIGURATION) INTERSECTION TRAFFIC CONTROLS AND APPROACH LANES



PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA



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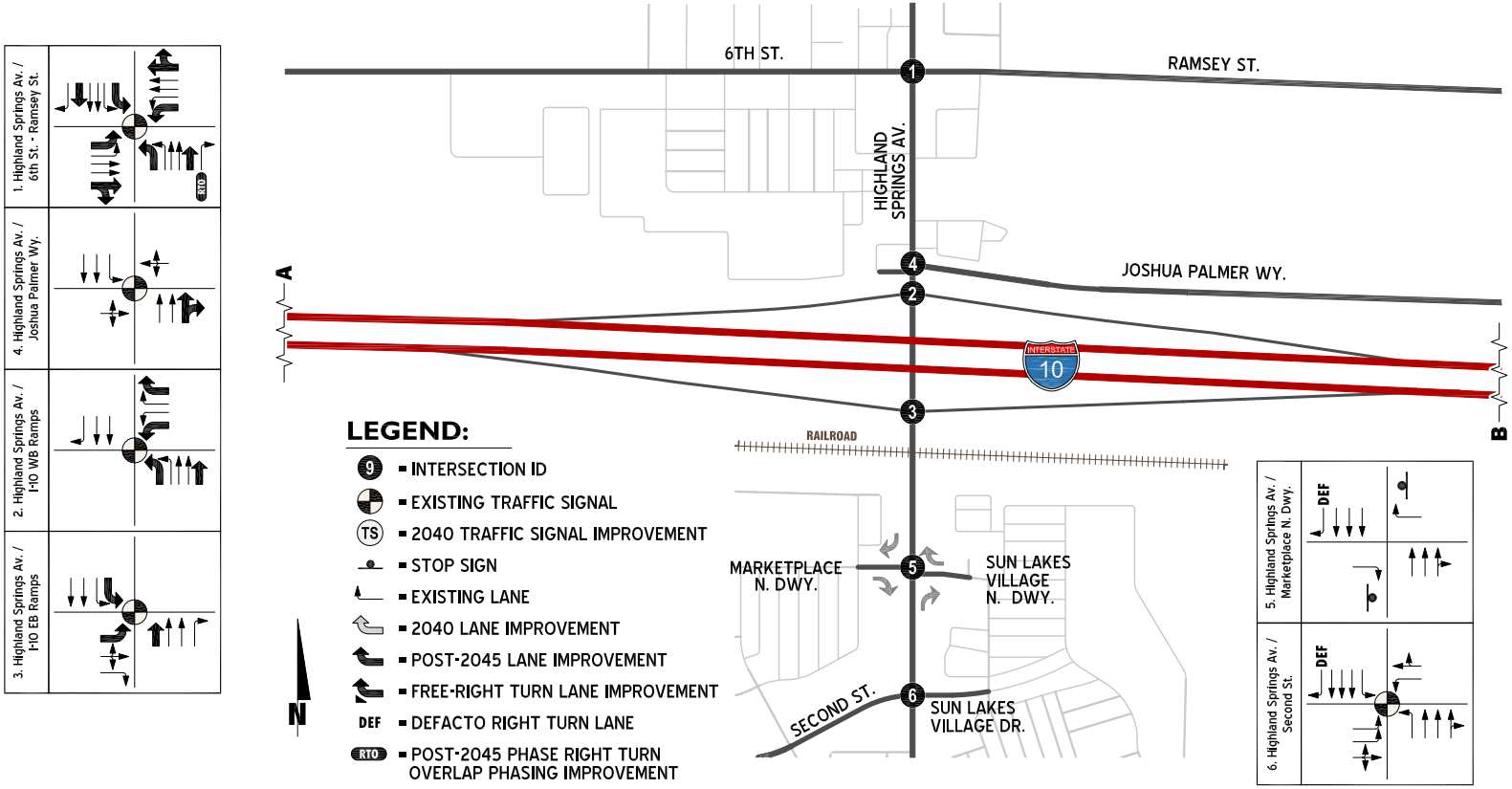
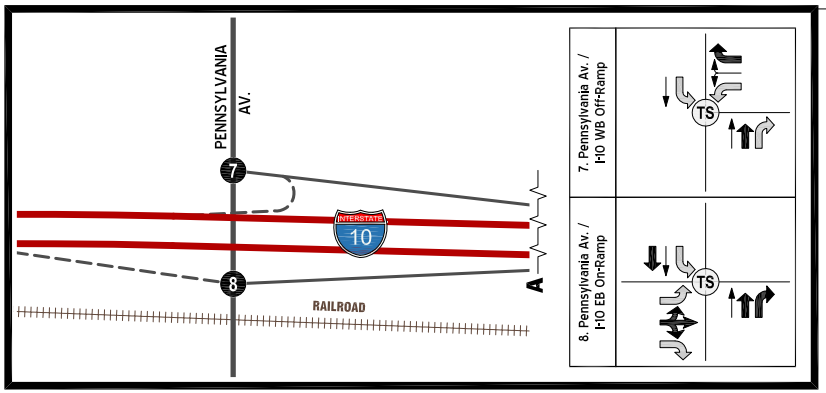
URBAN CROSSROADS

