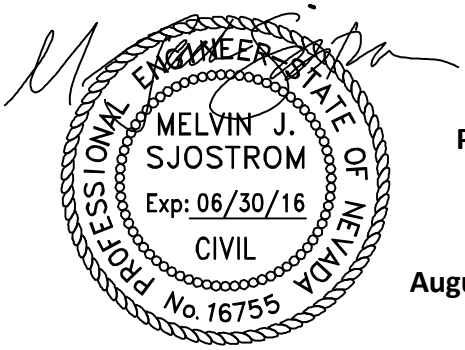
City of Las Vegas

I-515 and Charleston Boulevard Interchange

Alternatives Feasibility Study



Prepared by:

CA Group

August 31, 2015

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INTRODUCTION

CA Group was retained by the City of Las Vegas to conduct a Feasibility Study for the I-515 and Charleston Blvd. Interchange and along three quarters of a mile on Charleston Blvd. from Honolulu Street/Sandhill Road to Lamb Blvd.. The intent of this Feasibility Study is to document the alternatives evaluated, methodology and provide recommendations for improvements for the interchange and Charleston Blvd. that provide significant traffic operations, congestion mitigation and safety benefits while providing reasonable construction impacts, both environmentally and to the interstate, and meeting current available construction funding.

EXISTING CONDITIONS

The following section describes the existing condition of the interchange and Charleston Blvd corridor. The project corridor itself falls into several agency jurisdictions and ownership. The I-515 Interchange is controlled by the Federal Highway Administration (FHWA) and Nevada Department of Transportation (NDOT). Charleston Blvd. within the project limits is the political boundary between the City of Las Vegas and unincorporated Clark County, therefore, the south half of Charleston Blvd is Clark County and the north half is City of Las Vegas. While the City of Las Vegas is conducting this feasibility study, input and consensus from NDOT and Clark County will be critical.

There are several existing utility companies that utilize the corridor for distribution of their services. Chiefly and most obvious is NV Energy's overhead distribution lines, located on both the north and south sides of Charleston. These distribution poles create obstructions in the existing sidewalks causing maneuvering challenges for disabled pedestrians. A 12-inch water line with various lateral connection locations and two sanitary sewer lines of 45-inch and 51-inch diameters are present in the Charleston roadway. A 4-inch Southwest Gas line, storm drainage facilities, and many dry utilities including underground and overhead installations for COX, Centurylink, City signal systems and FAST also reside in the study area corridor.

The existing Charleston roadway corridor is built out to its maximum available 100-foot right of way for the majority of its length. It has 110-feet of right of way from the I-515 interchange to Broadalbin Drive, the south 10-feet of which is not built out as roadway. NDOT's I-515 right of way is also tight given the traffic volumes that utilize the interchange. Current traffic volumes on I-515 are approaching 130,000 AADT. Charleston Blvd., between Lamb and the I-515 interchange, experiences AADT of over 72,000. The interchange serves as the main ingress/egress point between the north east and the interstate system connecting to the rest of the valley.

Figures 1 and 2 below present the physical conditions of the interchange itself and the study corridor.

I-515 and Charleston Blvd Interchange – Figure 1

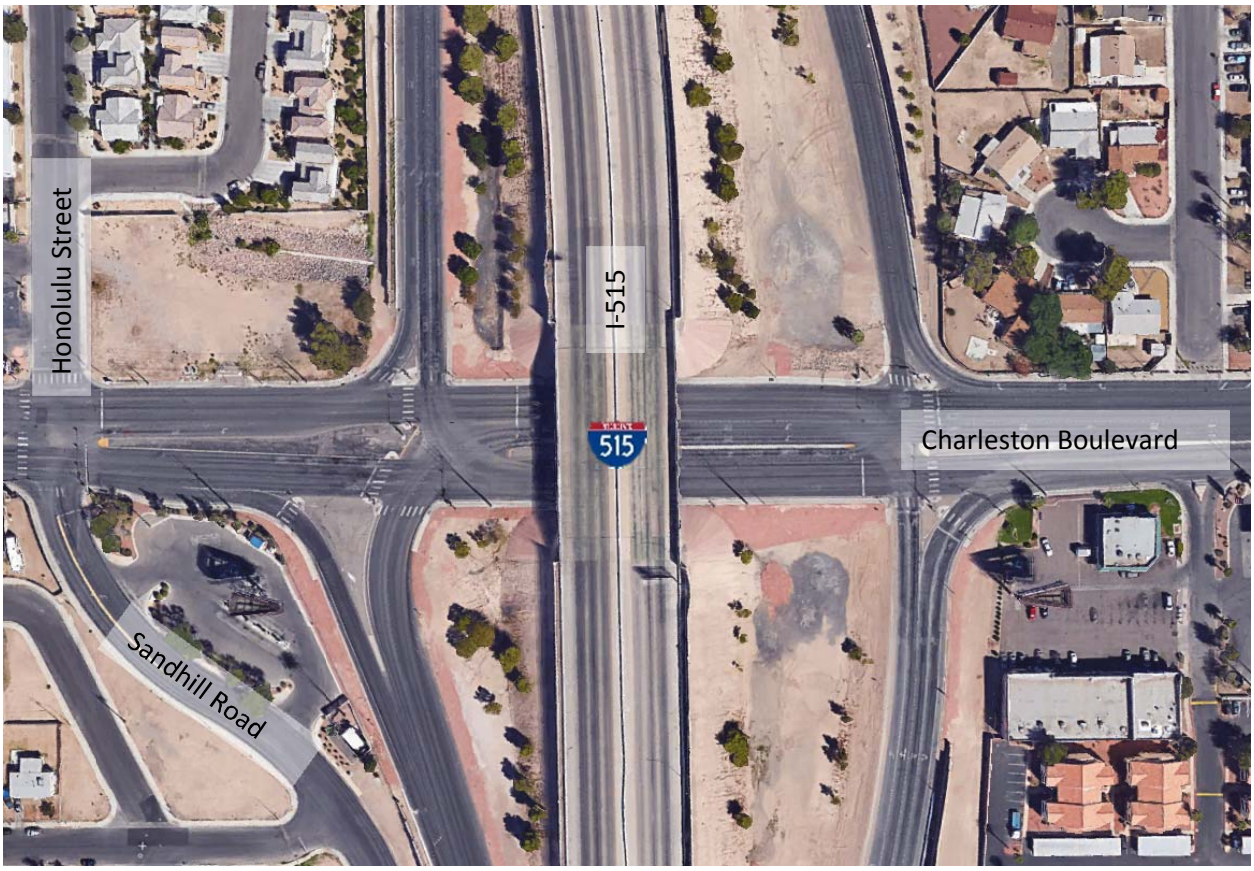


Figure 1 shows the current interchange at I-515 and Charleston Blvd., the focal point of this study. It was constructed by NDOT on the I-515 as a standard diamond freeway interchange. I-515 passes over Charleston Blvd. with a single span bridge, with an approximate 215-foot free span, NDOT structure #I-1444. The southbound off-ramp provides a single lane exit from I-515 with a single dedicated right turn lane and dual left turn lanes at Charleston Blvd. The northbound off-ramp also consists of a single lane exit from the freeway and provides both dual rights and dual lefts at the Charleston Blvd. intersection. Charleston Blvd. connects to the northbound on-ramp with a westbound dedicated right turn pocket and an eastbound dedicated single left turn lane. The northbound on-ramp then connects to I-515 with a single lane tapered entrance. The northbound on-ramp is metered, with two lanes of queue storage. Connections to the southbound on-ramp from Charleston Blvd. include a short dedicated right turn pocket for eastbound traffic and a signalized dual left turn for westbound traffic. The southbound on-ramp is also metered and provides two general purpose lanes and one HOV lane for queue storage. The ramp then enters the freeway via a two-lane parallel entrance. The ramp terminals are spaced approximately 480-feet apart. The existing right of way at the interchange is not all one contiguous piece, but consists of many parcels, all identified as “public right of way”. There is space for possible reconfiguration within the right of way, with more room available adjacent to the south bound off-ramp and both northbound on- and off-ramps, and less room adjacent to the south bound on-ramp.

Charleston Boulevard – Figure 2

Figure 2 shows the overall project study area. The posted speed limit on Charleston Blvd. today is 45 miles per hour (MPH). It consists of a six-lane arterial from Honolulu St./Sandhill Rd. to Lamb Blvd., which is consistent with Clark County standards for a fully developed roadway on a 100-foot right of way with curb, gutter and sidewalks on each side of the road. An extra 10-feet of right of way exists but is not utilized for roadway on the south half of Charleston Blvd., from the northbound ramp at I-515 to Broadalbin Drive. A median island divides this corridor to separate the large volumes of traffic and set up left turn pockets. Signalized intersections are present at Honolulu St./Sandhill Rd., I-515 interchange ramp terminals, Sacramento Drive, and Lamb Blvd. Left turn pockets are provided within the median island providing eastbound access to Prince Lane and westbound access to a commercial property from Charleston Blvd. Other left turn access is limited to the signalized locations previously identified.

Pedestrian access is accommodated via 5-foot curb-side sidewalks that are continuous on both sides of Charleston Blvd. The existing curb ramps are old and are not in compliance with current ADA standards. The Charleston corridor has multiple businesses and pedestrian destinations and is utilized by many pedestrians at all times of the day.

The City is currently acquiring right-of-way and preparing a construction contract for widening of the Charleston Blvd. and Lamb Blvd. intersection. This will convert the existing eastbound dual lefts to triple lefts. These improvements have been considered as “existing” improvements for this study since the project will be constructed prior to any alternatives of this particular study being installed.

MODEL DEVELOPMENT AND TRAFFIC VOLUMES

Methodology

This section outlines the procedures used to forecast future traffic volumes on Charleston Blvd. between Honolulu St./Sandhill Rd. and Lamb Blvd., which fall in the jurisdiction of both City of Las Vegas and Clark County.

Data Analysis

The project scope of work requires obtaining traffic data from the latest approved Regional Transportation Commission (RTC) model, Nevada Department of Transportation (NDOT) historic traffic data, and current turning movement counts to develop a methodology for forecasting future traffic growth.

NDOT has several traffic count stations near the intersection of Charleston Blvd. at I-515 that can provide good historical traffic data which can be used along with the RTC model for the traffic volume forecast.

Existing AM and PM peak hour turning movements were taken on Charleston Blvd. at the signalized intersections listed below:

- Honolulu St./Sandhill Rd.
- SB I-515 on/off ramp
- NB I-515 on/off ramp
- Sacramento Dr.
- Lamb Blvd.

Historic Traffic Volumes

All available historic Annual Average Daily Traffic (AADT) volumes were collected from NDOT's Traffic Information Division's Annual Traffic Report. The review of NDOT traffic count data revealed the following count stations could be used to project future traffic volumes in the corridor:

- Station 556 – Charleston Blvd. 0.1 mile west of Sandhill Rd.
- Station 795 – Charleston Blvd. 400 feet east of I-515 NB ramps
- Station 557 – Charleston Blvd. 200 feet east of Lamb Blvd.
- Station 799 – I-515 between Boulder Hwy. and Charleston Blvd.
- Station 800 – I-515 NB off-ramp for Charleston Blvd.
- Station 801 – I-515 SB on-ramp from Charleston Blvd.
- Station 779 – I-515 NB on-ramp from Charleston Blvd.
- Station 791 – I-515 SB off-ramp for Charleston Blvd.
- Station 784 – I-515 between Eastern Ave. and Las Vegas Blvd.

The collected AADT data for each station is shown in Table 1.

Table 1 - AADT data for Various Count Stations

NDOT - AADT											
Station	Location	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
556	Charleston Blvd 0.1 mile W of Sandhill Rd	29,700	32,000	34,000	37,500	34,000	33,000	33,000	31,000	29,000	31,000
795	Charleston Blvd 400' E of NB ramps of US-95	71,000	74,500	77,000	75,000	73,000	74,000	73,000	69,000	70,000	72,500
557	Charleston Blvd 200' E of Lamb Blvd	48,000	54,500	57,000	56,500	56,000	54,000	55,000	54,000	55,000	54,000
799	I-515/US-95 b/n Boulder Hwy & Charleston Intch	133,400	134,000	135,000	139,000	136,000	135,000	135,000	127,000	129,000	128,000
800	I-515/US-95 NB off-ramp of Charleston Blvd	14,700	15,100	14,300	15,100	15,000	15,000	16,000	15,000	14,000	14,500
801	I-515/US-95 SB on-ramp of Charleston Blvd	16,200	16,700	16,000	17,600	18,000	17,000	17,000	16,000	16,000	16,000
779	I-515/US-95 NB on-ramp of Charleston Blvd	17,100	18,000	18,100	16,900	17,000	18,000	17,000	18,000	18,000	17,500
791	I-515/US-95 SB off-ramp of Charleston Blvd	16,500	16,800	16,800	16,600	17,000	16,000	16,000	16,000	16,000	15,500
784	I-515/US-95 b/n Las Vegas Blvd & Eastern Ave Intch	158,000	156,000	161,000	162,000	155,000	156,000	155,000	153,000	155,000	153,000
	Data Adjusted/Estimated from NDOT										

Reviewing the NDOT AADT history from the above table revealed that the traffic volume for the past ten years (2003 to 2012) has remained fairly flat without any significant increase or decrease in the volumes. One of the key observations from the above table was the traffic demand at interchange at Charleston Blvd. and I-515 is generated by commuters wanting to access the interstate. The evidence of this is the volume of traffic on both the on- and off-ramps. Even though the traffic at the ramps has not increased, the demand was still consistent for the past 10 years. There are numerous unknown factors affecting growth in southern Nevada. The rate of recovery from the recent downturn in the economy is one of those unknowns.

