TRAFFIC/TRANSPORTATION TECHNICAL STUDY

FOR THE

BRUCE ROAD WIDENING PROJECT

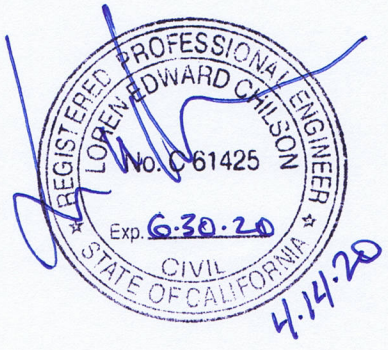
April 14, 2020

PREPARED FOR:

City of Chico

PREPARED BY:

HEADWAY TRANSPORTATION



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EXECUTIVE SUMMARY

Proposed Project

The proposed project consists of the widening of Bruce Road from two lanes to four lanes from Skyway to State Route (SR) 32 to serve anticipated regional travel demands. The signalized intersections on Bruce Road will also be modified to include additional turn lanes and traffic signal modifications associated with the additional travel lanes. Bicycle and pedestrian facilities will be added to improve multi-modal connectivity throughout the corridor.

The widening of Bruce Road has been planned and anticipated for many years based on needs identified during long-term regional planning efforts. Policies identified in the City of Chico *2030 General Plan* and the Butte County Association of Governments (BCAG) *Regional Transportation Plan & Sustainable Communities Strategy (RTP/SCS)* encourage enhancements for safe and efficient travel and optimum productivity. The Bruce Road Widening (Skyway to SR32) project is listed in the adopted *2016 RTP/SCS* as a Funded Project (Table 6-6) and is understood to be a Funded Project in the *2020 RTP/SCS* update. The need for the widening was identified through regional travel demand modelling and traffic analysis as part of the *RTP/SCS* development and the project need is again confirmed in this Technical Study.

Analysis Scenarios

Two analysis scenarios are included in this evaluation of Bruce Road – "No Build" and "Build."

Under the "No Build" scenario, Bruce Road and the associated study intersections were analyzed based on existing lane configurations and traffic controls. Bruce Road is currently a two-lane roadway (one through travel lane in each direction) with some short sections that have additional lanes.

Under the "Build" scenario, Bruce Road would be widened to four lanes (two lanes in each direction) for the entire length between Skyway and SR 32. The signalized intersections will also be modified to include additional turn lanes as recommended in the *Bruce Road Widening Traffic Analysis Memo* (Headway Transportation, 2018) and confirmed as needed in subsequent traffic studies evaluating the Bruce Road corridor. Bicycle and pedestrian facilities, including bicycle lanes, sidewalks, and crosswalks will also be installed to improve multi-modal connectivity.

Each analysis scenario was analyzed during the following three time periods:

- Existing (2020) Conditions
- Opening Day (2024) Conditions
- 2040 Conditions

Existing Conditions

The study intersections currently operate at acceptable levels of service under Existing No Build Conditions and they would operate acceptably with the widening project (under Existing Build Conditions).

Opening Day Conditions

The study intersections are expected to operate at acceptable levels of service under the "No Build" and "Build" scenarios at Opening Day Conditions (2024). The delay at the study intersections is expected to decrease with the project consistent with the project purpose and goals.

2040 Conditions

Under 2040 No Build Conditions, the study intersections are expected to degrade to unacceptable LOS F during the AM and PM peak hours. With the widening project, the study intersections are shown to operate at acceptable levels of service under 2040 Build Conditions during the AM and PM peak hours. This long-term operational benefit is the core purpose if the widening project.

VMT

Vehicle Miles Travelled (VMT) was estimated specifically for the Bruce Road corridor area to describe how VMT would vary under the various scenarios and future year study periods.

The estimated daily VMT for Existing No Build Conditions is 21,801 per day. The estimated daily VMT for Existing Build Conditions is 22,663 per day, which includes 862 project induced VMT per day. VMT can be expected to increase slightly with the project in the near-term.

The estimated daily VMT for Opening Day No Build Conditions is 28,660 per day. The estimated daily VMT for Opening Day Build Conditions is 29,522 per day, which includes 862 project induced VMT per day. VMT can be expected to increase slightly with the project in the Opening Day timeframe.

Under 2040 No Build Conditions, the 2040 daily traffic volumes on Bruce Road are expected to exceed the capacity of a two-lane arterial roadway. Traffic volumes in excess of the two-lane capacity would then divert to alternate routes with longer trip lengths in search of less delay and congestion. Most of the diverted traffic can be assumed to utilize Forest Avenue and Notre Dame Boulevard which are adjacent parallel routes. The estimated daily VMT for 2040 No Build Conditions is approximately 71,961 per day. The estimated daily VMT for 2040 Build Conditions is 57,027 per day, which includes 862 project induced VMT per day.

VMT can be expected to ultimately decrease as a result of the widening project. Without the widening, some drivers would increase their trip length to avoid congestion on Bruce Road and thereby increase the total amount of travel in the study area. The increased travel distance of trips would more than offset the

anticipated induced travel demand affects, therefore the project is expected to reduce VMT compared to the “No Build” scenario.

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INTRODUCTION

This report presents the findings of a Traffic/Transportation Technical Study completed to assess the potential traffic impacts of the Bruce Road Widening project in Chico, CA. This technical study has been prepared to document existing traffic conditions, quantify traffic volumes under three analysis scenarios, identify potential impacts, document findings, and make recommendations to mitigate impacts, if any are found. The location of the project is shown on **Figure 1**.

The widening of Bruce Road has been planned and anticipated for many years based on needs identified during long-term regional planning efforts. The following policy documents define the purpose and need for widening improvements on Bruce Road:

2030 General Plan (City of Chico)

- Policy CIRC-1.1 (Transportation Improvements) – Safely and efficiently accommodate traffic generated by development and redevelopment associated with build-out of the General Plan Land Use Diagram.
- Action CIRC-1.1 (Roadway Network) – Enhance existing roadways and intersection and develop the roadway system shown in Figure CIRC-1 over the life of the General Plan as needed to accommodate development.
- Policy CIRC-1.4 (Level of Service Standards) – Maintain LOS D or better for roadways and intersections at the peak PM period (noting some exceptions which permit LOS E).

2016 and 2020 Regional Transportation Plan & Sustainable Communities Strategy (BCAG)

The *Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS)* specifies the policies, projects, and programs necessary over a 20+ year period to maintain, manage, and improve the region's transportation system. The Butte County Association of Governments (BCAG) is in the process of updating the adopted 2016 RTP/SCS to create the 2020 RTP/SCS. Programmatic level Environmental Impact Reports are prepared with each RTP/SCS update. The 2020 Draft Policy Element includes for following goals and objectives:

- 1. Policy on Highways, Streets, and Roads
  - Goal: A safe and efficient regional road system that accommodates the demand for movement of people and goods.
  - Objective 1.2: Identify and prioritize improvements to the regional roadway system.
- 13. Policy on Quality of Travel and Livability
  - Mobility Goal: The transportation system should provide for convenient travel options for people and goods and maximize its productivity. The system should reduce both the time it takes to travel as well as the total costs of travel.