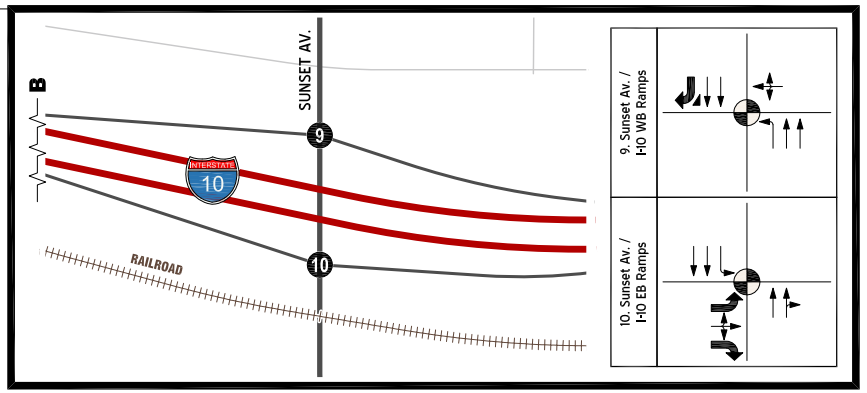
EXHIBIT 20: ADDITIONAL IMPROVEMENTS NEEDED FOR POST-2045 ALTERNATIVE 1 (EXISTING CONFIGURATION) CONDITIONS