RTC Model

The review of AADT from the RTC Model runs for the year 2013, 2025, and 2035 revealed mixed growth rate (positive/negative) along the study corridor. Since RTC model has traffic volumes for three different years, a separate growth rate was calculated from 2013 to 2025, 2025 to 2035 and 2013 to 2035. It should be noted that the RTC 2035 Model run includes a new interchange at I-515 and Pecos Road. This in turn reduces the ramp volumes at Charleston Blvd interchange as shown in the table below. Detailed growth rates calculated from the RTC model are shown in Table 2.

Table 2- RTC Model Growth rate

RTC MODEL - AADT				Growth Rate		2013 to 2035
Location	2013	2025	2035	2013 to 2025	2025 to 2035	
Charleston Blvd W of Sandhill Rd	18,039	18,892	22,380	0.4%	1.7%	1.0%
Charleston Blvd E of NB ramps of US-95	47,575	51,671	48,204	0.7%	-0.7%	0.1%
Charleston Blvd E of Lamb Blvd	35,360	40,833	40,325	1.2%	-0.1%	0.6%
I-515/US-95 b/n Boulder Hwy & Charleston Intch	129,284	157,324	180,190	1.6%	1.4%	1.5%
I-515/US-95 NB off-ramp of Charleston Blvd	9,323	10,686	4,193	1.1%	-8.9%	-3.6%
I-515/US-95 SB on-ramp of Charleston Blvd	3,826	5,282	2,068	2.7%	-9.0%	-2.8%
I-515/US-95 NB on-ramp of Charleston Blvd	12,347	13,817	14,372	0.9%	0.4%	0.7%
I-515/US-95 SB off-ramp of Charleston Blvd	9,341	10,084	11,739	0.6%	1.5%	1.0%
I-515/US-95 b/n Las Vegas Blvd & Eastern Ave Intch	146,016	169,642	168,996	1.3%	0.0%	0.7%

A comparison of the RTC model run with NDOT's historical traffic volumes showed a significant deviation as shown on the table below. The NDOT observed volumes are consistently higher that the volumes from the RTC model run.

Table 3 - NDOT and RTC AADT Comparison

NDOT vs RTC EXISTING COMPARISON					
STATION	LOCATION	NDOT AADT 2012	RTC MODEL 2013	Δ NDOT vs RTC	% CHANGE
556	Charleston Blvd 0.1 mile W of Sandhill Rd	31,000	18,039	12,961	72%
795	Charleston Blvd 400' E of NB ramps of US-95	72,500	47,575	24,925	52%
557	Charleston Blvd 200' E of Lamb Blvd	54,000	35,360	18,640	53%
799	I-515/US-95 b/n Boulder Hwy & Charleston Intch	128,000	129,284	(1,284)	-1%
800	I-515/US-95 NB off-ramp of Charleston Blvd	14,500	9,323	5,177	56%
801	I-515/US-95 SB on-ramp of Charleston Blvd	16,000	3,826	12,174	318%
779	I-515/US-95 NB on-ramp of Charleston Blvd	17,500	12,347	5,153	42%
791	I-515/US-95 SB off-ramp of Charleston Blvd	15,500	9,341	6,159	66%
784	I-515/US-95 b/n Las Vegas Blvd & Eastern Ave Intch	153,000	146,016	6,984	5%

Turning Movement Counts

The 2013 peak-hour turning movement counts for five signalized intersections on Charleston Blvd along the study limits are shown in the following table. Counts were performed during morning and evening peak-hours (October 17, 2013).

Table 4 - 2013 AM/PM Turning Movement Counts

2013 TURNING MOVEMENT COUNTS							
INTERSECTION	DIRECTION	AM			PM		
		RIGHT	THRU	LEFT	RIGHT	THRU	LEFT
Charleston Blvd/Honolulu St (Sandhill Rd)	SB	9	12	54	10	11	61
	WB	25	978	48	51	1007	72
	NB	162	8	57	107	4	46
	EB	22	773	3	44	1219	6
Charleston Blvd/I-515 SB Ramps	SB	148	0	527	160	0	886
	WB	0	903	1209	0	892	827
	NB	0	0	0	0	0	0
	EB	559	430	0	520	890	0
Charleston Blvd/I-515 NB Ramps	SB	0	0	0	0	0	0
	WB	932	1617	0	773	1324	0
	NB	728	0	501	925	0	451
	EB	0	760	158	0	1605	99
Charleston Blvd/Sacramento Dr	SB	193	11	26	84	16	25
	WB	7	2263	13	20	1889	50
	NB	11	1	21	42	9	65
	EB	18	1289	61	11	2277	105
Charleston Blvd/Lamb Blvd	SB	644	735	87	537	758	123
	WB	48	1329	154	113	979	218
	NB	94	510	144	267	855	213
	EB	109	797	422	183	1532	635

Forecast Methodology

To develop 2035 turning movement counts, it was assumed that the current traffic distribution will remain constant for future years. Since both the NDOT historical AADT counts and the RTC model did not show any significant growth in the traffic volumes, and after consultation with the City of Las Vegas staff, it was decided that a minimum growth rate of 1.5% be used to develop forecast volumes. The 1.5% growth rate is consistent with the recent economic projections of a modest recovery.

Future Traffic Volumes

The 1.5% growth rate was applied to the existing peak hour turning movement counts to develop the forecast volumes. Table 5 shows the forecasted turning movement counts for 2035 AM and PM peak hours. It is clear that the tremendous traffic demand at the interchange will continue in future years which necessitates improvements on Charleston Blvd and its interchange with I-515.

Table 5 - 2035 AM/PM Forecasted Traffic Volumes

2035 TURNING MOVEMENT COUNTS							
INTERSECTION	DIRECTION	AM			PM		
		RIGHT	THRU	LEFT	RIGHT	THRU	LEFT
Charleston Blvd/Honolulu St (Sandhill Rd)	SB	12	17	75	14	15	85
	WB	35	1357	67	71	1397	100
	NB	225	11	79	148	6	64
	EB	31	1073	4	61	1691	8
Charleston Blvd/I-515 SB Ramps	SB	205	0	731	222	0	1229
	WB	0	1253	1678	0	1238	1148
	NB	0	0	0	0	0	0
	EB	776	597	0	722	1235	0
Charleston Blvd/I-515 NB Ramps	SB	0	0	0	0	0	0
	WB	1293	2244	0	1073	1837	0
	NB	1010	0	695	1283	0	626
	EB	0	1055	219	0	2227	137
Charleston Blvd/Sacramento Dr	SB	268	15	36	117	22	35
	WB	10	3140	18	28	2621	69
	NB	15	1	29	58	12	90
	EB	25	1789	85	15	3159	146
Charleston Blvd/Lamb Blvd	SB	894	1020	121	745	1052	171
	WB	67	1844	214	157	1358	302
	NB	130	708	200	370	1186	296
	EB	151	1106	586	254	2126	881

PROJECT NEEDS

The first step in developing the alternatives is to identify existing and future deficiencies at each project intersection. These deficiencies represent needs of the project. Successful alternatives meet these needs without creating additional deficiencies. Deficiencies could include non-compliant ADA pedestrian access, poor access management and safety concerns, and poor traffic operations - consisting of unacceptable Levels of Service (LOS) which equate to unacceptable delay and/or travel time. While non-compliant ADA access is an independent deficiency, it is common to see correlation between poor LOS, poor access management and high crash rates. The goal of the study is to develop project alternatives that mitigate deficiencies in the following key areas:

Pedestrians and ADA Access

Any proposed improvement along the corridor must include enhancement of the pedestrian realm which will include the upgrade of any deficient ADA ramps to current standards, and provide a clear sidewalk width that complies with the Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-way (PROWAG). Pedestrian activities within the corridor can be attributed to the fact that commercial developments exist along Charleston Blvd. as well as the existence of public transit along the corridor. There are a total of four (two in each direction) transit stops on Charleston Blvd. between Honolulu St./Sandhill Rd. and Lamb Blvd. These stops should be evaluated for adequate space to enhance the safety of the pedestrians waiting at the stops and for the pedestrians passing by. Charleston does not have bike lanes today, nor is it a designated bicycle route in the RTC's Master Plan, however, there is bicycle traffic generated through the interchange by a north-south bike route that crosses the interchange.

Access Management

The location and frequency of access points (driveways) along a roadway can significantly impact the roadway's traffic operation and safety. Charleston Blvd. currently has a raised median island separating the eastbound and westbound traffic and provides an effective access management by only allowing right turn in and out at un-signalized driveway locations.

Safety

Crash data was obtained from NDOT showing crash history for the corridor from April 2010 to April 2013. A total of 721 total accidents were reported occurring within the corridor during that period, 451 of which are property damage only, 269 injury accidents, and 1 fatal accident which occurred at the intersection of Broadalbin Drive and Charleston Blvd. Angle and rear-end accidents comprised a majority of the types of accidents occurring at each intersection. Table 6 provides a summary of the crash data from 2010-2013 for each intersection.

Alternatives were reviewed for Crash Modification Factors based on the type of improvement. Crash Reduction Factors are provided as a means of evaluating each alternative's potential reduction in crashes, and as a measure of effectiveness in meeting the project needs related to safety.

Table 6 – 3 Year Crash Data Summary (April 2010 – April 2013)

Intersection	Total Number of Accidents	Angle		Rear End		Number of Injury Accidents	Number of Property Damage Only
		Number	Percentage	Number	Percentage		
Honolulu St./ Sandhill Rd.	20	8	40.0%	7	30.0%	7	13
I-515 SB ramp	141	43	30.5%	78	55.3%	50	91
I-515 NB ramp	184	31	16.8%	115	62.5%	58	126
Sacramento Dr	71	15	21.1%	49	69.0%	28	43
Ronald Ln	15	3	20.0%	11	73.3%	6	9
Prince Ln	20	8	40.0%	11	55.0%	14	6
Broadalbin Dr	17	5	29.4%	12	70.6%	11	5
Moonlight Dr	12	5	41.7%	5	41.7%	3	9
Lamb Blvd	199	86	43.2%	97	48.7%	76	123

The review of the crash data revealed crash patterns were consistent with a congested corridor having signalized intersections.

Traffic Operations

The City's desire to mitigate congestion at the I-515 and Charleston Blvd. Interchange required a traffic modeling software which can model both conventional and alternative interchange designs. The micro-simulation traffic modeling software VISSIM was chosen to evaluate future traffic conditions at the interchange as well as within the project corridor. VISSIM is a micro-simulation program that simulates each car's movement, and is increasingly used to model complex traffic situations that occur at alternative interchanges such as a Diverging Diamond Interchange. The traffic operations simulations were conducted for the design year 2035 forecast AM and PM peak hours for the no-build as well as the build alternatives.

VISSIM Introduction

VISSIM is a microscopic, time-step and behavior based simulation model developed to model urban traffic and public transit operations. The program can analyze traffic and transit operations under constraints such as lane configuration, traffic composition, traffic signals, transit stops, etc..., thus making it a useful tool for the evaluation of various alternatives based on transportation engineering and planning measures of effectiveness.

The traffic simulator in VISSIM is a microscopic traffic flow simulation model including car following and lane change logic. VISSIM uses the psycho-physical driver behavior model developed by Wiedemann (1974). The basic concept of this model is that the driver of a faster moving vehicle starts to decelerate as he reaches his individual perception threshold to a slower moving vehicle. This results in an iterative process of acceleration and deceleration.

Delay

VISSIM does not directly output HCM Level of Service (LOS); instead, delay is the metric of performance that is measured using VISSIM. VISSIM defines delay as the difference between the actual vehicle travel time and its desired travel time. Note that this is a microscopic definition of delay that is specific to each vehicle. This is different than the other software packages that compare actual travel times to an average link free-flow travel time.

The average total delay per vehicle is computed only for the vehicles completing the travel-time measurement section. The delay is computed for each vehicle by subtracting the ideal travel time from the actual travel time. The ideal travel time is computed assuming no other vehicles are present on the network and no delays occur at signal controls or stop signs. Reduced speeds for turns are taken into account in the ideal travel time. For this study, delay is measured by seconds/vehicle.

Travel Time

VISSIM outputs travel-time results between selected points on the network. The average is computed from the actual travel times of all vehicles that pass the destination point after they have passed the start point. Vehicles that have not reached the destination point and denied entry vehicles are not included in the travel-time results.