- Objective 13.1: Assist in efforts which enhance mobility for the region. The system should provide for convenient travel options for people and goods and maximize its productivity. The system should reduce both the time it takes to travel as well as the total costs of travel.

The Bruce Road Widening (Skyway to SR32) project is listed in the adopted *2016 RTP/SCS* as a Funded Project (Table 6-6) and is understood to be a Funded Project in the *2020 RTP/SCS* update. The need for the widening was identified through regional travel demand modelling and traffic analysis as part of the *RTP/SCS* development and the project need is again confirmed in this Technical Study.

Study Area and Evaluated Scenarios

The limits of the project are Bruce Road from State Route (SR) 32 to Skyway (shown on **Figure 1**). The study intersections were selected to evaluate those that would be most modified, widened, and serve the highest traffic volumes. The signalized locations are the most significant and critical locations in the corridor for assessing overall traffic operations. The following intersections are included in this study:

- Bruce Road/SR 32
- Bruce Road/Humboldt Road
- Bruce Road/Picholine Way
- Bruce Road/E. 20th Street
- Bruce Road/Skyway

This study includes analysis of both the weekday AM and PM peak hours as these are the periods of time in which peak traffic occurs. The evaluated scenarios are:

- Existing (2020) No Build Conditions
- Existing Build Conditions
- Opening Day (2024) No Build Conditions
- Opening Day Build Conditions
- 2040 No Build Conditions
- 2040 Build Conditions

ANALYSIS SCENARIOS

No-Build

Under the "No Build" scenarios, Bruce Road and the associated study intersections were analyzed based on existing lane configurations and traffic controls (current 2020 conditions). Bruce Road is primarily a two-lane roadway (one through lane in each direction) with some short sections with additional lanes (see the Existing Conditions section for more detail). **Figure 2** shows the existing lane configurations at the study intersections.

Build

Under the "Build" scenario, Bruce Road would be widened to four lanes (two through lanes in each directions) for the entire length between Skyway and SR 32. The signalized intersections will also be modified to include additional turn lanes as recommended in the *Bruce Road Widening Traffic Analysis Memo* (Headway Transportation, 2018) and confirmed as needed in subsequent traffic studies evaluating the Bruce Road corridor. Bicycle and pedestrian facilities, including bicycle lanes, sidewalks, and crosswalks would also be installed to improve multi-modal connectivity throughout the corridor and encourage travel by alternate modes. **Figure 3** shows the proposed lane configurations at the study intersections.

ANALYSIS METHODOLOGY

Level of service (LOS) is a term commonly used by transportation practitioners to measure and describe the operational characteristics of intersections, roadway segments, and other facilities. This term equates seconds of delay per vehicle at intersections to letter grades "A" through "F" with "A" representing optimum conditions and "F" representing breakdown or over capacity flows.

Intersections

The complete methodology for intersection level of service analysis is established in the *Highway Capacity Manual (HCM) 2010*, published by the Transportation Research Board (TRB). **Table 1** presents the delay thresholds for each level of service grade at signalized and unsignalized intersections.

Table 1: Level of Service Definition for Intersections

Level of Service	Brief Description	Average Delay (seconds per vehicle)	
		Signalized Intersections	Unsignalized Intersections
A	Free flow conditions.	< 10	< 10
B	Stable conditions with some affect from other vehicles.	10 to 20	10 to 15
C	Stable conditions with significant affect from other vehicles.	20 to 35	15 to 25
D	High density traffic conditions still with stable flow.	35 to 55	25 to 35
E	At or near capacity flows.	55 to 80	35 to 50
F	Over capacity conditions.	> 80	> 50

Source: Highway Capacity Manual (2010), Chapters 18 through 21

Level of service calculations were performed for the study intersections using the Synchro 9 software package with analysis and results reported in accordance with *HCM 2010* methodology.

Roadway Segments

Roadway segment level of service thresholds are provided in the City of Chico *General Plan Update Draft Environmental Impact Report (EIR)*, September 2010. Thresholds were established for PM peak hour roadway segment volumes and are shown in **Table 2**.

Table 2: PM Peak Hour Roadway Segment LOS Thresholds

Facility Type	Level of Service (Two-Way Traffic Volumes)					
	A	B	C	D	E	F
Minor 2-Lane Highway	90	200	680	1,410	1,740	> 1,740
Major 2-Lane Highway	120	290	790	1,600	2,050	> 2,050
4-Lane, Multilane Highway[1]	1,070	1,760	2,530	3,280	3,650	> 3,650
Major 2-Lane Collector	-	-	550	1,180	1,520	> 1,520
2-Lane Arterial	-	-	970	1,760	1,870	> 1,870
4-Lane Arterial, Undivided	-	-	1,750	2,740	2,890	> 2,890
4-Lane Arterial, Divided	-	-	1,920	3,540	3,740	> 3,740

Notes: 1. LOS capacity threshold is for one direction.
Source: *General Plan Update Draft EIR*, City of Chico, September 2010

The City of Chico does not have established roadway segment thresholds based on daily traffic volumes. Existing traffic volume data on Bruce Road shows a PM peak hour K-factor of approximately 10 percent. Therefore, to determine the Daily Roadway Segment LOS Thresholds, the PM peak hour thresholds were multiplied by 10 as an approximation. **Table 3** shows the derived Daily Roadway Segment LOS Thresholds.

Table 3: Daily Roadway Segment LOS Thresholds

Facility Type	Level of Service (Two-Way Traffic Volumes)					
	A	B	C	D	E	F
Minor 2-Lane Highway	900	2,000	6,800	14,100	17,400	> 17,400
Major 2-Lane Highway	1,200	2,900	7,900	16,000	20,500	> 20,500
4-Lane, Multilane Highway[1]	10,700	17,600	25,300	32,800	36,500	> 36,500
Major 2-Lane Collector	-	-	5,500	11,800	15,200	> 15,200
2-Lane Arterial	-	-	9,700	17,600	18,700	> 18,700
4-Lane Arterial, Undivided	-	-	17,500	27,400	28,900	> 28,900
4-Lane Arterial, Divided	-	-	19,200	35,400	37,400	> 37,400

Notes: This table is provided only to approximate daily roadway segment volume capacity, not for the purposes of conducting level of service analysis.
1. LOS capacity threshold is for one direction.
Sources: Headway Transportation, 2020

Level of Service Policy

The City of Chico *2030 General Plan* Circulation Element establishes the following level of service standards for roadways and intersections:

> Policy CIRC-1.4 (Level of Service Standards) – Maintain LOS D or better for roadways and intersections at the peak PM period, except as specified below:
>
> - LOS E is acceptable for City streets and intersections under the following circumstances:
> - Downtown streets within the boundaries identified in Figure DT-1 of the Downtown Element.
> - Arterials served by scheduled transit.
> - Arterials not served by scheduled transit, if bicycle and pedestrian facilities are provided within or adjacent to the roadway.
> - Utilize Caltrans LOS standards for Caltrans' facilities.
> - There are no LOS standards for private roads.

Noting that bicycle and pedestrian facilities are planned to be constructed on Bruce Road with the widening project, LOS E was used as the threshold for this analysis. The policy is understood to be LOS E for the overall intersection (weighted average of delay for all movements) in accordance with *HCM 2010* methodology.