PENNSYLVANIA AV./I-10 INTERCHANGE AREA



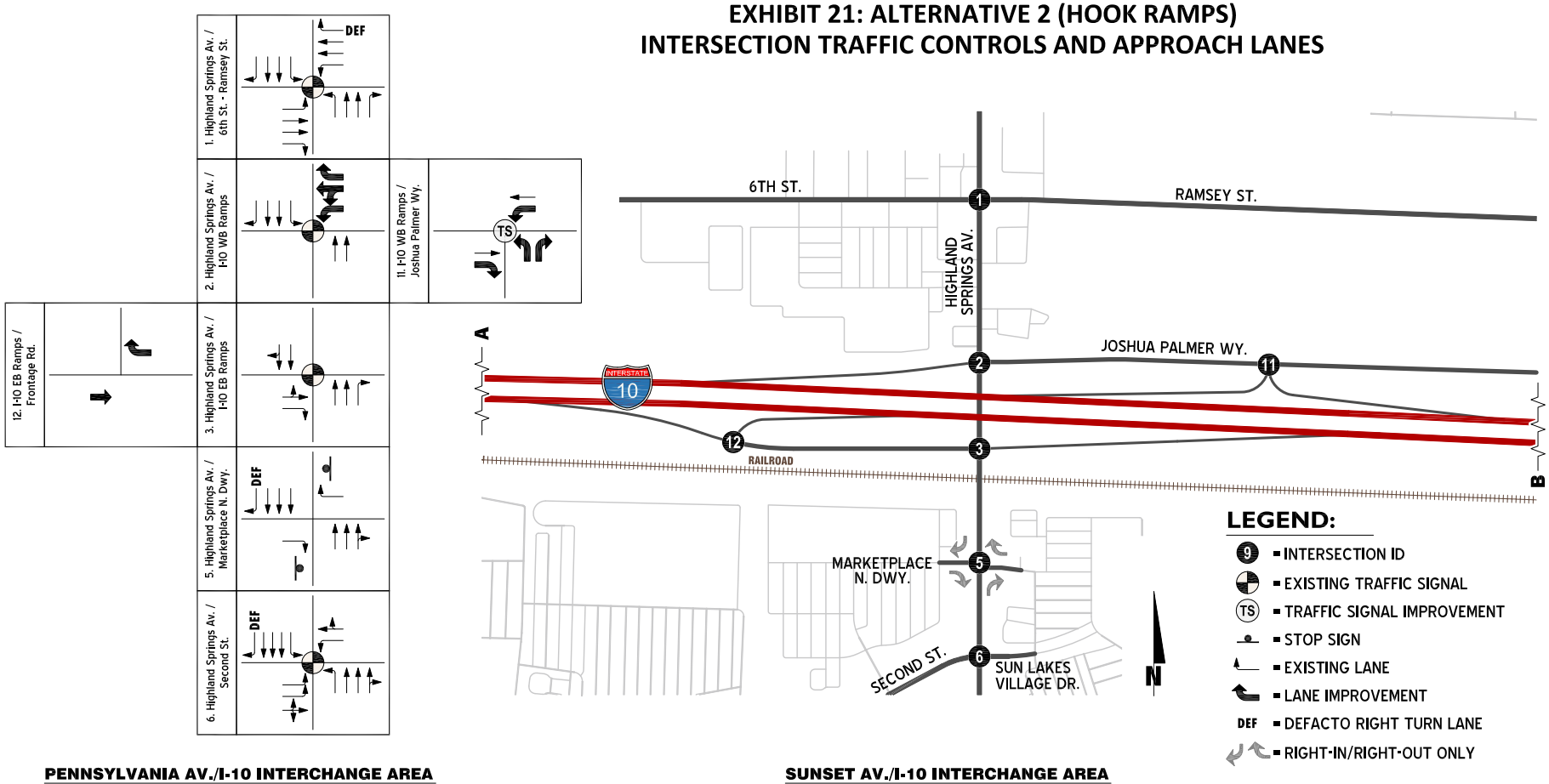
SUNSET AV./I-10 INTERCHANGE AREA



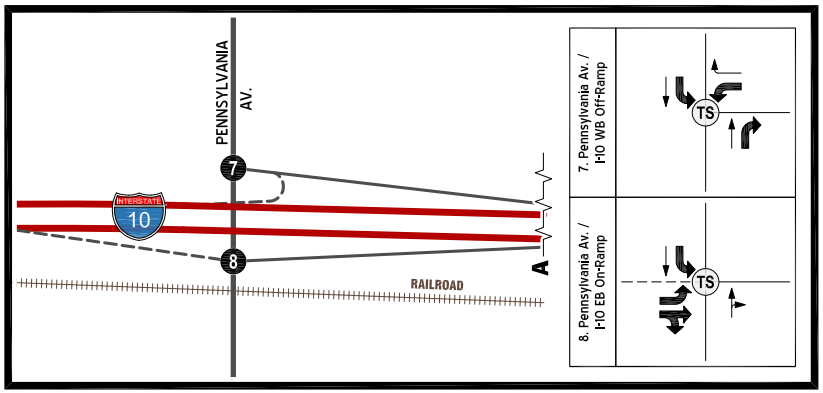
12522 - 01 - study area.dwg

URBAN CROSSROADS

EXHIBIT 21: ALTERNATIVE 2 (HOOK RAMPS)