ALTERNATIVES EVALUATION

As outlined in the previous section, operational improvements are needed for the Charleston Blvd. and I-515 interchange and along Charleston Blvd. from Honolulu St./Sandhill Rd. to Lamb Blvd. This section of the study documents the various alternatives analyzed to determine if the proposed alternatives will have a positive impact on the level of delay for the project intersections. Analysis includes establishing preliminary intersection geometrics, traffic analysis, cost estimation, identifying additional right of way needed, utility conflicts, environmental concerns, and providing an estimated benefit-cost ratio for each alternative. Comparison between the proposed alternatives includes the no-build, or existing condition as described in pages 3 through 5.

Alternative 1 – Dual Right, Westbound to Northbound

The first alternative analyzed focused on the westbound Charleston Blvd. to northbound I-515 traffic movements. The proposed alternative would provide balanced lane utilization between westbound through traffic and right turn traffic at the interchange. Modification would reduce the existing three through lanes and single dedicated right turn lane to two through lanes and two dedicated right turn lanes. In addition, the third westbound lane would be reintroduced from the free flow I-515 southbound off-ramp. See Figure 3 below. The proposed improvements would be limited to reconstruction of the existing pork chop median island, striping modifications, and traffic signal adjustments. The addition of dual right turns has a positive Crash Reduction Factor of 14.

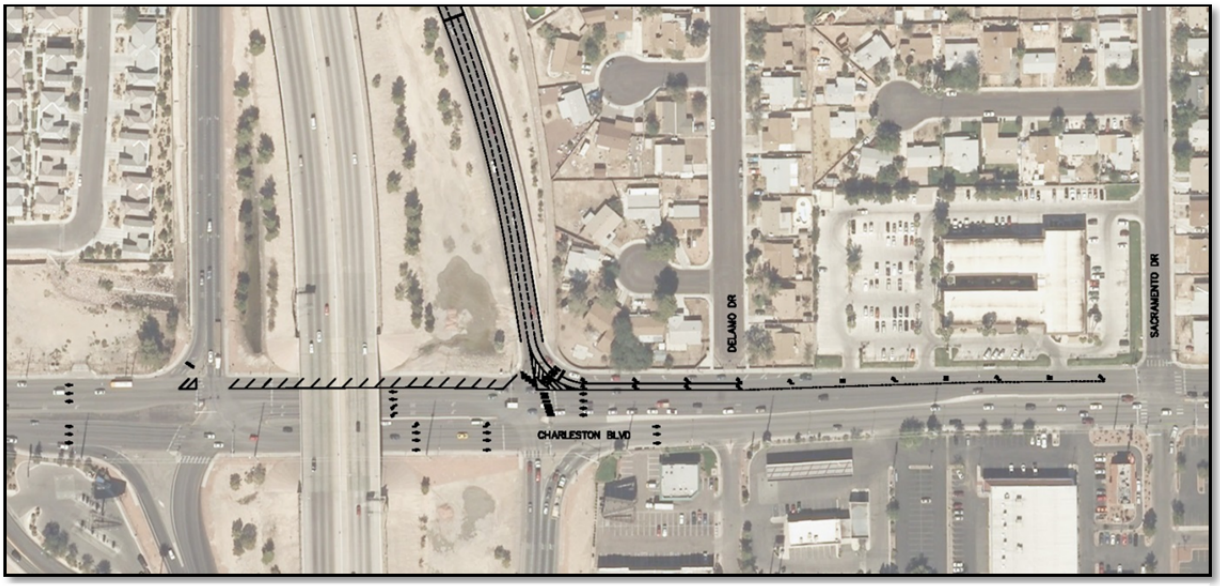


Figure 3 – Alternative 1

Table 7 compares the intersection delays for the no-build condition compared to the proposed alternative. While a more dramatic improvement was initially expected with Alternative 1, the conversion of one of the westbound through lanes to create the dual rights to the northbound on-ramp resulted in insignificant changes to the delay at the interchange for the 2035 peak volumes. After additional analysis of the 2035 traffic operations, it was discovered the primary breakdown of

westbound Charleston Blvd. is related to the westbound to southbound left turn in 2035. Preliminary construction costs for Alternative 1 are estimated under $50,000.

Table 7 - Intersection Delay Comparison for No-Build and Alternative-1

Vissim Results - 2035 NO BUILD								
	CHARLESTON BLVD & HONOLULU ST							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	18.1				19.7			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	20.0	11.5	23.0	40.0	22.0	9.9	26.8	47.0
	CHARLESTON BLVD & SB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	56.6				43.4			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	40.7	74.2	-	49.0	22.5	37.7	-	99.0
	CHARLESTON BLVD & NB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	60.6				38.8			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	6.1	87.9	113.0	-	10.1	29.6	151.9	-
	CHARLESTON BLVD & SACRAMENTO DR							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	58.2				32.4			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	8.4	115.4	49.5	224.7	4.2	46.6	109.2	212.4
	CHARLESTON BLVD & LAMB BLVD							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	77.6				53.0			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	24.7	182.1	63.5	105.9	32.9	70.2	54.9	62.0

Vissim Results - 2035 ALTERNATIVE-1								
	CHARLESTON BLVD & HONOLULU ST							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	17.7				22.3			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	20.0	10.3	23.0	40.0	23.0	17.3	27.6	47.0
	CHARLESTON BLVD & SB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	57.8				45.6			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	40.9	77.3	-	49.0	24.3	41.3	-	99.0
	CHARLESTON BLVD & NB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	63.3				43.7			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	6.8	91.8	117.9	-	8.9	42.2	150.3	-
	CHARLESTON BLVD & SACRAMENTO DR							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	58.9				29.6			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	8.4	116.5	49.5	248.6	5.2	39.0	258.4	71.9
	CHARLESTON BLVD & LAMB BLVD							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	77.5				52.4			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	24.6	186.5	65.5	101.1	33.2	67.7	55.5	60.0

Alternative 2 – Eastbound Auxiliary Lane

Alternative 2 presented a potential solution to the Charleston Blvd. eastbound approach at the Lamb Blvd. intersection. The City is currently finalizing plans and right-of-way acquisition to improve the intersection including construction of triple lefts from eastbound Charleston Blvd. to northbound Lamb Blvd. Alternative 2 would provide 600 feet of additional left turn storage through reconstruction of the median island and restriping. Figure 4 shows the proposed Alternative 2 improvements. The auxiliary

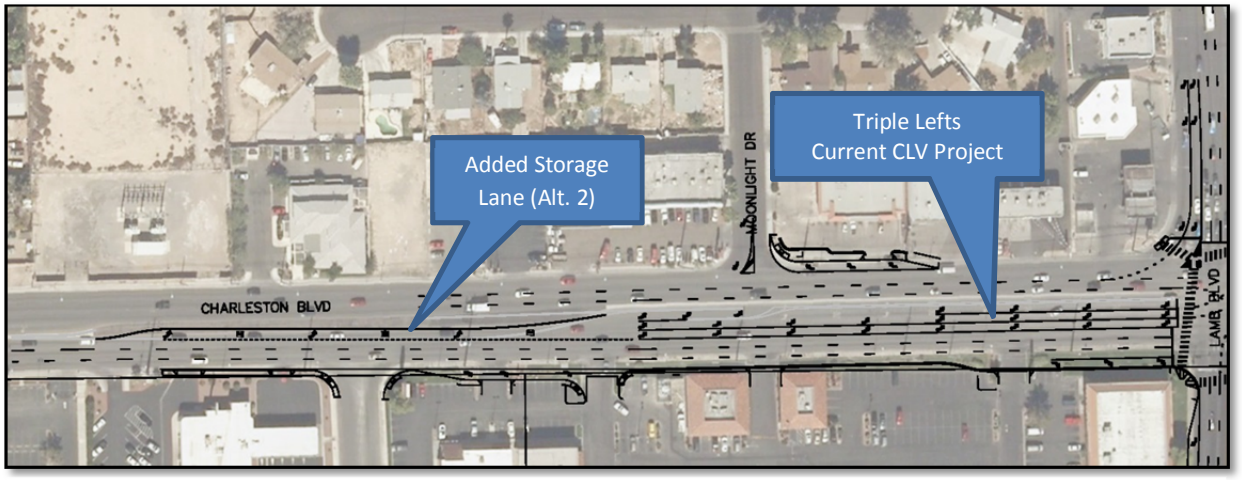


Figure 4 – Alternative 2

lane provides a positive Crash Reduction Factor of 10 throughout its limits, resulting in minor potential for reduction of crashes.

The intersection delay comparison summary in Table 8 indicates that Alternative 2 does not provide a significant savings in intersection delay. Preliminary construction costs for Alternative 2 are estimated under $75,000.

Table 8 - Intersection Delay Comparison for No-Build and Alternative-2

Vissim Results - 2035 NO BUILD								
	CHARLESTON BLVD & HONOLULU ST							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	18.1				19.7			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	20.0	11.5	23.0	40.0	22.0	9.9	26.8	47.0
	CHARLESTON BLVD & SB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	56.6				43.4			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	40.7	74.2	-	49.0	22.5	37.7	-	99.0
	CHARLESTON BLVD & NB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	60.6				38.8			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	6.1	87.9	113.0	-	10.1	29.6	151.9	-
	CHARLESTON BLVD & SACRAMENTO DR							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	58.2				32.4			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	8.4	115.4	49.5	224.7	4.2	46.6	109.2	212.4
	CHARLESTON BLVD & LAMB BLVD							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	77.6				53.0			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	24.7	182.1	63.5	105.9	32.9	70.2	54.9	62.0

Vissim Results - 2035 ALTERNATIVE-2								
	CHARLESTON BLVD & HONOLULU ST							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	17.8				20.1			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	20.0	10.7	23.1	40.0	23.0	9.9	27.8	47.0
	CHARLESTON BLVD & SB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	56.7				44.2			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	40.5	75.0	-	49.0	23.8	38.5	-	99.0
	CHARLESTON BLVD & NB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	60.4				39.7			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	6.3	88.3	112.0	-	10.0	32.0	151.7	-
	CHARLESTON BLVD & SACRAMENTO DR							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	58.7				32.7			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	8.5	120.4	48.7	200.1	4.4	44.7	120.5	249.0
	CHARLESTON BLVD & LAMB BLVD							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	78.4				53.3			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	23.6	191.8	65.5	107.9	34.0	67.4	57.6	61.3

Alternative 3 – Diverging Diamond Interchange (DDI) Retrofit

Alternative 3 analyzed a diverging diamond interchange (DDI) retrofit at I-515 and Charleston Blvd. The DDI footprint would not impact the existing bridge structure. The improvements, as currently designed, would have minor right-of-way impacts to the northeast quadrant. The proposed DDI would provide two through lanes in each direction. Dual turn lanes are provided from westbound Charleston Blvd. to southbound I-515; a single left is provided from eastbound Charleston Blvd to I-515 northbound; and dual lefts are constructed for both northbound and southbound exit ramps. Additional improvements include providing a triple right from the northbound I-515 exit to eastbound Charleston Blvd and a dual right from westbound Charleston Blvd to the I-515 northbound on-ramp (Alternative 1). Improvements would include new curb, gutter, and sidewalk; new and reconstructed pavement sections; new traffic signal system; new median islands; widening of the northbound off-ramp; and new signing and striping. Figure 5 provides an Alternative 3 plan view. DDI interchange retrofits provide a Crash Reduction Factor of 46, which has been shown to be a substantial improvement in the potential reduction of crashes when compared to a typical diamond interchange.

Traffic analysis shows that Alternative 3 will provide significant savings in interchange delay. One concern with the DDI is its impact to Charleston Blvd. between I-515 and Lamb Blvd. Due to the DDI's

operational effectiveness, increased breakdown at the Lamb Blvd. and Charleston Blvd. intersection will occur. This is attributed to the DDI delivering a higher volume of traffic to Charleston Blvd. when compared to the existing condition. Intersection delay forecasts for Alternative 3 are presented in Table 9.