EXISTING CONDITIONS

Bruce Road is generally a north-south arterial roadway that connects Skyway to E. 8th Street/California Park Drive. North of E. 8th Street/California Drive, Bruce Road becomes Chico Canyon Road. This widening project is specifically on the segment of Bruce Road from Skyway to SR 32.

Bruce Road is primarily a two-lane roadway (one through lane in each direction) with some sections that have additional lanes, including:

- Skyway to Raley Boulevard – two southbound lanes
- Skyway to approximately 300 feet north of Skyway – two northbound lanes
- E. 20th Street to Picholine Way – two northbound lanes
- Remington Drive to Picholine Way – two southbound lanes

The speed limit on Bruce Road within the project limits is 45 miles per hour (mph).

Bicycle & Pedestrian Facilities

Existing bicycle and pedestrian facilities on Bruce Road are limited. There is a northbound bicycle lane from E. 20th Street to Picholine Way and a southbound buffered bicycle lane from Remington Drive to

Picholine Way. There are also sidewalks in the same general locations, as well as between Skyway and Raley Boulevard and on all four corners of the Bruce Road/Humboldt Road intersection.

Transit Facilities

B-Line (Butte Regional Transit) provides fixed-route transit service in Butte County. There is one route that operates on Bruce Road, Route 7 (Bruce/Manzanita), with service between E. 20th Street and Remington Drive. Service is provided Monday through Friday from 6:45 AM to 5:30 PM.

Exhibit 1: B-Line Transit Route 7

Traffic Volumes

Existing AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) peak hour traffic volume data was collected at the study intersections on May 7, 8, and 9, 2019. Daily roadway segment counts, including vehicle classification, were collected from November 7-13, 2019 and January 27-30, 2020. All traffic volume data was collected after the Camp Fire in Paradise, CA. **Figure 4** shows the existing peak hour intersection turning movement volumes.

Intersection Level of Service Analysis

Existing AM and PM peak hour intersection level of service analysis was performed for the study intersections on Bruce Road. Two analysis scenarios were analyzed:

- No Build – including existing lane configurations and controls (shown on **Figure 2**)
- Build – including four lanes on Bruce Road from Skyway to SR 32 and the intersection lane configurations shown on **Figure 3**

The existing traffic volumes, heavy vehicle percentages, and peak hour factors (PHFs) from the counts were used in the analysis. **Table 4** shows the level of service results and the technical calculations are provided in **Appendix A**.

Table 4: Existing Intersection Level of Service

Intersection	Control	No Build				Build			
		AM		PM		AM		PM	
		Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS
Bruce Road/SR 32	Signal								
Overall		35.8	D	27.5	C	20.6	C	18.7	B
Bruce Rd/Humboldt Rd	Signal								
Overall		11.5	B	10.6	B	10.2	B	7.8	A
Bruce Rd/Picholine Way	Signal								
Overall		6.5	A	8.1	A	6.2	A	7.3	A
Bruce Rd/E. 20th St	Signal								
Overall		18.1	B	21.3	C	15.0	B	16.0	B
Bruce Rd/Skyway	Signal								
Overall		20.8	C	23.8	C	20.8	C	23.0	C

Notes: 1. Delay is reported in seconds per vehicle for the overall intersection for signalized intersections.
Source: Headway Transportation, 2020

As shown in the table, the study intersections currently operate at acceptable levels of service and would continue to do so with the widening project. The intersection delay is expected to decrease (operations will improve) with the project.

OPENING DAY CONDITIONS

Opening Day Conditions are anticipated to occur in the year 2024 and represent how Bruce Road intersections will operate just after the widening project is complete.

Traffic Volumes

Opening Day traffic volumes were developed using linear interpolation between the Existing and 2040 traffic volumes. **Figure 5** shows the peak hour intersection volumes.

Intersection Level of Service Analysis

AM and PM peak hour intersection level of service analysis was performed for the study intersections on Bruce Road for the "No Build" and "Build" scenarios. **Table 5** shows the level of service results and the technical calculations are provided in **Appendix B**.

Table 5: Opening Day Intersection Level of Service

Intersection	Control	No Build				Build			
		AM		PM		AM		PM	
		Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS
Bruce Rd/SR 32	Signal								
Overall		59.2	E	35.3	D	21.7	C	19.5	B
Bruce Rd/Humboldt Rd	Signal								
Overall		15.6	B	14.8	B	12.1	B	10.9	B
Bruce Rd/Picholine Way	Signal								
Overall		10.4	B	14.1	B	9.8	A	10.0	B
Bruce Rd/E. 20th St	Signal								
Overall		30.0	C	34.4	C	17.5	B	18.3	B
Bruce Rd/Skyway	Signal								
Overall		25.5	C	28.2	C	24.5	C	26.6	C

Notes: 1. Delay is reported in seconds per vehicle for the overall intersection for signalized intersections.
Source: Headway Transportation, 2020

As shown in the table, the study intersections are expected to operate at acceptable levels of service under the "No Build" and "Build" scenarios. The delay at the study intersections is expected to decrease (traffic operations will improve) with the widening project.

2040 CONDITIONS

Traffic Volumes

Future year (2040) traffic volume forecasts were developed using information from the BCAG countywide travel demand model and the *Stonegate Vesting Tentative Subdivision Map and General Plan Amendment/Rezone Draft Environmental Impact Report* (WRA Environmental Consultants, April 2018), which presents traffic forecasting and analysis specific to the Bruce Road study intersections. The traffic volumes developed in the Stonegate EIR were forecasted for the year 2035 using the 2010 BCAG travel demand model. In order to analyze the year 2040 in this technical study, the 2035 volumes were adjusted up by 1 percent per year for five years. Since the planned/approved development projects in the study area were included in the travel demand model, a 1 percent per year growth rate reasonably accounts for regional background growth. The following planned/approved development projects were included in the travel demand model:

- Stonegate – mixed use development located on the east and west sides of Bruce Road between E. 20th Street and Skyway
- Meriam Park – mixed use development located on the northwest quadrant of the Bruce Road/E. 20th Street intersection and extending north along Bruce Road
- Belvedere Heights – residential development located north of E. 20th Street and west of Bruce Road

- Special Planning Area 5 – residential and commercial development located east of Potter Road between E. 20th Street and Skyway
- Canyon View High School – located on the northwest quadrant of the Bruce Road/Raley Boulevard intersection
- Valley's Edge Specific Plan – mixed use development located east of the Steve Harrison Bike Path, north of Skyway, and south of E. 20th Street
- Oak Valley and other small projects

The Stonegate EIR traffic study did not include traffic volumes for the Bruce Road/Humboldt Drive or Bruce Road/Picholine Way intersections, however these intersections were analyzed separately in the *Bruce Road Widening Traffic Analysis Memo*. The 2040 forecast traffic volumes at the five study intersections were balanced between intersections as necessary to account for any inconsistencies in the traffic data. **Figure 6** shows the 2040 intersection turning movement volumes at the study intersections.

Intersection Level of Service Analysis

AM and PM peak hour intersection level of service analysis was performed for the study intersections using the 2040 traffic volume forecasts (shown on **Figure 6**) and the lane configurations shown on **Figures 2** and **3**. The traffic signal cycle lengths were optimized and phasing was modified to include protected left-turns and permitted plus overlap right-turns on some approaches consistent with the Bruce Road Widening Project. **Table 6** shows the level of service results. The technical calculations are provided in **Appendix C**.