INTERSECTION TRAFFIC CONTROLS AND APPROACH LANES



PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA

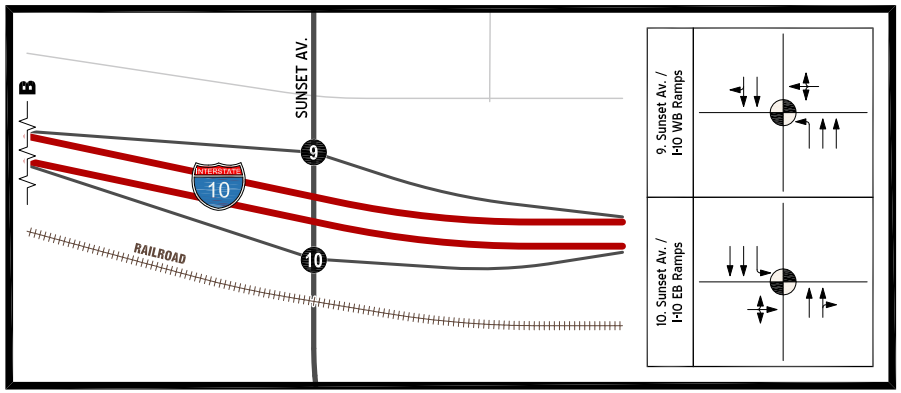
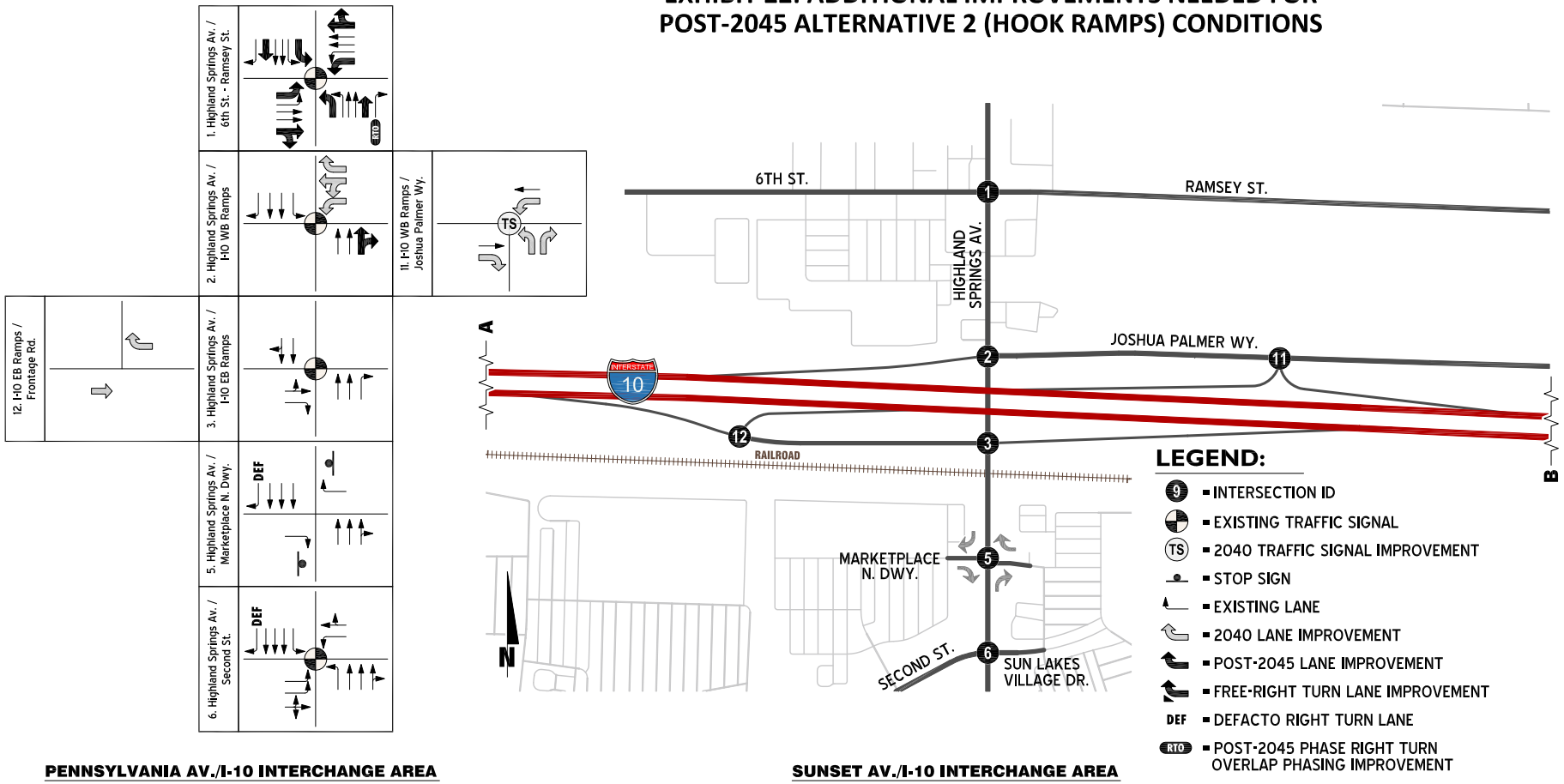
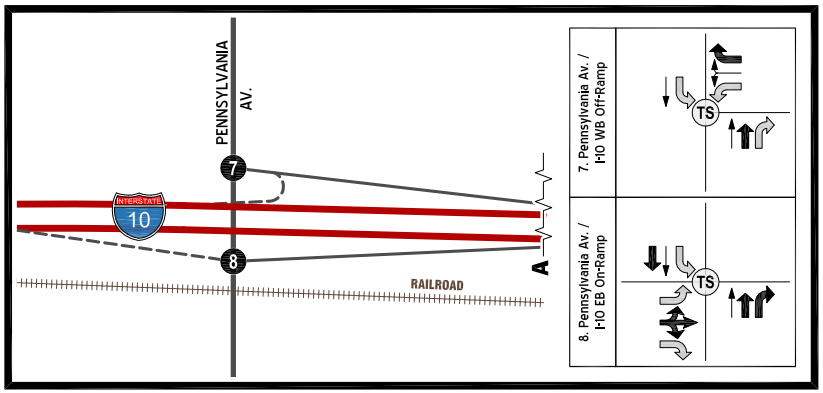