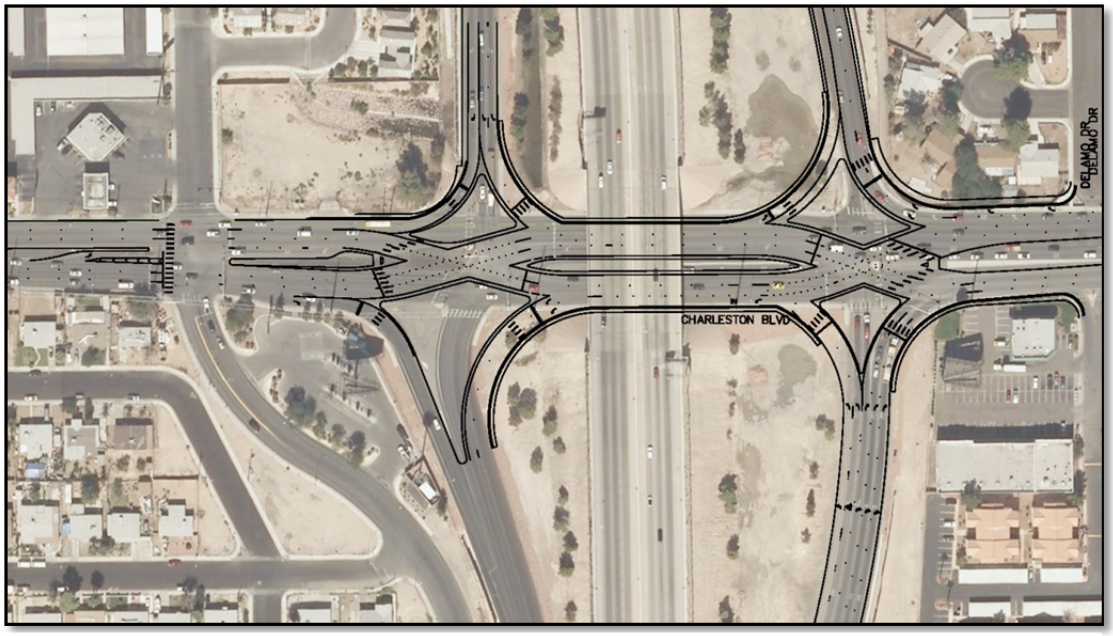


Figure 5 – Alternative 3

One concern associated with the DDI is pedestrian access. When compared to the existing condition, all of the crossing locations in the DDI alternative have shorter crossing distances. This decreases the crossing time for the pedestrians and essentially reduces the amount of time the pedestrians are in the roadway. With decreased pedestrian crossing distances and times comes less risk to the pedestrian. Pedestrian access can be perpetuated through a single, center running sidewalk or through traditional outside sidewalks on both sides of the roadway. One safety aspect of the pedestrians using the inside (median area) vs. the outside is the pedestrians are protected by a barrier while walking through the interchange. Also, using the inside design reduces the number of pedestrian crossings from twelve to eight, reducing pedestrian conflicts points.

A concern does arise on the high volume turning movement from westbound Charleston Blvd. to the northbound and southbound on-ramps. Providing dual lane turning movements would require pedestrian actuated signals which could interfere with operations and pedestrian expectations, most notably for the westbound to southbound movements. The possibility of using a HAWK signal at the westbound to northbound ramp movement could increase pedestrian safety without creating undue traffic interruption with a conventional signal operation. The use of an educational component for this option could be beneficial. It would benefit the drivers and the pedestrians on how the HAWK signal works.

Preliminary construction costs for Alternative 3 are estimated at $5,600,000, including right-of-way.

Table 9 - Intersection Delay Comparison for No-Build and DDI

Vissim Results - 2035 NO BUILD								
	CHARLESTON BLVD & HONOLULU ST							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	18.1				19.7			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	20.0	11.5	23.0	40.0	22.0	9.9	26.8	47.0
	CHARLESTON BLVD & SB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	56.6				43.4			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	40.7	74.2	-	49.0	22.5	37.7	-	99.0
	CHARLESTON BLVD & NB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	60.6				38.8			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	6.1	87.9	113.0	-	10.1	29.6	151.9	-
	CHARLESTON BLVD & SACRAMENTO DR							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	58.2				32.4			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	8.4	115.4	49.5	224.7	4.2	46.6	109.2	212.4
	CHARLESTON BLVD & LAMB BLVD							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	77.6				53.0			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	24.7	182.1	63.5	105.9	32.9	70.2	54.9	62.0

Vissim Results - 2035 DIVERGING DIAMOND INTERCHANGE								
	CHARLESTON BLVD & HONOLULU ST							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	19.9				39.2			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	20.9	16.5	22.0	40.8	56.0	14.0	51.5	48.2
	CHARLESTON BLVD & SB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	14.1				33.3			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	24.3	10.9	-	14.9	53.3	13.8	-	48.9
	CHARLESTON BLVD & NB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	29.8				41.4			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	16.2	44.7	20.4	-	37.5	34.4	57.8	-
	CHARLESTON BLVD & SACRAMENTO DR							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	40.5				30.7			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	10.6	51.2	44.4	268.2	25.8	30.2	89.3	60.9
	CHARLESTON BLVD & LAMB BLVD							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	57.7				58.8			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	28.0	82.0	49.0	76.2	65.0	62.0	53.0	52.1

Alternative 4 – I-515/Charleston Blvd Triple Lefts

Since the 2035 models projected a significant breakdown in the westbound to southbound movement at the I-515 interchange, the design team analyzed the impacts of providing triple lefts. Alternative 4 focuses on maximizing left turn capacity throughout the I-515 interchange by installing triple left turn movements for westbound Charleston Blvd. to southbound on-ramp and southbound off-ramp to eastbound Charleston Blvd; as well as providing triple rights for the northbound off-ramp to eastbound Charleston Blvd. In addition, the dual right from westbound Charleston Blvd. to the northbound on-ramp (Alternative 1) would be included. Alternative 4 also proposes using two westbound and three eastbound through lanes to provide balanced lane utilization within the interchange. As part of the westbound dual right improvements, Alternative 4 would widen westbound Charleston Blvd. to provide a dedicated right turn lane from Sacramento Dr. to the I-515 interchange. These improvements would require right-of-way acquisition and construction of the new lane including curb, gutter, sidewalk and pavement section. Figure 6 shows the proposed Alternative 4 improvements. The evaluation of Crash Modification Factors for this alternative considered the effects of the triple left turn lanes, which have a Crash Reduction Factor of 26, attributed to the observed reduction in rear end crashes.

The corridor traffic analysis shows Alternative 4 provides a better balanced corridor operation when compared to Alternative 3 (DDI). This improved balance between the I-515 interchange and Lamb Blvd. intersection provides an improved and consistent corridor travel time for the proposed alternatives. Pedestrian crossings in this alternative will be very similar to the existing conditions. In this alternative and the existing condition the pedestrian crossing distances will be slightly longer on the north side of the road. There will be a need for a pedestrian refuge island for pedestrians crossing north to south on

the east side of the interchange and the need to signalize the west bound to north bound turning movement for the pedestrians.

The possibility of using a HAWK signal at the westbound to northbound ramp crossing could increase pedestrian safety without creating undue traffic interruption with a conventional signal operation.

The use of and educational component for this option could be beneficial. It would benefit the drivers and the pedestrians on how the HAWK signal works and the proper way to use the pedestrian refuge island.

Alternative 4's preliminary construction cost estimate is approximately $5.2 million, including potential right-of-way costs.

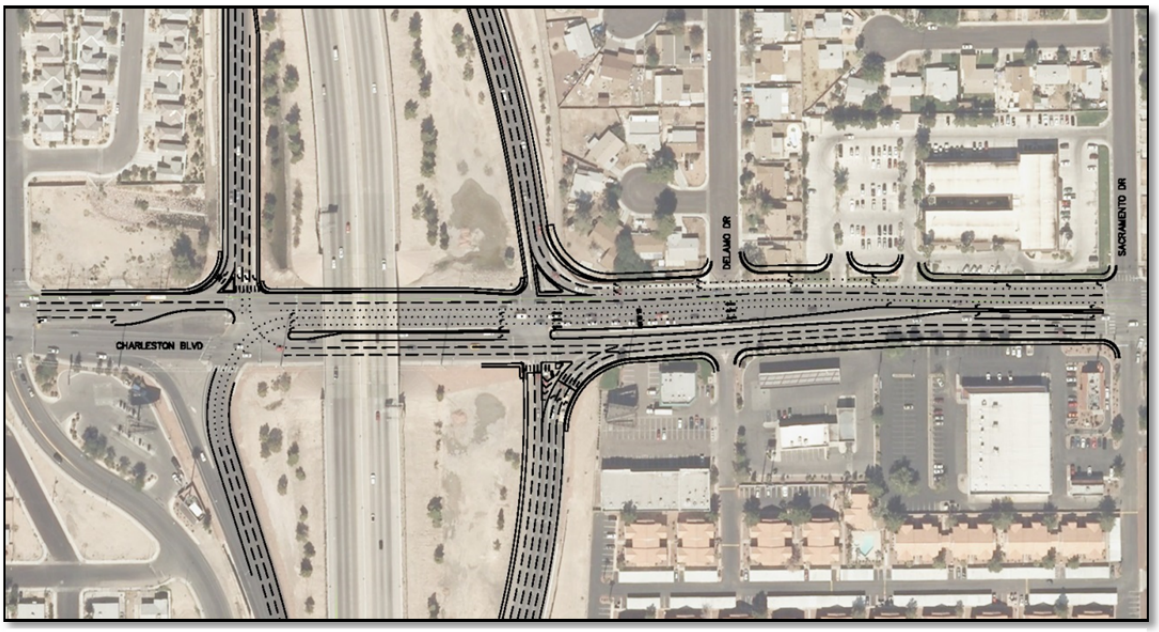


Figure 6 – Triple Left Alternative

Table 10 - Intersection Delay Comparison for No-Build and Alternative-4

Vissim Results - 2035 NO BUILD								
	CHARLESTON BLVD & HONOLULU ST							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	18.1				19.7			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	20.0	11.5	23.0	40.0	22.0	9.9	26.8	47.0
	CHARLESTON BLVD & SB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	56.6				43.4			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	40.7	74.2	-	49.0	22.5	37.7	-	99.0
	CHARLESTON BLVD & NB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	60.6				38.8			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	6.1	87.9	113.0	-	10.1	29.6	151.9	-
	CHARLESTON BLVD & SACRAMENTO DR							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	58.2				32.4			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	8.4	115.4	49.5	224.7	4.2	46.6	109.2	212.4
	CHARLESTON BLVD & LAMB BLVD							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	77.6				53.0			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	24.7	182.1	63.5	105.9	32.9	70.2	54.9	62.0

Vissim Results - 2035 CLV INTERIM DESIGN								
	CHARLESTON BLVD & HONOLULU ST							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	19.6				26.5			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	20.5	15.5	23.0	41.7	22.6	30.4	27.8	47.1
	CHARLESTON BLVD & SB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	54.4				46.2			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	33.5	72.7	-	39.7	18.4	47.1	-	82.2
	CHARLESTON BLVD & NB RAMPS							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	67.4				45.1			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	15.0	84.2	107.2	-	6.8	39.1	141.5	-
	CHARLESTON BLVD & SACRAMENTO DR							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	33.4				19.7			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	7.5	59.5	46.3	14.1	5.7	29.1	102.7	21.2
	CHARLESTON BLVD & LAMB BLVD							
	AM Peak Hour				PM Peak Hour			
Intersection Delay	61.6				51.8			
Approach	EB	WB	NB	SB	EB	WB	NB	SB
Approach Delay	19.5	104.9	56.7	72.0	41.8	64.3	52.9	51.8

Travel Time

Travel time is another means of evaluating the effectiveness of proposed improvements along a corridor. Table 11 shows the travel time output from VISSIM for the different alternatives in comparison to the no-build option. Alternative 3 (DDI) and 4 (Triple Lefts) show a significant travel time savings compared to the other alternatives.

Table 11. Travel Time Comparison

	2035 Travel Time (sec)			
	AM		PM	
	EB	WB	EB	WB
No-Build	223	1226	248	420
Alternative-1	223	1273	253	400
Alternative-2	222	1260	253	420
Alternative-3 (DDI)	206	606	390	334
Alternative-4 (Triple Lefts)	199	707	239	341

Cost Benefit

Alternatives 3 and 4 do provide a substantial benefit to the Charleston Blvd. corridor. While preliminary costs have been calculated, a true benefit cost analysis has not been completed for this project for several reasons. The Charleston Blvd. is a true multi-modal corridor and analyzed from the standpoint of bikes, pedestrians, and transit, the benefit cost analysis only considers the cars and construction costs and it is difficult to accurately assign cost benefits for the bikes, pedestrians, and transit. In addition, alternative benefits, such as ability to expand, driver expectancy and compatibility with NDOT's future I-515 corridor study analysis cannot truly be quantified, reducing potential benefits when compared to proposed construction cost.

RECOMMENDATIONS

The purpose of the this report is to provide the City of Las Vegas with recommendations for improvements to the Charleston Blvd. corridor from Honolulu St./Sandhill Rd. to Lamb Blvd., including the I-515 and Charleston Blvd. interchange. This section provides the recommended improvements and future recommendations, including findings that have been identified by the project team during the evaluation.

Recommendations

The I-515 and Charleston Blvd. interchange traffic operations will continue to deteriorate creating increased delays throughout the project corridor. This study has identified two lower cost improvements that could be constructed in the next 5-10 years. Both alternatives provide positive Crash Reduction Factors and acceptable levels of delays through the time of completion to the year 2035, based on current traffic, population, and zoning forecasts. Both options have been evaluated for including 10-foot sidewalk and buffer areas for pedestrian use. Most significantly, both options consider improvements to traffic operations of the I-515 and Charleston interchange. Future study and potential implementation of two-lane exits for both the north and south bound exit of I-515 are expected to show improvement of I-515 operations as well.