Table 6: 2040 Intersection Level of Service

Intersection	Control	No Build				Build			
		AM		PM		AM		PM	
		Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS
Bruce Rd/SR 32	Signal								
Overall		**234.6**	**F**	**209.9**	**F**	32.5	C	32.3	C
Bruce Rd/Humboldt Rd	Signal								
Overall		**119.7**	**F**	**140.9**	**F**	56.8	E	53.2	D
Bruce Rd/Picholine Way	Signal								
Overall		**107.2**	**F**	**133.8**	**F**	19.5	B	21.4	C
Bruce Rd/E. 20th St	Signal								
Overall		**268.0**	**F**	**272.8**	**F**	41.6	D	55.8	E
Bruce Rd/Skyway	Signal								
Overall		**83.0**	**F**	**145.5**	**F**	41.8	D	64.8	E

Notes: 1. Delay is reported in seconds per vehicle for the overall intersection for signalized intersections.
Source: Headway Transportation, 2020

As shown in the table, all of the study intersections are expected to operate at unacceptable LOS F during the AM and PM peak hours under 2040 No Build conditions. The study intersections are expected to operate at acceptable levels of service under 2040 Build conditions during the AM and PM peak hours. This demonstrated improvement for traffic operations is the primary purpose of the widening project.

VMT CALCULATIONS

This Vehicle Miles Travelled (VMT) analysis is based on local route analysis specific to Bruce Road and the parallel routes to which traffic would likely divert. VMT was calculated for the six analysis scenarios and includes the VMT generated by existing and forecasted traffic on the roadway, as well as the potential for induced demand VMT generated by the additional lanes on Bruce Road.

Bruce Road is classified as an Arterial roadway. Based on the LOS thresholds identified in **Table 3**, the estimated capacity of a two-lane arterial is approximately 20,570 vehicles per day (vpd) – based on the *HCM 2000* LOS E threshold of 18,700, plus 10 percent. The capacity of a four-lane arterial is approximately 31,790 vpd – based on the *HCM 2000* LOS E threshold of 28,900, plus 10 percent.

The VMT for each analysis scenario was calculated by multiplying the daily traffic volume on Bruce Road by the length of the roadway. Additionally, for the "Build" scenarios, where capacity will be added to the roadway, the induced demand (or project induced) VMT was also calculated. Project induced VMT was calculated using the National Center for Sustainable Transportation's Induced Travel Calculator, which is based on the following formula[1]:

Project Induced VMT = %Δ Lane Miles x Existing VMT x Elasticity

Where:

- Elasticity = %Δ in VMT / %Δ in Lane Miles

  The higher the elasticity, the greater the increase in VMT from a given increase in roadway capacity. An elasticity of 1.0 indicates that a given percent increase in lane miles will cause the same percent increase in VMT.

- The calculator commonly uses an elasticity of 1.0 for lane additions to Interstate highways, and an elasticity of 0.75 for lane additions to Class 2 or 3 facilities

The Induced Travel Calculator "allows users to estimate the VMT induced… as a result of expanding the capacity of roadways managed by Caltrans in one of California's urbanized counties (counties with a metropolitan statistical area (MSA)). The calculator applies only to Caltrans-managed facilities with Federal Highway Administration (FHWA) functional classifications of 1, 2, or 3. That corresponds to Interstate highways (Class 1), other freeways and expressways (Class 2), and other principal arterials (Class 3)." Butte County does have a MSA, however, Bruce Road does not have a FHWA functional classification of 1, 2, or 3.

While it is important to consider the possible effects of the project on induced demand VMT, the recommended methodology for calculating induced VMT is in the early stages of development and does

[1] https://blinktag.com/induced-travel-calculator/about.html

not directly apply to the proposed project characteristics. The majority of the studies sited and used to develop elasticity figures are based on highly congested, urban areas. The Project Induced VMT for this project was calculated using the formula above, with location specific inputs that match the character of the project setting.

"Increased highway capacity can lead to increased VMT in the short run in several ways: if people shift from other modes to driving, if drivers make longer trips (by choosing longer routes and/or more distant destinations), or if drivers make more frequent trips. Longer-term effects may also occur if households and businesses move to more distant locations or if development patterns become more dispersed in response to the capacity increase. One study concludes that the full impact of capacity expansion on VMT materializes within five years and another concludes that the full effect takes as long as 10 years." (Handy, 2015)

As noted above, there are many factors that contribute to the potential for induced demand VMT, however, they all support the theory that induced demand is more likely in a congested, urban environment where driving a vehicle is an undesirable option. The Bruce Road corridor currently does not have a connected system of transit or bicycle and pedestrian facilities, therefore people would not be shifting from other modes to driving. The VMT analysis for this project is specific to the project corridor and already accounts for drivers making longer trips. Therefore the potential for induced demand VMT for this project would be generated by drivers making more frequent trips.

The Impact of Highway Capacity and Induced Travel on Passenger Vehicle Use and Greenhouse Gas Emissions Technical Background Document (Handy/Boarnet, 2014) references six studies published between 1997 and 2011. Only one study appears to have focused on suburban settings (rather than congested urban/metropolitan settings), and the elasticities (0.10 in the short term and 0.39 in the long term) were much lower than those reported for urban settings.

The project induced VMT for this project was calculated based on an elasticity of 0.4 which is appropriate to the project setting.

Existing No Build Conditions

The existing daily traffic volumes do not exceed the capacity of a two-lane arterial roadway ("No Build" conditions). Daily VMT was calculated by multiplying the daily traffic volume on each segment by the length of the segment. The Existing No Build Conditions VMT estimate is approximately 21,801 vehicle miles per day. Detailed calculations are provided in **Appendix D**.

Existing Build Conditions

The existing traffic volumes on Bruce Road do not exceed the capacity of a four-lane arterial roadway ("Build" conditions). Existing Build Conditions VMT would be the same as the Existing No Build Conditions VMT (daily traffic volume multiplied by the length of the roadway) plus the addition of the Project Induced VMT. Using the methodology described above, the Existing Build Conditions VMT is expected to be

approximately 22,663 per day (21,801 plus 862 project induced VMT per day). Detailed calculations are provided in **Appendix D**.

Opening Day No Build Conditions

The Opening Day daily traffic volumes are not expected to exceed the capacity of a two-lane arterial roadway ("No Build" conditions). Daily VMT was calculated by multiplying the daily traffic volume on each segment by the length of the segment. The Opening Day No Build Conditions VMT estimate is approximately 28,660 vehicle miles per day. Detailed calculations are provided in **Appendix D**.

Opening Day Build Conditions

The Opening Day traffic volumes on Bruce Road are not expected to exceed the capacity of a four-lane arterial roadway ("Build" conditions). Opening Day Build Conditions VMT would be the same as the Opening Day No Build Conditions VMT (daily traffic volume multiplied by the length of the roadway) plus the addition of the Project Induced VMT. Using the methodology described above, the Opening Day Build Conditions VMT is expected to be approximately 29,522 per day (28,660 plus 862 project induced VMT per day). Detailed calculations are provided in **Appendix D**.