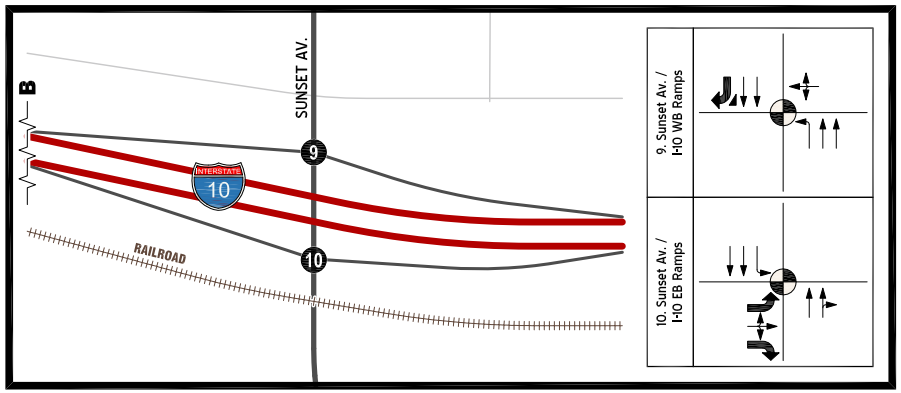
EXHIBIT 22: ADDITIONAL IMPROVEMENTS NEEDED FOR POST-2045 ALTERNATIVE 2 (HOOK RAMPS) CONDITIONS