The City of Las Vegas has provided a full review of all proposed alternatives, and through their participation in the preparation of this study, has identified a preference of the recommended alternatives. A combination of improvements, consisting of the Triple Left Turn Improvements and the Eastbound Auxiliary Lane Improvements are recommended for implementation by the City. The City selected the Triple Left Turns over the DDI due to significant pedestrian volumes and the conflicts with the free-flow ramps of the DDI alternative.

Diverging Diamond Interchange (DDI)

The I-515 and Charleston Blvd. interchange clear span bridge configuration provides an opportunity to reconfigure the existing interchange into a DDI without impacting the bridge. Right-of-way acquisitions would be required; however, these impacts are similar in magnitude to those of the Triple Left Alternative. The new configuration would also require widening the northbound off-ramp to provide additional queue storage and required lanes. One concern of the DDI's introduction of free flow movements in the westbound to southbound and westbound to northbound turning movements is the conflicting pedestrian movements. Pedestrian crossings of free flow ramps with the traffic volumes expected at the Charleston interchange poses potential risk for increased vehicle-pedestrian conflicts. An actuated traffic signal would be required at both free-flow ramp crossings, negating some of the benefit of the DDI. Even with that concern addressed in the VISSIM model, the DDI configuration provides the best traffic operations at the interchange. As a result of this efficiency, the interchange sends more traffic to the Lamb Blvd. and Charleston Blvd. intersection faster, creating additional delay at that intersection when compared to the Triple Left Alternative (Alternative 4). The DDI provides the highest level of potential crash reduction according to results from other implementations. Overall

operations of the interchange, Lamb Blvd. intersection and, Charleston Blvd corridor are improved by the DDI configuration when compared to the no-build condition.

Triple Left Turn Improvements

Alternative 4, Triple Left Turn Improvements, will increase the left turn capacity at the several high volume ramps within the interchange area, therefore reducing existing and projected delays within the interchange and corridor. Right of way acquisitions will be required to support the enhanced westbound to northbound right turns. This alternative provides similar overall corridor operations as the DDI Alternative while maintaining the existing interchange movements and controls. The proposed improvements also include bicycle lanes under the I-515 bridge between the ramp terminals to accommodate bicycle traffic through the interchange. It also maintains existing pedestrian pathways, and provides signalized crossings for pedestrians at all conflict points. The only drawback for pedestrians is the extended crossing distances introduced by the additional turn lanes at the ramp intersections. The volume of traffic demand placed upon the interchange is well served by this capacity increase, and there is an expected reduction in the number of crashes as a result. Overall operations of the interchange, Lamb Blvd. intersection and, Charleston Blvd corridor are best balanced by the Triple Left Turns option.

Eastbound Auxiliary Lane

The City of Las Vegas has also requested that Alternative 2 be carried forward with either of the above alternatives, and that additional analysis be performed to review the effectiveness of the auxiliary lane in combination with these improvements.

Next Steps

This study has identified two potential alternatives that will significantly aid in reducing traveler delay while improving safety within the Charleston Blvd. corridor from Honolulu St./Sandhill Rd. to Lamb Blvd. While this study summarizes the City's alternatives analysis; this corridor falls within numerous jurisdictions and will require obtaining additional agency input and consensus. Upon input from NDOT, RTC, FAST, and Clark County, a final locally preferred alternative can be identified. This locally preferred alternative will then need to be refined to a 30% design level to accommodate inclusion of the Eastbound Auxiliary lane improvements, as well as review possible enhancements to the pedestrian environment – such as including a buffer space between the roadway and the sidewalks. In addition, for any work within the I-515 control of access or federally funded improvements, a NEPA document and clearance will need to be conducted.

Appendix 1

Study Comments and Responses

I-515 and Charleston Blvd Interchange Feasibility Study

REVIEW COMMENT SHEET

PROJECT:
PROJECT NUMBER:
SUBMITTAL:
PACKAGE
PACKAGE RECEIVED:

CLIENT / PROJECT MANAGER:
CLV/Joanna Wadsworth
DESIGNER /CONSULTANT PROJECT MANAGER:
CA Group/Chad Anson

Reviewers/Initials
NDOT - Nevada Dept. of Transportation
CLV - City of Las Vegas
PDK P.D. Kiser, NDOT Safety
HH Hoang Hong, NDOT Traffic Ops

RESPONSE / TYPE ACTION
"A" - ACCEPT COMMENT / WILL COMPLY, REACT AS SUGGESTED
"B" - WILL EVALUATE
"C" - NEEDS TO CLARIFY TO COMMENT
"D" - WILL TAKE NO ACTION IN RESPONSE TO REVIEW COMMENT
"E" - STET = skip Original Reviewers comment (TAKE NO ACTION IN RESPONSE TO ORIGINAL REVIEWER'S COMMENT)

LOCATION					CA Group - RESPONSE			
COMMENT NO.	PAGE NO.	REVIEWER COMMENTS	DATE	REVIEWER INFORMATION	RESPONSE TYPE / ACTION	REVIEW RESPONSE	DATE	RESPONDENT INFORMATION
1	Page 6 - RTC model	Table 2 in this section is intended to show the growth rate between 2013 and 2035 and shows the forecasted traffic volumes on the study section for 2013, 2025 and 2035. The problem I have with the forecasted traffic volumes is they are considerably lower than the existing volumes. The report does not explain this large differential with the existing volumes nor does it explain why the RTC model was not calibrated to current traffic volume levels. In my opinion this makes the annual growth numbers suspect. A calibrated RTC model may come up with the same growth numbers as shown in Table 2 but you won't know that unless the calibration work is done.	10/29/2014	PDK	A	The RTC model forecast numbers presented were direct output from the RTC and no calibration was conducted. Our intent was to determine the model growth rate and compare it with the historical growth rate, and the comparison revealed a flat growth rate so a 1.5% rate was suggested and accepted by CLV. It should be noted that the RTC model includes the interchange at Pecos in 2035 so that explains the volume reduction for that year.	7-23-15	CA
2	Page 14, Alternative 3, Diverging Diamond Interchange (DDI) Retrofit	The last sentence of this section indicates that Table 9 shows Level of Service forecasts. That is incorrect, the table shows intersection delay forecasts and there is no mention of the corresponding Level of Service. The same is true for Tables 7, 8 and 10. I would assume the City would want to know what the Levels of Service are based on the intersection delay. I suggest they also show the LOS for each intersection.	10/29/2014	PDK	A	VISSIM does not provide LOS output like HCS does so the text will be changed to read "Intersection Delay forecast".	7-23-15	CA
3	Page 16, Alternative 4, I-515/Charleston Triple Lefts	Figure 5 shows triple right turns on the NB off-ramp going onto EB Charleston. There is no mention of this proposed configuration in this section. This is a major change and would require considerable traffic control to make it work and most likely would increase delay on EB Charleston.	10/29/2014	PDK	A	Text will be modified to include the triple rights, the triple rights were added to address observations that the queue from the NB off extends to the aux lane on I-515 and does have a positive effect on the delay on that approach.	7-23-15	CA
4	Page 10	NDOT do not have the capability to review Vissim model.	10/30/2014	HH	D	CLV wanted to evaluate a DDI. VISSIM should be used since it can simulate the operations at a DDI. Early on in the project, CA Group had discussions with UDOT that VISSIM was currently the best way to evaluate a DDI.	7-23-15	CA
5	Page 12	Increase? Most of the Alt - 1 Intersection Delay in Table 7 are higher than the No Build.	10/30/2014	HH	A	Text will be modified to "While a more dramatic improvement was initially expected with Alternative 1, the conversion of one of the westbound through lanes to create the dual rights to the northbound on-ramp resulted in insignificant changes to the delay at the interchange for the 2035 peak volumes."	7-23-15	CA
6	Page 14	2 thru westbound and 3 thru eastbound?	10/30/2014	HH	D	The WB through volumes are relatively lower than the WB to SB on ramp volumes, and we were trying not to reconstruct the existing I-515 structure.	7-23-15	CA
7	Page 14	Is triple right necessary? This phase is overlapping with the westbound left + thru. The green time should be more than adequate to handle with a dual right.	10/30/2014	HH	D	The triple rights were added to address observations that the queue from the NB off extends to the aux lane on I-515 and does have a positive effect on the delay on that approach.	7-23-15	CA

I-515 and Charleston Blvd Interchange Feasibility Study

REVIEW COMMENT SHEET

LOCATION					CA Group - RESPONSE			
COMMENT NO.	PAGE NO.	REVIEWER COMMENTS	DATE	REVIEWER INFORMATION	RESPONSE TYPE / ACTION	REVIEW RESPONSE	DATE	RESPONDENT INFORMATION
8	Page 17 - Table 11	Worst than the No Build? Typo?	10/30/2014	HH	D	The increase of the overall travel time for the EB direction in the DDI alternative can be explained by the fact that the DDI is more efficient in delivering traffic from the SB off ramp onto EB Charleston than the conventional diamond interchange. Essentially the EB traffic is being metered by the signal at the SB off ramp of the no build scenario, less traffic on EB Charleston make for less travel time. The Vissim simulation shows the backup for the EB traffic, since the DDI delivers more traffic on a saturated EB direction.	7-23-15	CA
9	Page 19 Recommendations	From Tables 7, 8, and 11 - The results for Alt. 1 & 2 didn't show any improvement.	10/30/2014	HH	D	Alternatives 1 and 2 do not show any savings in the future since the 2035 breakdown along Charleston occurs at the westbound to southbound left turn queue at I-515 and Charleston. However, incorporating Alternative 1 improvements into Alternatives 3 and 4 does help provide additional benefit since Alternatives 3 and 4 address the left turn movement.	7-23-15	CA
10	Page 19 DDI	Too much signal control within the DDI will defeat the purpose of having one. One option is to have the ped walkway running down the middle. The other option is to coordinate the phasing so that the Ped phases won't conflict with the vehicle phases.	10/30/2014	HH	A	Agreed	7-23-15	CA
11		Additional information that would be helpful in the existing conditions would be; length of study area, structure number, a close up map of the interchange	11/5/2014	NDOT	A	Changed text to address structure # and the length.	7-23-15	CA
12		Existing Conditions states that the existing utilities and available right of way will be described in this section. While the section does talk about ownership of the roadways, right of way impacts was not clearly discussed and utilities impacts are not mentioned	11/5/2014	NDOT	A	Added Text to address comments	7-23-15	CA
13	Page 4	The map on page 4 should have I-515 labeled at a minimum. It would be nice to have the other streets labeled as well	11/5/2014	NDOT	A	Updated the map with street names	7-23-15	CA
14	Page 5	Page 5 lists Honolulu Street as Honolulu Street/Sandhill Road. This should be consistent throughout the report	11/5/2014	NDOT	A	Updated the report	7-23-15	CA
15	General	Traffic volumes are discussed in detail including a comparison between NDOT and RTC data, but what AADT is actually being used?	11/5/2014	NDOT	D	Analysis requires peak-hour counts. So AADT was not used. Future peak-hour traffic volume forecast was discussed in page 8. AADT was only used to determine the growth rate.	7-23-15	CA
16	Page 7 & 8	Table 4 and Table 5 list I-15 instead of I-515	11/5/2014	NDOT	A	Updated the tables	7-23-15	CA
17	Page 8	The Project Needs section title is confusing. Are pedestrians and ADA access, access management, safety, and traffic operations the needs for this project? What are the needs, how are they being measured, and what are the goals for improvement?	11/5/2014	NDOT	A	Agreed. Added a note on Page 9.	7-23-15	CA
18	General	Alternatives Evaluation presents the alternatives based on an acceptable level of delay. What is the current level of delay and what is the threshold for what is an acceptable level of delay?	11/5/2014	NDOT	A	Added text on first paragraph in page 12	7-23-15	CA
19	General	A write up explaining the no build condition in 2035 to compare to the alternatives is needed	11/5/2014	NDOT	A	Added text on first paragraph in page 12	7-23-15	CA
20	General	What is the unit for the delay?	11/5/2014	NDOT	A	seconds/vehicle. Added a note under delay on page 11	7-23-15	CA