2040 No Build Conditions

The 2040 traffic volume forecasts are expected to exceed the capacity of a two-lane arterial roadway (the forecast volume on the highest segment is 31,040 vpd, approximately 10,470 vpd more than the two-lane capacity of Bruce Road). It was assumed that the 10,470 vpd traffic would divert to the two closest parallel routes – Forest Avenue and Notre Dame Boulevard (which is planned to connect SR 32 to Skyway by 2040). Forest Avenue is currently a four-lane arterial roadway, and Notre Dame Boulevard is a two-lane arterial roadway. Forest Avenue is likely a more desirable route with four lanes and a 35 mph speed limit, compared to Notre Dame Boulevard that has two lanes and a 25 mph speed limit. Therefore, traffic was assumed to divert to Forest Avenue first, then to Notre Dame Boulevard if necessary. Based on estimated 2040 forecasts for Forest Avenue (calculated using the existing volume plus the growth in the model between the base year and 2040), the remaining capacity available on Forest Avenue would be approximately 6,380 vpd. The remaining 4,090 vpd (10,470 vpd minus 6,380 vpd) were assumed to divert to Notre Dame Boulevard. VMT for the study corridor was calculated by multiplying each route volume by the length of the route (detailed calculations are provided in **Appendix D**).

The 2040 No Build Conditions VMT estimate is 71,961 vehicle miles per day.

2040 Build Conditions

The 2040 traffic volume forecasts are not expected to exceed the capacity of a four-lane arterial roadway ("Build" conditions). No diversion would occur in this scenario. VMT was calculated by multiplying the daily volume on each segment by the length of the segment plus the addition of the Project Induced VMT. Using the methodology described above, the 2040 Build Conditions VMT estimate is approximately 57,027

per day (56,165 plus 862 project induced VMT per day). Detailed calculations are provided in **Appendix D**. The estimated VMT for the "Build" scenario is approximately 14,938 less vehicle miles per day than the "No Build" scenario.

CONCLUSIONS

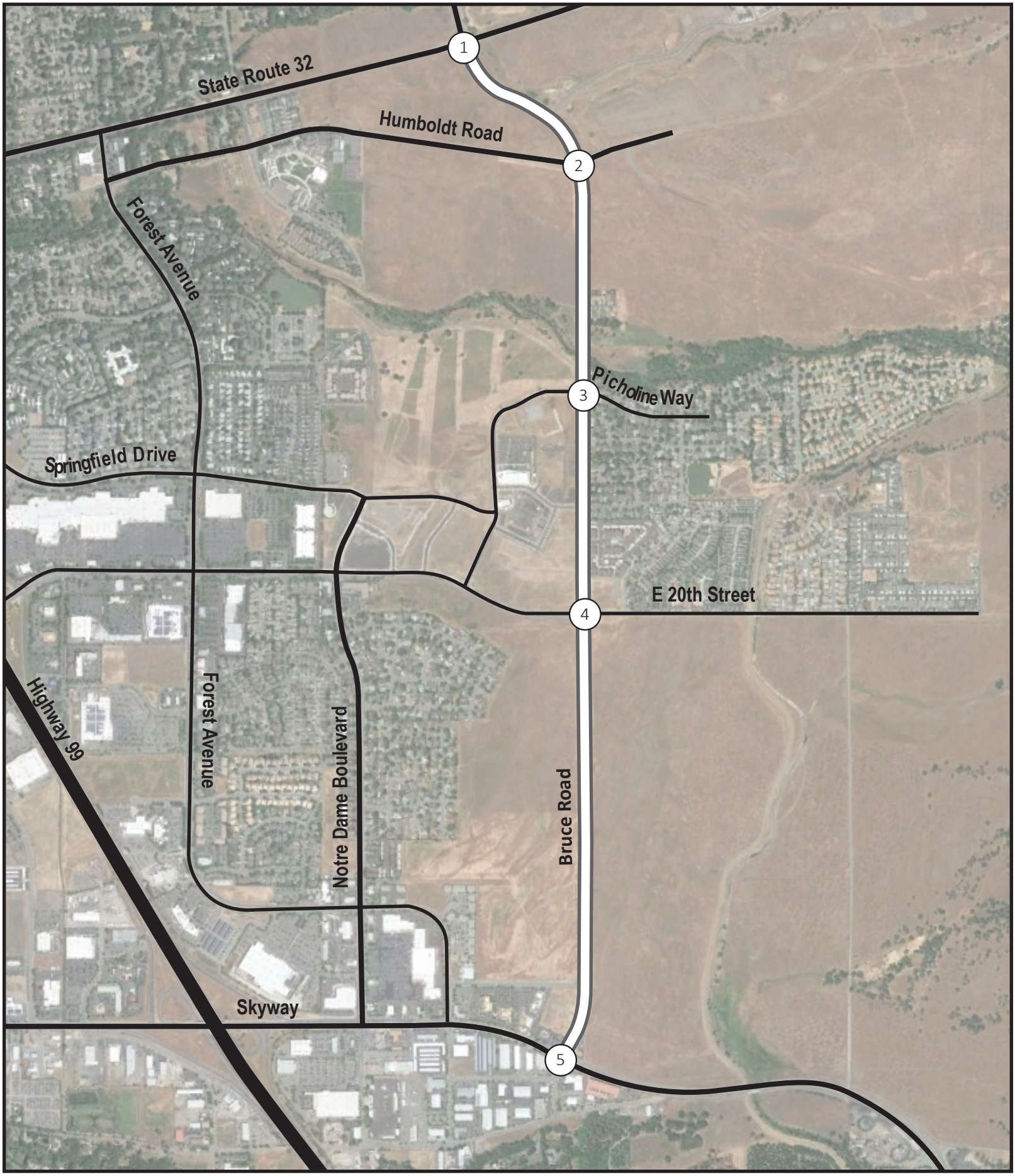
Following is a list of the key findings:

- The proposed project is the widening of Bruce Road from Skyway to SR 32 from two lanes to four lanes (two through travel lanes in each direction).
- The study intersections currently operate at acceptable levels of service under Existing No Build Conditions and would continue to do so with the widening project (under Existing Build Conditions).
- The study intersections are expected to operate at acceptable levels of service under the "No Build" and "Build" scenarios in Opening Day Conditions. The delay at the study intersections is expected to decrease (traffic operations will improve) with the project.
- The study intersections are expected to operate at LOS F during the AM and PM peak hours under 2040 No Build conditions. Widening of Bruce Road is needed to maintain traffic operations in accordance with General Plan policies.
- With the widening project, the study intersections are expected to operate at acceptable levels of service under 2040 Build conditions during the AM and PM peak hours.
- Daily vehicle miles travelled (VMT) was calculated for each project scenario based on local route analysis specific to Bruce Road and the parallel routes to which traffic would likely divert. VMT calculations include the VMT generated by the existing and forecasted traffic on Bruce Road, as well as the potential for induced demand VMT generated by the additional lanes on Bruce Road.
- The estimated daily VMT for each project scenario is:
  - Existing No Build Conditions – 21,801 per day
  - Existing Build Conditions – 22,663 per day
  - Opening Day No Build Conditions – 28,660 per day
  - Opening Day Build Conditions – 29,522 per day
  - 2040 Day No Build Conditions – 71,961 per day
  - 2040 Day Build Conditions – 57,027 per day
- The project has the potential to reduce VMT by constructing improvements on the desired travel route, thereby avoiding diversion of trips to other longer routes.