PENNSYLVANIA AV./I-10 INTERCHANGE AREA



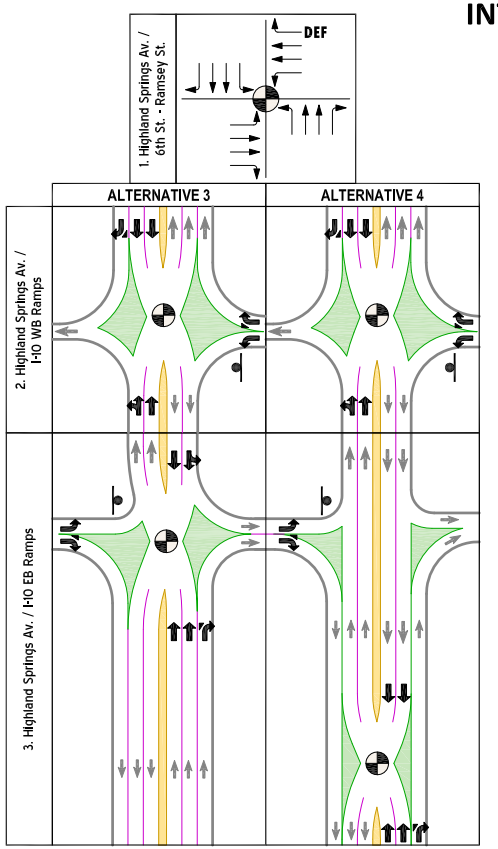
SUNSET AV./I-10 INTERCHANGE AREA

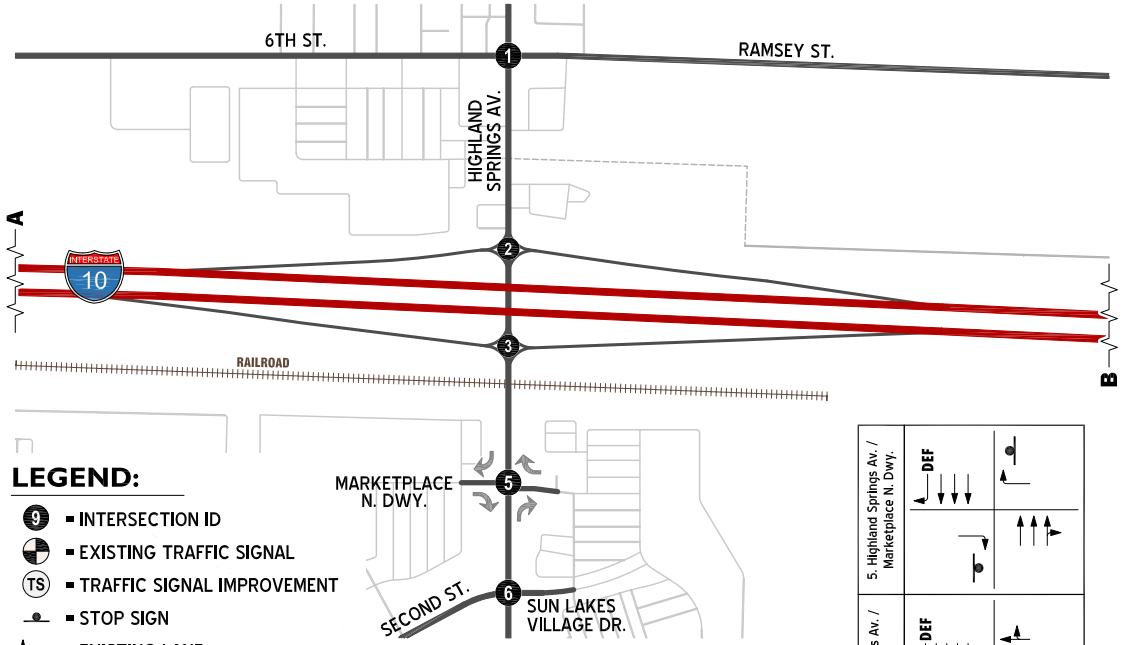


12522 - 01 - study area.dwg

URBAN CROSSROADS

EXHIBIT 23: ALTERNATIVES 3 & 4 (DIVERGING DIAMOND INTERCHANGE)
INTERSECTION TRAFFIC CONTROLS AND APPROACH LANES

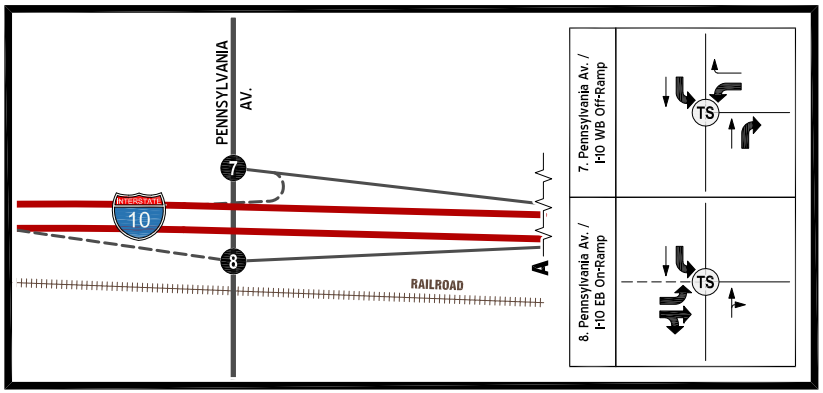




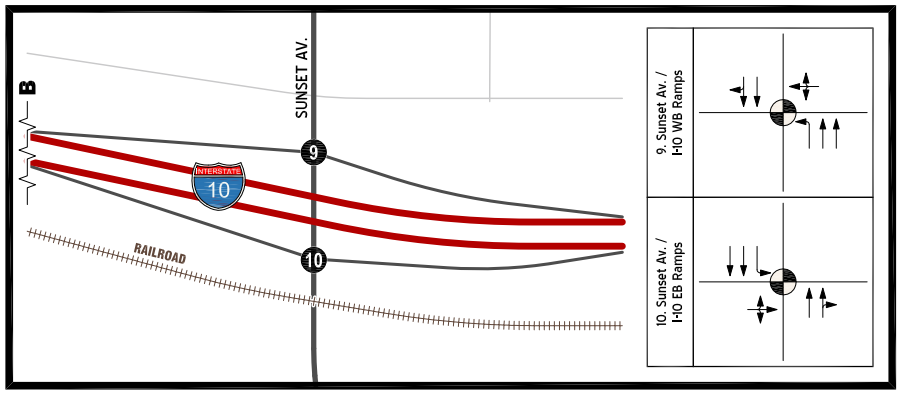
LEGEND:

- 9 = INTERSECTION ID
- = EXISTING TRAFFIC SIGNAL
- TS = TRAFFIC SIGNAL IMPROVEMENT
- = STOP SIGN
- = EXISTING LANE
- = LANE IMPROVEMENT
- = FREE-RIGHT TURN LANE IMPROVEMENT
- DEF = DEFACTO RIGHT TURN LANE
- = RIGHT-IN/RIGHT-OUT ONLY

PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA



12522 - 01 - study area.dwg

Exhibit 24 shows the potential additional intersection improvements needed for Post-2045 conditions for Alternatives 3 and 4 (DDI).

The primary difference between a DDI and a conventional diamond interchange is the design of directional crossovers on either side of the interchange. This eliminates the need for left turning vehicles to cross the paths of approaching through vehicles.