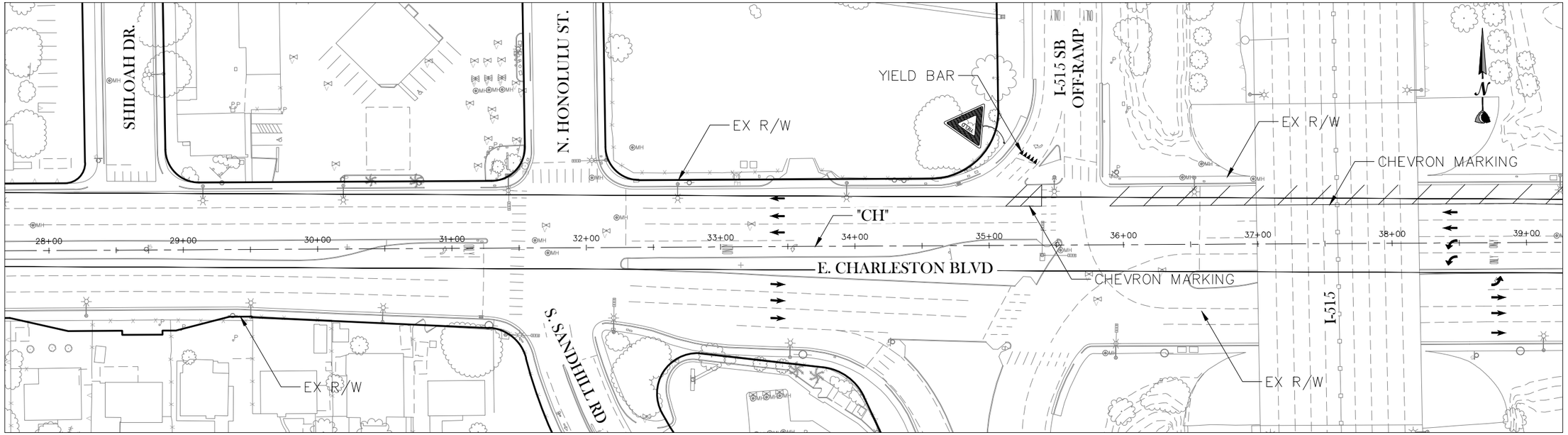
I-515 and Charleston Blvd Interchange Feasibility Study

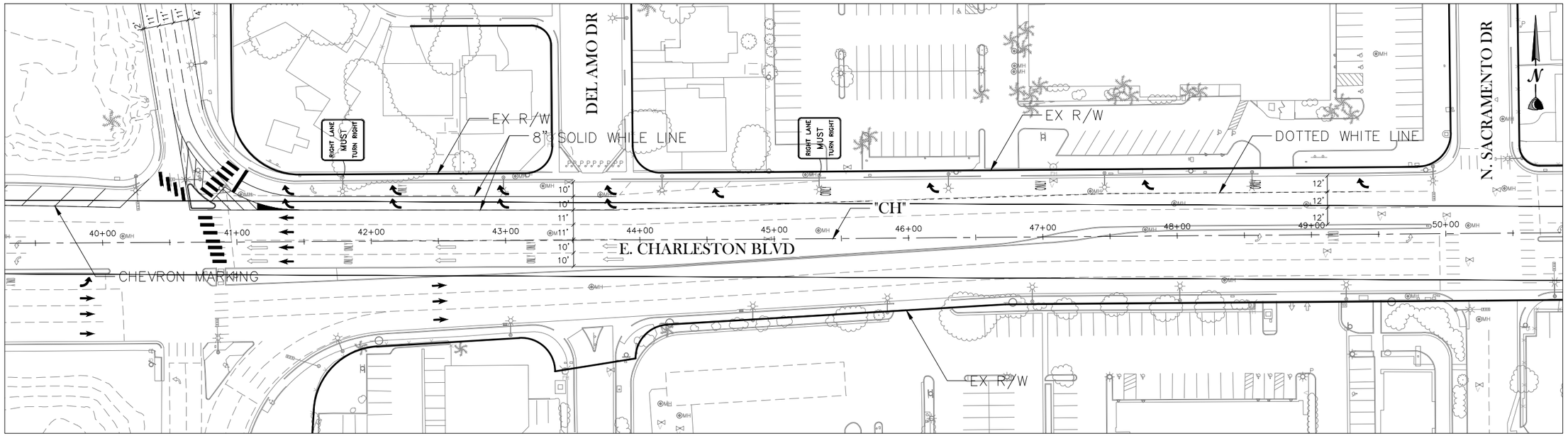
REVIEW COMMENT SHEET

LOCATION					CA Group - RESPONSE			
COMMENT NO.	PAGE NO.	REVIEWER COMMENTS	DATE	REVIEWER INFORMATION	RESPONSE TYPE / ACTION	REVIEW RESPONSE	DATE	RESPONDENT INFORMATION
21	Page 14	Page 14 references the level of service in Table 9, but level of service is not provided	11/5/2014	NDOT	A	VISSIM does not provide LOS output like HCS does so the text will be changed to read "Intersection Delay forecast".	7-23-15	CA
22	Page 17 - Table 11	Table 11 shows that the DDI creates more of a delay for the eastbound traffic in the pm. The pm eastbound and westbound travel time is the same. Is this accurate?	11/5/2014	NDOT	D	The increase of the overall travel time for the EB direction in the DDI alternative can be explained by the fact that the DDI is more efficient in delivering traffic from the SB off ramp onto EB Charleston than the conventional diamond interchange. Essentially the EB traffic is being metered by the signal at the SB off ramp of the no build scenario, less traffic on EB Charleston make for less travel time. The Vissim simulation shows the backup for the EB traffic, since the DDI delivers more traffic on a saturated EB direction.	7-23-15	CA
23	Page 18	How are the recommended alternatives addressing all of the needs for this project?	11/5/2014	NDOT	D	The alternatives are providing reduced vehicular congestion within a confined budget and avoiding negative impacts to mainline I-515. Right-of-way impacts are also minimized.	7-23-15	CA
24	Page 16	Alternate 4 shows reducing westbound thru lane on Charleston from three to two. Will 2035 traffic numbers be able to handle this lane reduction?	11/5/2014	NDOT	D	Two lanes should be able to handle the through traffic. The WB through volumes are relatively lower than the WB to SB on ramp volumes in the AM and almost equal during the PM, AM (thru 1253, lefts 1678) - PM (thru 1238, left 1148)	7-23-15	CA
25	Page 17	The Alternatives evaluation paragraph on Page 17 mentions “providing an estimated cost benefit ratio for each alternative”. There are no cost to benefit ratio shown in report	11/5/2014	NDOT	A	That is an old sentence. It was later decided that a true cost benefit would be difficult to determine due to the impacts to pedestrians within the various alternatives. There is a concern the DDI will not be as pedestrian friendly as the triple lefts and have unmeasurable impacts to pedestrians.	7-23-15	CA
26	General	What are the identifying risks associated with each alternative or at least the two recommended alternatives?	11/5/2014	NDOT	A	We can provide.	7-23-15	CA
27	General	A cost to benefit ratio should be shown on all recommendations	11/5/2014	NDOT	D	It was decided that a true cost benefit would be difficult to determine due to the impacts to pedestrians within the various alternatives. There is a concern the DDI will not be as pedestrian friendly as the triple lefts and have unmeasurable impacts to pedestrians.	7-23-15	CA
28	General	Crash modification factors should be shown for all alternatives or are they just delay driven?	11/5/2014	NDOT	D	Alternatives are delay driven, for the first 3 alternatives we are adding capacity for major movements to address delay; the crash modification factors for DDI is 0.54	7-23-15	CA

Appendix 2

Alternative Preliminary Plans





GRAPHIC SCALE

40 0 20 40 80

1" = 40'

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REVISIONS

NO.	DATE	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS

CITY OF LAS VEGAS NEVADA

CITY ENGINEER: DAVID N. BOWERS, P.E., P.T.O.E.
PROGRAM MANAGER: XXXX.

DESIGNED BY: XX
DRAWN BY: XX
CHECKED BY: XX
DATE: SEP 2013

CA Group, Inc
2785 S. RAINBOW BLVD
LAS VEGAS, NV 89146
PHONE: (702) 685-5945
FAX: (702) 685-5947

TITLE: CHARLESTON - I-515 INTERCHANGE IMPROVEMENTS

SHEET: ALTERNATIVE 1
WESTBOUND CHARLESTON BLVD DUAL RIGHT

PREMILINARY
NOT FOR CONSTRUCTION

Sheet 1 XX of XX

DRAWING NO. ###-####

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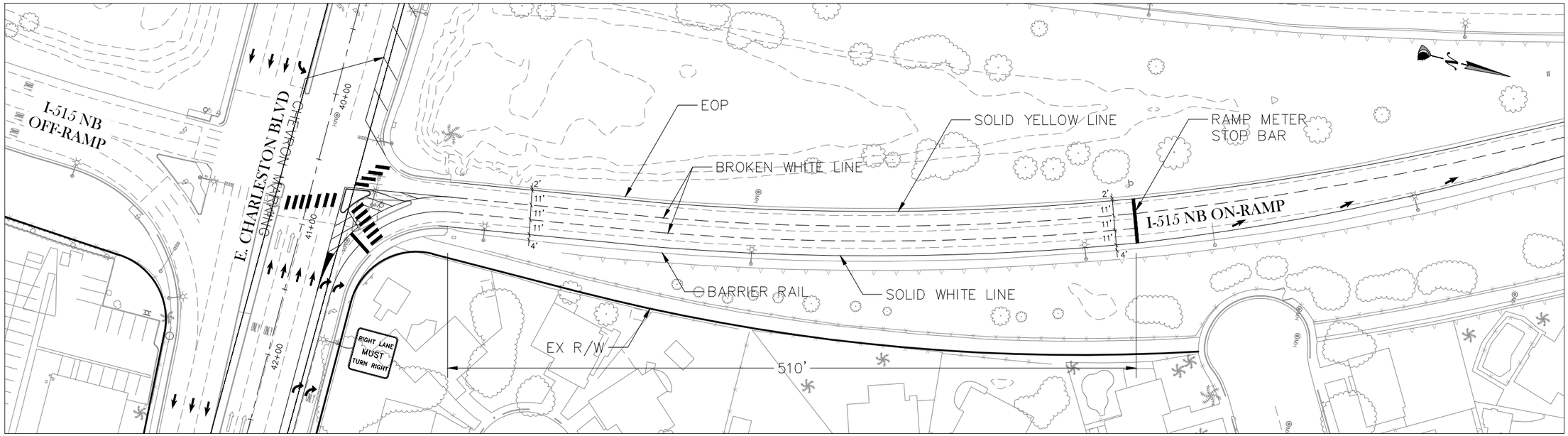

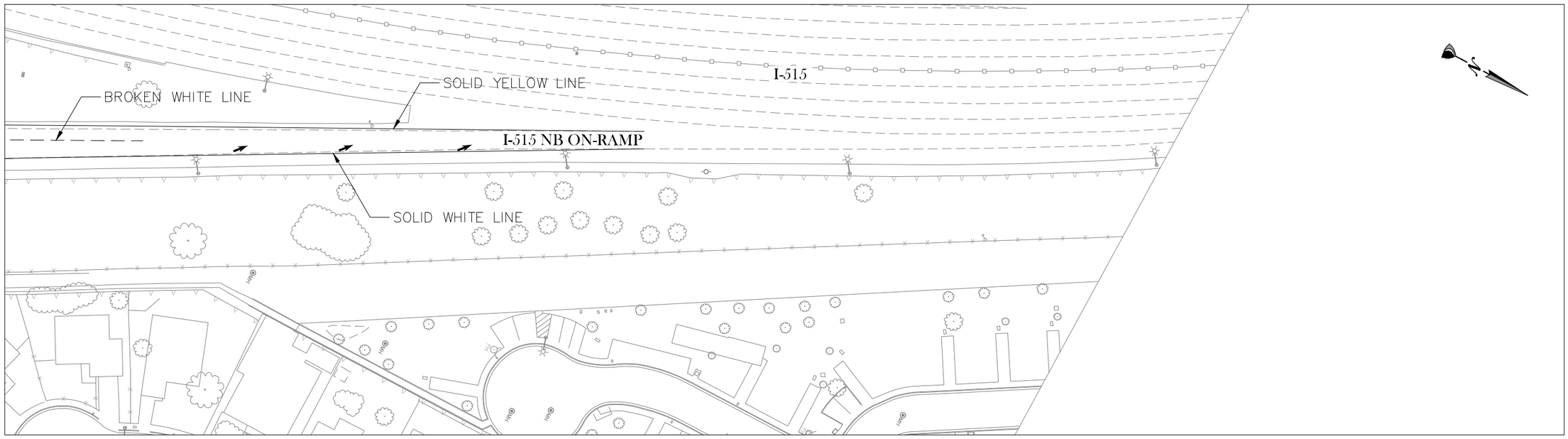

GRAPHIC SCALE

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SHEET: ALTERNATIVE 1
WESTBOUND CHARLESTON BLVD DUAL RIGHT

PREMILINARY
NOT FOR CONSTRUCTION

Sheet
2
XX of XX

DRAWING NO.
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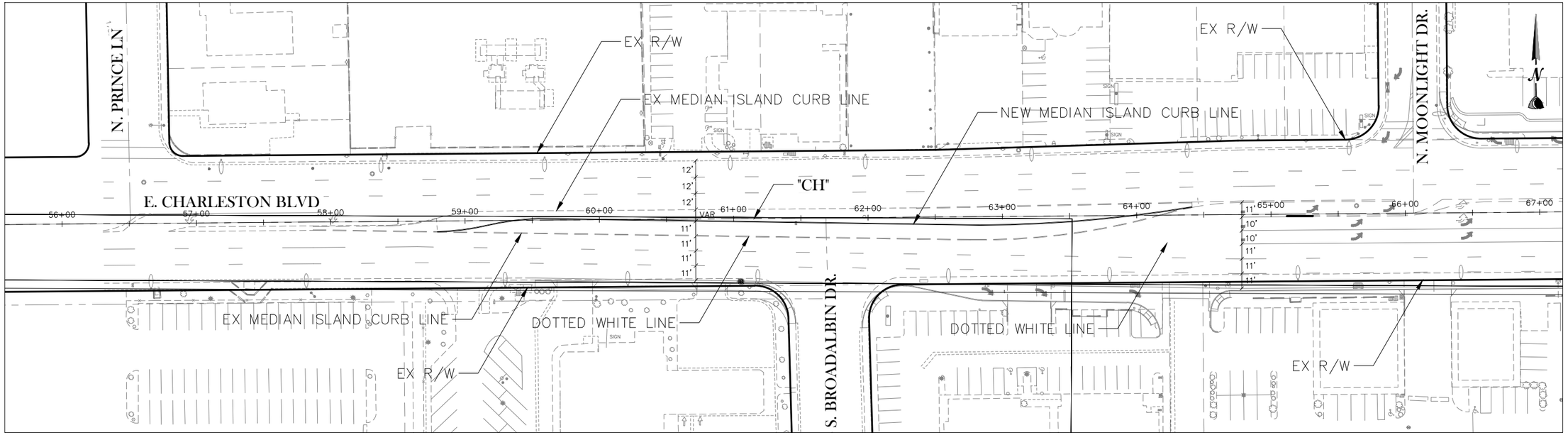