References

Handy, Susan. (2015). *Increasing Highway Capacity Unlikely to Relieve Traffic Congestion*. https://escholarship.org/uc/item/58x8436d.

Handy, Susan; Boarnet, Marlon G. (2015). *Impact of Highway Capacity and Induced Travel on Passenger Vehicle Use and Greenhouse Gas Emissions*. https://ww3.arb.ca.gov/cc/sb375/policies/hwycapacity/highway_capacity_bkgd.pdf.



HEADWAY TRANSPORTATION

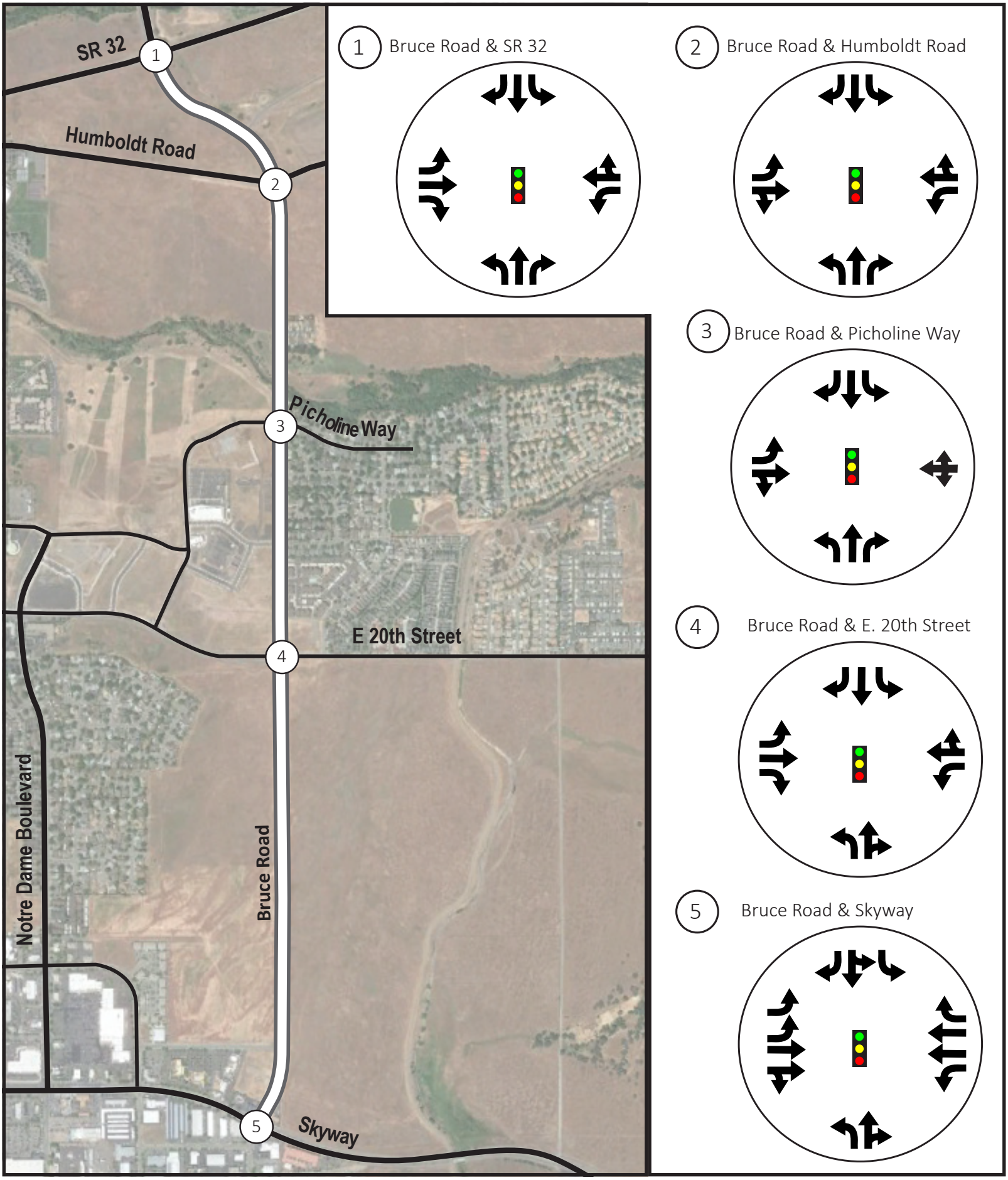
NO SCALE

- Study Roadway

X - Study Intersection

Figure 1

Bruce Road Widening Project
Traffic/Transportation Technical Study
Project Location