By shifting cross street traffic to the left side of the street between the signalized crossover intersect ions, vehicles on the crossroad making a left turn on to or off of ramps do not conflict with vehicles approaching from other directions.

The DDI design has been shown to reduce the severity of conflicts, as conflicts between left-turning movements and the opposing through movement are eliminated. The remaining conflicts are reduced to merge conflicts for turning movements, and the reduced speed crossover conflict of the two through movements.

The difference between Alternative 3 and Alternative 4 involves the location of the southerly crossover intersection (intersection #3). In Alternative 3, this crossover intersection occurs north of the railroad. The crossover intersection occurs south of the railroad in Alternative 4.

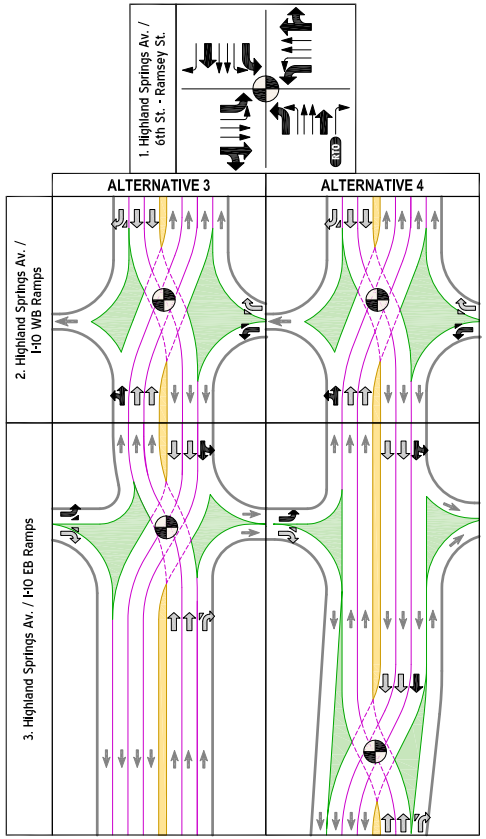
NEXT STEPS

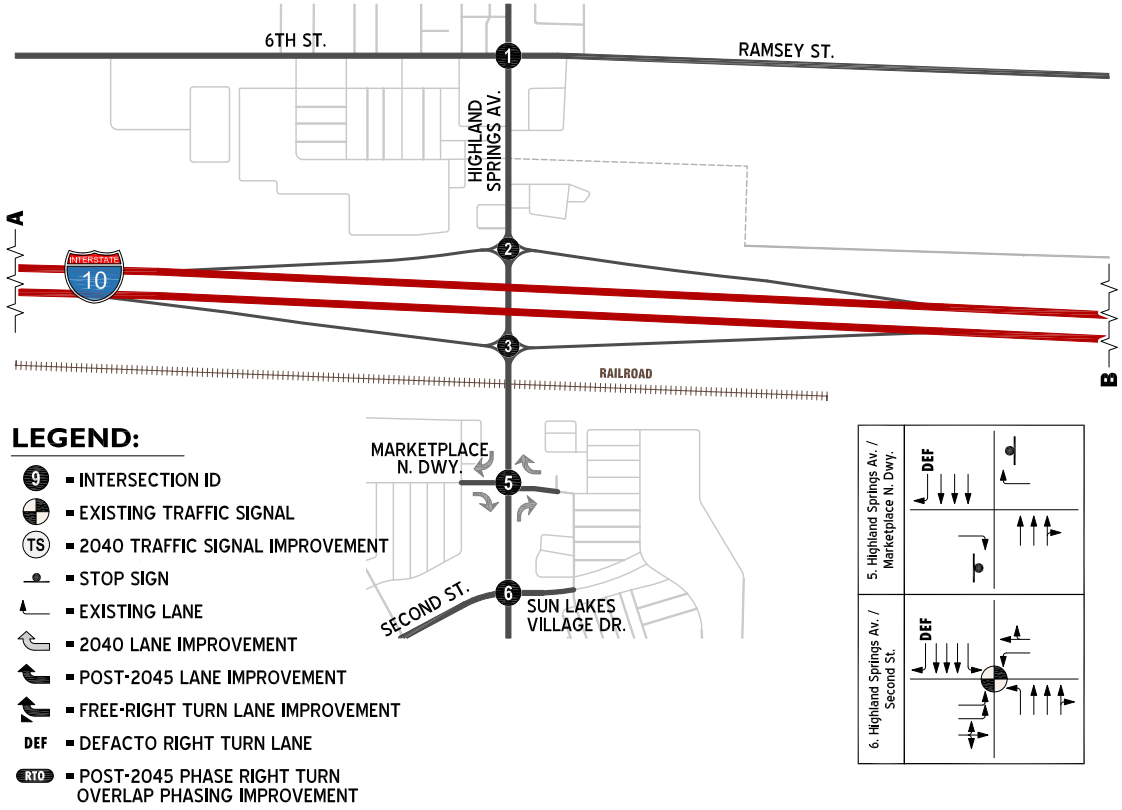
This draft TFOA presents the methodology and initial findings of the operational analysis, for review by RCTC, Caltrans and adjacent Cities. Electronic data will be provided as needed. Urban Crossroads, Inc will respond to comments and revise the analysis, as necessary.