GRAPHIC SCALE

40 0 20 40 80

1" = 40'

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DATE: SEP 2013

CA Group, Inc
2785 S. RAINBOW BLVD
LAS VEGAS, NV 89146
PHONE: (702) 685-5945
FAX: (702) 685-5947

TITLE: CHARLESTON - I-515 INTERCHANGE IMPROVEMENTS

SHEET: ALTERNATIVE 2
EASTBOUND CHARLESTON BLVD AUXILIARY LANE

PREMILINARY
NOT FOR CONSTRUCTION

Sheet 1
XX of XX

DRAWING NO.
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SHILOAH DR.

N. HONOLULU ST.

I-515 SB OFF-RAMP

I-515 SB

TYPE 4 LANE LINE

EX R/W

STORAGE LANE LINE

CAT TRACK

MATCH EXIST.

E. CHARLESTON BLVD

"CH"

28+00 29+00 30+00 31+00 32+00 33+00 34+00 35+00 36+00 37+00 38+00 39+00

BEGIN PROJECT
"CH" 28+50
MATCH EXIST.

TYPE 4 LANE LINE

DOTTED WHITE LINE

HILO AVE

S. SANDHILL RD

I-515 SB ON-RAMP

I-515 NB

N

GRAPHIC SCALE

40 0 20 40 80

1" = 40'

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PROGRAM MANAGER: XXXX.

DESIGNED BY: XX
DRAWN BY: XX
CHECKED BY: XX
DATE: SEP 2013

CA Group, Inc
CIVIL/TRAFFIC/LANDSCAPE ARCHITECTURE
2785 S. RAINBOW BLVD
LAS VEGAS, NV 89146
PHONE: (702) 685-5945
FAX: (702) 685-5947

TITLE:
CHARLESTON – I-515 INTERCHANGE IMPROVEMENTS

SHEET:
ALTERNATIVE 3
DIVERGING DIAMOND INTERCHANGE

PREMILINARY
NOT FOR CONSTRUCTION

Sheet
1
XX of XX

DRAWING NO.
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I-515 NB ON-RAMP

DEL AMO DR

N. SACRAMENTO DR

E. CHARLESTON BLVD

MATCH EXIST.

PROPOSED R/W

EX R/W

CAT TRACK

TYPE 4 LANE LINE

DOTTED WHITE LINE

"CH"

40+00 41+00 42+00 43+00 44+00 45+00 46+00 47+00 48+00 49+00 50+00

STORAGE LANE LINE

END PROJECT
"CH" 50+50
MATCH EXIST.

I-515 NB OFF-RAMP

ONLY ONLY ONLY

GRAPHIC SCALE

40 0 20 40 80

1" = 40'

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DESIGNED BY: XX
DRAWN BY: XX
CHECKED BY: XX
DATE: SEP 2013

2785 S. RAINBOW BLVD
LAS VEGAS, NV 89146
PHONE: (702) 685-5945
FAX: (702) 685-5947

CA Group, Inc

TITLE: CHARLESTON - I-515 INTERCHANGE IMPROVEMENTS

SHEET: ALTERNATIVE 3
DIVERGING DIAMOND INTERCHANGE

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Sheet
2
XX of XX

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###-####

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SHILOAH DR.

N. HONOLULU ST.

I-515 SB OFF-RAMP

I-515 SB

EX R/W

TYPE 4 LANE LINE

EX R/W

CAT TRACK

DOTTED WHITE LINE

BIKE LANE

"CH"

28+00 29+00 30+00 31+00 32+00 33+00 34+00 35+00 36+00 37+00 38+00 39+00

E. CHARLESTON BLVD

EX R/W

BEGIN PROJECT "CH" 32+00 MATCH EXIST.

STORAGE LANE LINE

MATCH EXIST.

MATCH EXIST.

EX R/W

STORAGE LANE LINE

BIKE LANE

HILO AVE

S. SANDHILL RD

I-515 SB ON-RAMP

I-515 NB

N

GRAPHIC SCALE

40 0 20 40 80

1" = 40'

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CITY OF LAS VEGAS NEVADA

CITY ENGINEER: DAVID N. BOWERS, P.E., P.T.O.E.
PROGRAM MANAGER: XXXX.

DESIGNED BY: XX
DRAWN BY: XX
CHECKED BY: XX
DATE: SEP 2013

CA Group, Inc
CAVIGLIA ANSON
2785 S. RAINBOW BLVD
LAS VEGAS, NV 89146
PHONE: (702) 685-5945
FAX: (702) 685-5947

TITLE:

CHARLESTON - I-515 INTERCHANGE IMPROVEMENTS

SHEET:

ALTERNATIVE 4
TRIPLE LEFT TURN DIAMOND INTERCHANGE

PREMILINARY
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Sheet
1
XX of XX

DRAWING NO.
###-####

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I-515 NB ON-RAMP

DEL AMO DR

N. SACRAMENTO DR

E. CHARLESTON BLVD

MATCH EXIST.

TYPE 4 LANE LINE

PROPOSED R/W

EX R/W

DOTTED WHITE LINE

"CH"

STORAGE LANE LINE

END PROJECT
"CH" 50+50
MATCH EXIST.

40+00 41+00 42+00 43+00 44+00 45+00 46+00 47+00 48+00 49+00 50+00

ONLY

I-515 NB OFF-RAMP

N

GRAPHIC SCALE

40 0 20 40 80

1" = 40'

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PROGRAM MANAGER: XXXX.

DESIGNED BY: XX
DRAWN BY: XX
CHECKED BY: XX
DATE: SEP 2013

CA Group, Inc
2785 S. RAINBOW BLVD
LAS VEGAS, NV 89146
PHONE: (702) 685-5945
FAX: (702) 685-5947

TITLE: CHARLESTON - I-515 INTERCHANGE IMPROVEMENTS

SHEET: ALTERNATIVE 4
TRIPLE LEFT TURN DIAMOND INTERCHANGE

PREMILINARY
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Sheet
2
XX of XX
DRAWING NO.
###-####

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Appendix 3

Cost Estimates

Developed by: CA Group/CH2M Hill
Project Manager: Chad Anson

ALERNATIVE 1 - WB Charleston Dual Right Turns to NB I-515

Preliminary Cost Estimate (some items may be combined or assumed inclusive in other items of work shown)

Turn Arrows and "ONLY" (15), Merge Arrows (6), Yield Bar (15 SF), Chevron Markings (1695 SF), Crosswalks (340 SF), Stop Bar (40 SF), Ramp Meter Stop Bar (70 SF)

Item No.	UNIT	Item Description	Quantity	Unit Price	Item Total	Summary	Category	Notes
2021108	LINFT	REMOVAL OF CONCRETE BARRIER RAIL	0	$ 18.00	$ -			
2021144	SQYD	REMOVAL OF BITUMINOUS SURFACE	20	$ 7.00	$ 140.00			
2021212	SQYD	REMOVAL OF SIDEWALK	0	$ 15.00	$ -	$680	Removals	
2021216	SQYD	REMOVAL OF SLOPE PAVING	0	$ 40.00	$ -			
2021224	LINFT	REMOVAL OF CURB AND GUTTER	0	$ 5.00	$ -			
2021316	SQYD	REMOVAL OF MEDIAN ISLAND	60	$ 9.00	$ 540.00			
2030508	CUYD	ROADWAY EXCAVATION	30	$ 14.00	$ 420.00			
3020500	TON	TYPE 1 CLASS B AGGREGATE BASE	60	$ 16.00	$ 960.00			
4026002	TON	PLANTMIX SURFACING (TYPE 2C) (WET)	30	$ 66.00	$ 1,980.00			
4036002	TON	PLANTMIX OPEN-GRADED SURFACING (1/2-INCH)(WET)	10	$ 85.00	$ 850.00			
5020508	CUYD	CLASS A CONCRETE (ISLAND PAVING)	10	$ 300.00	$3,000			
5020628	LINFT	CONCRETE BARRIER RAIL (TYPE A)	0	$ 50.00	$0	$7,990	Roadway	
6130584	LINFT	CLASS A CONCRETE CURB (TYPE 2)	65	$ 12.00	$780			
6130732	LINFT	CLASS A CONCRETE CURB AND GUTTER (TYPE 5)	0	$ 17.00	$0			
6130864	SQYD	CLASS A CONCRETE SIDEWALK (4-INCH)	0	$ 35.00	$0			
6160713	EACH	GUARDRAIL TERMINAL	0	$ 2,200.00	$ -			
6180088	EACH	GUARDRAIL-BARRIER RAIL CONNECTION (TRIPLE CORRUGATION)	0	$ 1,500.00	$ -			
6180528	LINFT	GALVANIZED GUARDRAIL (TRIPLE CORRUGATION)	0	$ 29.00	$ -			
	LS	DRAINAGE	0	$ -	$ -	$0	Drainage	
6230764	LS	REMOVAL OF EXISTING LIGHTING SYSTEM	0	$ 30,000.00	$ -	$0	Lighting & Signals	Relocate signal pole (1), Signal modification
6230316	EACH	STEEL POLE, TYPE 7 (ALL)	0	$ 7,500.00	$ -			
	EACH	TRAFFIC SIGNAL SYSTEM	0	$ 250,000.00	$ -			
	EACH	MODIFY EXISTING TRAFFIC SIGNAL SYSTEM	0	$ 150,000.00	$ -			
	LS	PERMANENT SIGNS	1	$ 700.00	$700	$700	Signs	Install sign on light pole (2), Relocate sign posts (2)
	LS	MOT (4% OF ROADWAY, DRAINAGE, STRUCTURES, RETAINING WALLS, STRIPING & SIGNALS)TOTAL	1	$1,200	$1,200	$1,200	MOT	
	LINFT	RAISED PAVEMENT MARKERS	3755	$ 2.00	$ 7,510.00	$20,560	Striping	
6330612	LINFT	EPOXY PAVEMENT STRIPING (8-INCH SOLID WHITE)	1310	$ 5.00	$ 6,550.00			
6330620	LINFT	EPOXY PAVEMENT STRIPING (8-INCH SOLID YELLOW)	1300	$ 5.00	$ 6,500.00			
6400149	SQFT	RETAINING WALL SURFACE AREA	0	$ 70.00	$ -	$0	Structures	
	LS	UTILITIES	0	$ -	$ -	$0	Utilities	Relocate utility box (2)
					Subtotal	$31,130		
				0.4	Contigency	$12,452		

Construction Total:	$43,582
ROW Total:	0
GRAND TOTAL:	**$43,582**

Developed by: CA Group/CH2M Hill
Project Manager: Chad Anson

Alternative 2: East Bound Charleston Auxiliary Lane

Preliminary Cost Estimate (some items may be combined or assumed inclusive in other items of work shown)

Turn Arrows and "ONLY" (6)