1 Bruce Road & SR 32

2 Bruce Road & Humboldt Road

3 Bruce Road & Picholine Way

4 Bruce Road & E. 20th Street

5 Bruce Road & Skyway

HEADWAY TRANSPORTATION

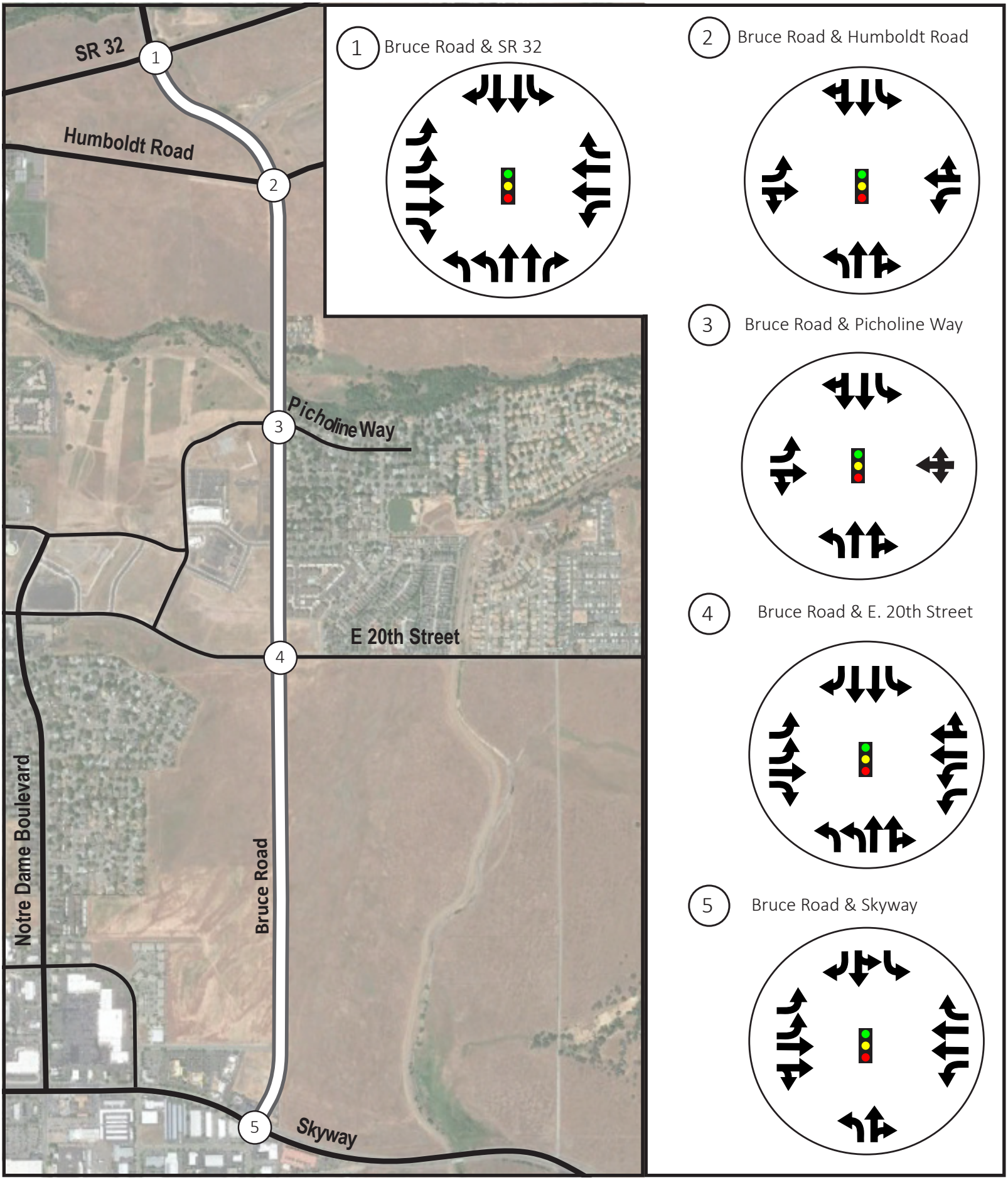
NO SCALE

- Study Roadway

X - Study Intersection

Figure 2

Bruce Road Widening Project
Traffic/Transportation Technical Study
Existing (No Build) Lane Configurations & Controls



HEADWAY TRANSPORTATION

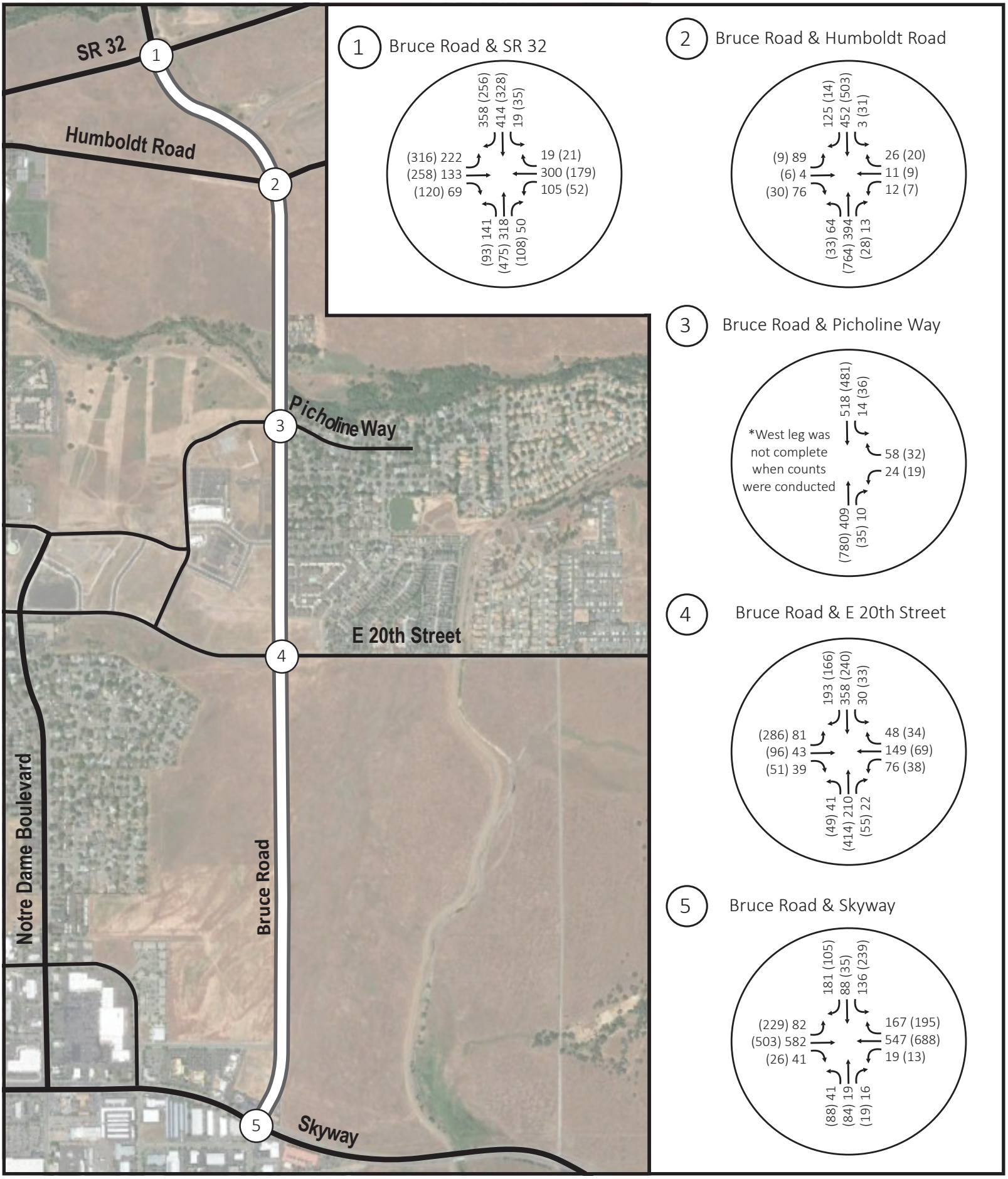
NO SCALE

- Study Roadway

X - Study Intersection

Figure 3

Bruce Road Widening Project
Traffic/Transportation Technical Study
Plus Project (Build) Lane Configurations & Controls