It is anticipated that this technical information will eventually be folded into the Traffic Engineering Performance Assessment (TEPA) to be prepared for the project. The intent of the TEPA is to identify existing and future operational deficiencies and recommend alternatives to improve overall traffic conditions, including pedestrian and bicycle accommodations.

At this time, the improvements under consideration are designed to reduce vehicle delays and queuing in the interchange area, as opposed to the inducement of new travel activities. As such, the project alternatives are not anticipated to increase the amount of existing or future vehicle miles travelled (VMT) in the study area.

EXHIBIT 24: ADDITIONAL IMPROVEMENTS NEEDED FOR POST-2045 ALTERNATIVES 3 & 4 (DIVERGING DIAMOND INTERCHANGE) CONDITIONS



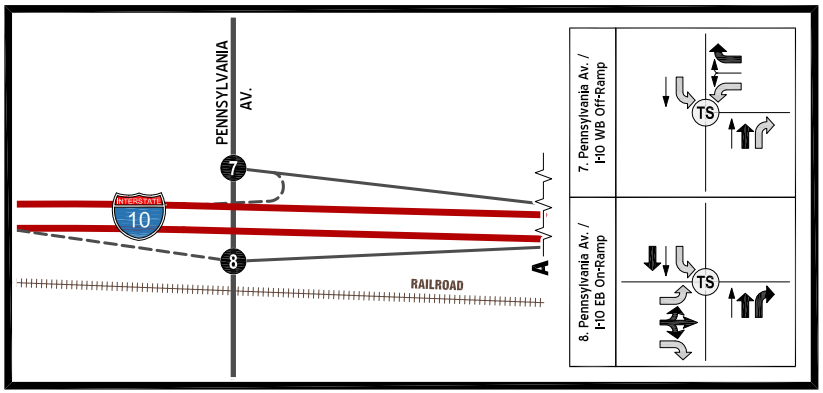


LEGEND:

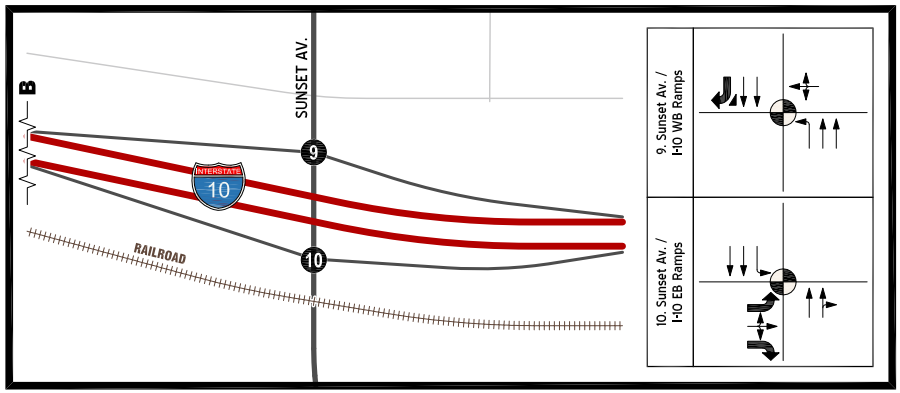
- 9 = INTERSECTION ID
- = EXISTING TRAFFIC SIGNAL
- TS = 2040 TRAFFIC SIGNAL IMPROVEMENT
- = STOP SIGN
- = EXISTING LANE
- = 2040 LANE IMPROVEMENT
- = POST-2045 LANE IMPROVEMENT
- = FREE-RIGHT TURN LANE IMPROVEMENT
- DEF = DEFACTO RIGHT TURN LANE
- RTO = POST-2045 PHASE RIGHT TURN OVERLAP PHASING IMPROVEMENT

N

PENNSYLVANIA AV./I-10 INTERCHANGE AREA



SUNSET AV./I-10 INTERCHANGE AREA



12522 - 01 - study area.dwg