HEADWAY TRANSPORTATION

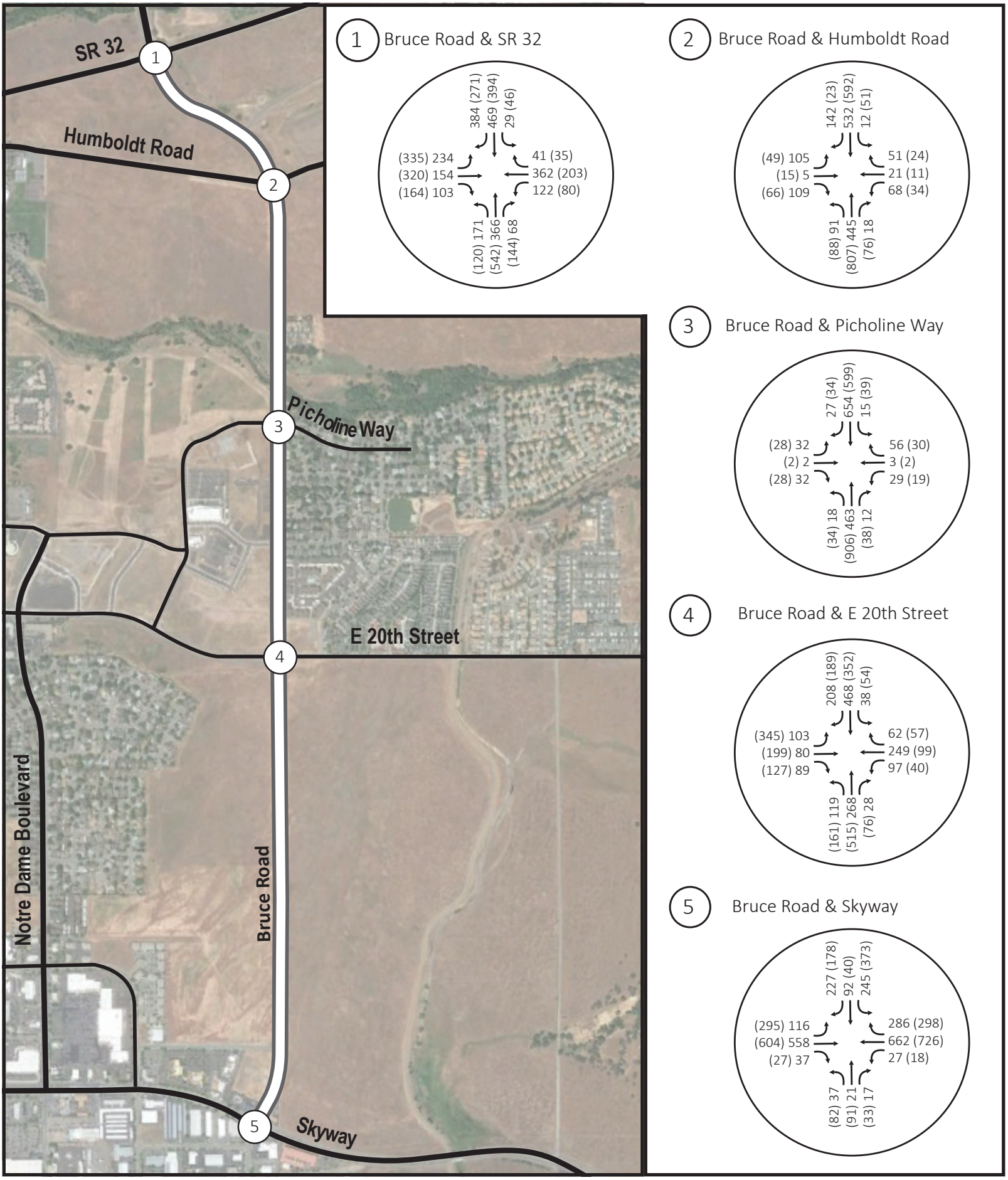
NO SCALE

- Study Roadway

X - Study Intersection

Figure 4

Bruce Road Widening Project
Traffic/Transportation Technical Study
Existing Traffic Volumes



HEADWAY TRANSPORTATION

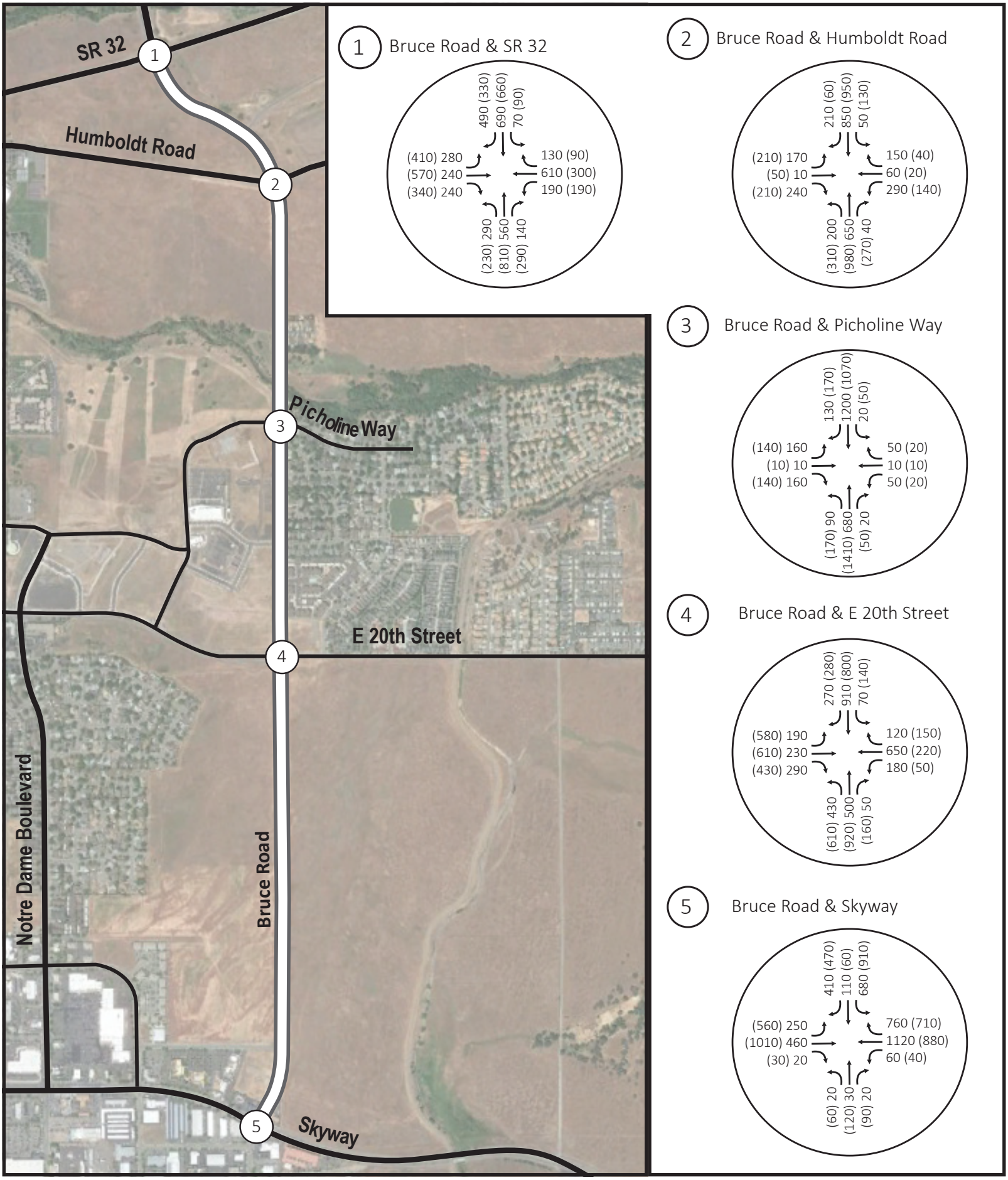
NO SCALE

- Study Roadway

X - Study Intersection

Figure 5

Bruce Road Widening Project
Traffic/Transportation Technical Study
Opening Day Traffic Volumes



HEADWAY TRANSPORTATION

NO SCALE

- Study Roadway

X - Study Intersection

Figure 6

Bruce Road Widening Project
Traffic/Transportation Technical Study
2040 Traffic Volumes