Item No.	UNIT	Item Description	Quantity	Unit Price	Item Total	Summary	Category	Notes
2021108	LINFT	REMOVAL OF CONCRETE BARRIER RAIL	0	18	0	9435	Removals	
2021144	SQYD	REMOVAL OF BITUMINOUS SURFACE	70	$ 7.00	$ 490.00			
2021212	SQYD	REMOVAL OF SIDEWALK	0	$ 15.00	$ -			
2021216	SQYD	REMOVAL OF SLOPE PAVING	0	$ 40.00	$ -			
2021224	LINFT	REMOVAL OF CURB AND GUTTER	565	$ 5.00	$ 2,825.00			
2021316	SQYD	REMOVAL OF MEDIAN ISLAND	680	$ 9.00	$ 6,120.00			
2030508	CUYD	ROADWAY EXCAVATION	220	$ 14.00	$ 3,080.00			
3020500	TON	TYPE 1 CLASS B AGGREGATE BASE	420	$ 16.00	$ 6,720.00			
4026002	TON	PLANTMIX SURFACING (TYPE 2C) (WET)	220	$ 66.00	$ 14,520.00			
4036002	TON	PLANTMIX OPEN-GRADED SURFACING (1/2-INCH)(WET)	30	$ 85.00	$ 2,550.00			
5020508	CUYD	CLASS A CONCRETE (ISLAND PAVING)	20	$ 300.00	$ 6,000.00			
5020628	LINFT	CONCRETE BARRIER RAIL (TYPE A)	0	$ 50.00	$0			
6130584	LINFT	CLASS A CONCRETE CURB (TYPE 2)	565	$ 12.00	$6,780			
6130732	LINFT	CLASS A CONCRETE CURB AND GUTTER (TYPE 5)	0	$ 17.00	$0			
6130864	SQYD	CLASS A CONCRETE SIDEWALK (4-INCH)	0	$ 35.00	$0			
6160713	EACH	GUARDRAIL TERMINAL	0	$ 2,200.00	$0			
6180088	EACH	GUARDRAIL-BARRIER RAIL CONNECTION (TRIPLE CORRUGATION)	0	$ 1,500.00	$ -			
6180528	LINFT	GALVANIZED GUARDRAIL (TRIPLE CORRUGATION)	0	$ 29.00	$ -			
	LS	DRAINAGE	0	$ -	$ -			
6230764	LS	REMOVAL OF EXISTING LIGHTING SYSTEM	0	$ 30,000.00	$ -	$0	Lighting & Signals	
6230316	EACH	STEEL POLE, TYPE 7 (ALL)	0	$ 7,500.00	$ -			
	EACH	TRAFFIC SIGNAL SYSTEM	0	$ 250,000.00	$ -			
	EACH	MODIFY EXISTING TRAFFIC SIGNAL SYSTEM	0	$ 150,000.00	$ -			
	LS	PERMANENT SIGNS	0	$ -	$ -			
	LS	MOT (4% OF ROADWAY, DRAINAGE, STRUCTURES, RETAINING WALLS, ST	1	$ 2,050.00	$2,050	$2,050	MOT	
	LINFT	RAISED PAVEMENT MARKERS	1040	$2	$2,080	$2,080	Striping	
6330612	LINFT	EPOXY PAVEMENT STRIPING (8-INCH SOLID WHITE)	0	$ 5.00	$ -			
6330620	LINFT	EPOXY PAVEMENT STRIPING (8-INCH SOLID YELLOW)	0	$ 5.00	$ -			
6400149	SQFT	RETAINING WALL SURFACE AREA	0	$ 70.00	$ -			
	LS	UTILITIES	0	$ -	$ -	$0	Utilities	Relocate utility box (1)
					Subtotal	53215		
				0.40	Contigency	$21,286		

Construction Total:	$74,501
ROW Total:	0
GRAND TOTAL:	**$74,501**

Developed by: CA Group/CH2M Hill
Project Manager: Chad Anson

Alternative 3: Diverging Diamond Interchange

Preliminary Cost Estimate (some items may be combined or assumed inclusive in other items of work shown)

Item No.	UNIT	Item Description	Quantity	Unit Price	Item Total	Summary	Category	Notes
2021108	LINFT	REMOVAL OF CONCRETE BARRIER RAIL	0	$ 18.00	$ -			
2021144	SQYD	REMOVAL OF BITUMINOUS SURFACE	290	$ 7.00	$ 2,030.00			
2021212	SQYD	REMOVAL OF SIDEWALK	1740	$ 15.00	$ 26,100.00	$64,775	Removals	
2021216	SQYD	REMOVAL OF SLOPE PAVING	0	$ 40.00	$ -			
2021224	LINFT	REMOVAL OF CURB AND GUTTER	3351	$ 5.00	$ 16,755.00			
2021316	SQYD	REMOVAL OF MEDIAN ISLAND	2210	$ 9.00	$ 19,890.00			
2030508	CUYD	ROADWAY EXCAVATION	3620	$ 14.00	$ 50,680.00			
3020500	TON	TYPE 1 CLASS B AGGREGATE BASE	12800	$16	$ 204,800.00			10190 EXCL SIDEWALKS, C&G, MEDIAN
4026002	TON	PLANTMIX SURFACING (TYPE 2C) (WET)	15530	$66	$ 1,024,980.00			
4036002	TON	PLANTMIX OPEN-GRADED SURFACING (1/2-INCH)(WET)	340	$85	$ 28,900.00			This quantity includes cold milling where we are only restriping.
5020508	CUYD	CLASS A CONCRETE (ISLAND PAVING)	10	$300	$3,000			
	CUYD	PCC MEDIAN (4" CONCRETE SLAB)	790	$ 300.00	$ 237,000.00			
5020628	LINFT	CONCRETE BARRIER RAIL (TYPE A)	0	$50	$0	$1,760,959	Roadway	
6130584	LINFT	CLASS A CONCRETE CURB (TYPE 2)	5208	$12	$62,496			
6130732	LINFT	CLASS A CONCRETE CURB AND GUTTER (TYPE 5)	3459	$17	$58,803			
6130864	SQYD	CLASS A CONCRETE SIDEWALK (4-INCH)	2580	$35	$90,300			
6160713	EACH	GUARDRAIL TERMINAL	0	$ 2,200.00	$ -			
6180088	EACH	GUARDRAIL-BARRIER RAIL CONNECTION (TRIPLE CORRUGATION)	0	$ 1,500.00	$ -			
6180528	LINFT	GALVANIZED GUARDRAIL (TRIPLE CORRUGATION)	0	$ 29.00	$ -			
	LS	DRAINAGE	1	$ 88,047.95	$ 88,047.95	$88,048	Drainage	5% of roadway improvements.
6230764	LS	REMOVE AND REPLACE EXISTING LIGHTING SYSTEM	1	$ 120,000.00	$ 120,000.00			
6230316	EACH	STEEL POLE, TYPE 7 (ALL)	17	$ 8,500.00	$ 144,500.00	$1,014,500	Lighting & Signals	
	EACH	TRAFFIC SIGNAL SYSTEM	2	$300,000	$ 600,000.00			
	EACH	REMOVE EXISTING TRAFFIC SIGNAL SYSTEM	1	$150,000	$ 150,000.00			
	LS	PERMANENT SIGNS	1	$ 97,609.59	$ 97,609.59	$97,610	Signs	
	LS	MOT (4% OF ROADWAY, DRAINAGE, STRUCTURES, RETAINING WALLS, STRIPING & SIGNALS)TOTAL	1	$ 131,600.00	$ 131,600.00	$131,600	MOT	
	EACH	REFLECTIVE RAISED PAVEMENT MARKERS	527	$ 2.00	$ 1,054.72			
	EACH	NON-REFLECTIVE RAISED PAVEMENT MARKERS	1542	$ 2.00	$ 3,084.40			
6330612	LINFT	EPOXY PAVEMENT STRIPING (8-INCH SOLID WHITE)	6329	$ 5.00	$ 31,645.00			
6330620	LINFT	EPOXY PAVEMENT STRIPING (8-INCH SOLID YELLOW)	2258	$ 5.00	$ 11,290.00			
6400149	SQFT	RETAINING WALL SURFACE AREA	0	$ 70.00	$ -	$0	Structures	
	LS	UTILITIES	1	$ 218,000.00	$ 218,000.00	$218,000	Utilities	adjustments, misc.
					Subtotal	$3,421,511		
				0.4	Contigency	$1,368,604		

	Construction Total:	$ 4,790,115
	ROW Total:	$ 800,000
	GRAND TOTAL:	**$ 5,590,115**

RIGHT-OF-WAY	1	778000	$ 800,000.00	

Developed by: CA Group/CH2M Hill
Project Manager: Chad Anson

Alternative 4: Triple Left Turns

Preliminary Cost Estimate (some items may be combined or assumed inclusive in other items of work shown)

Turn Arrows and "ONLY" (6)

Item No.	UNIT	Item Description	Quantity	Unit Price	Item Total	Summary	Category	Notes
2021108	LINFT	REMOVAL OF CONCRETE BARRIER RAIL	0	$ 18.00	$ -			
2021144	SQYD	REMOVAL OF BITUMINOUS SURFACE	280	$ 7.00	$ 1,960.00			
2021212	SQYD	REMOVAL OF SIDEWALK	1950	$ 15.00	$ 29,250.00	$57,205	Removals	
2021216	SQYD	REMOVAL OF SLOPE PAVING	0	$ 40.00	$ -			
2021224	LINFT	REMOVAL OF CURB AND GUTTER	3687	$ 5.00	$ 18,435.00			
2021316	SQYD	REMOVAL OF MEDIAN ISLAND	840	$ 9.00	$ 7,560.00			
2030508	CUYD	ROADWAY EXCAVATION	2470	$ 14.00	$ 34,580.00			
3020500	TON	TYPE 1 CLASS B AGGREGATE BASE	8280	$ 16.00	$ 132,480.00			6850 EXCL SIDEWALKS, C&G, MEDIAN
4026002	TON	PLANTMIX SURFACING (TYPE 2C) (WET)	12460	$ 66.00	$ 822,360.00			
4036002	TON	PLANTMIX OPEN-GRADED SURFACING (1/2-INCH)(WET)	230	$ 85.00	$ 19,550.00			
5020508	CUYD	CLASS A CONCRETE (ISLAND PAVING)	40	$ 300.00	$ 12,000.00			
	CUYD	PCC MEDIAN (4" CONCRETE SLAB)	170	$ 300.00	$ 51,000.00			
5020628	LINFT	CONCRETE BARRIER RAIL (TYPE A)	0	$ 50.00	$ -	$1,252,375	Roadway	
6130584	LINFT	CLASS A CONCRETE CURB (TYPE 2)	2962	$ 12.00	$ 35,544.00			
6130732	LINFT	CLASS A CONCRETE CURB AND GUTTER (TYPE 5)	3333	$ 17.00	$ 56,661.00			
6130864	SQYD	CLASS A CONCRETE SIDEWALK (4-INCH)	2520	$ 35.00	$ 88,200.00			
6160713	EACH	GUARDRAIL TERMINAL	0	$ 2,200.00	$ -			
6180088	EACH	GUARDRAIL-BARRIER RAIL CONNECTION (TRIPLE CORRUGATION)	0	$ 1,500.00	$ -			
6180528	LINFT	GALVANIZED GUARDRAIL (TRIPLE CORRUGATION)	0	$ 29.00	$ -			
	LS	DRAINAGE	1	$ 241,800.00	$ 241,800.00	$241,800	Drainage	940 LF of system North side. 3 DI mods south, 4 NEW ON NORTH SIDE
6230764	LS	REMOVAL OF EXISTING LIGHTING SYSTEM	1	$ 120,000.00	$ 120,000.00			
6230316	EACH	STEEL POLE, TYPE 7 (ALL)	17	$ 8,500.00	$ 144,500.00	$1,014,500	Lighting & Signals	
	EACH	TRAFFIC SIGNAL SYSTEM	2	$ 300,000.00	$ 600,000.00			
	EACH	MODIFY EXISTING TRAFFIC SIGNAL SYSTEM	1	$ 150,000.00	$ 150,000.00			
	LS	PERMANENT SIGNS (1% of Roadway, Drainage+sign bridges)	1	$ 92,523.75	$ 92,523.75	$92,524	Signs	Includes 1 sign bridges for prepositioning on WB side
	LS	MOT (4% OF ROADWAY, DRAINAGE, STRUCTURES, RETAINING WALLS, STRIPING & SIGNALS)TOTAL	1	$ 107,700.00	$ 107,700.00	$107,700	MOT	
	EACH	REFLECTIVE RAISED PAVEMENT MARKERS	662	$ 2.00	$ 1,324.18			
	EACH	NON-REFLECTIVE RAISED PAVEMENT MARKERS	1906	$ 2.00	$ 3,811.55	$34,041	Striping	33 Arrow Legends
6330612	LINFT	EPOXY PAVEMENT STRIPING (8-INCH SOLID WHITE)	3136	$ 5.00	$ 15,680.00			
6330620	LINFT	EPOXY PAVEMENT STRIPING (8-INCH SOLID YELLOW)	2645	$ 5.00	$ 13,225.00			
6400149	SQFT	RETAINING WALL SURFACE AREA	0	$ 70.00	$ -	$0	Structures	
	LS	UTILITIES	1	$ 218,000.00	$ 218,000.00	$218,000	Utilities	Cox, Century Link / NVE relocation / LVVWD
								120000 / 8 poles / 3 hydrants
					Subtotal	$3,018,144		80000 / 18000
				0.4	Contigency	$1,207,258		
					Construction Total:	$ 4,225,402		
					ROW Total:	$ 800,000		
					GRAND TOTAL:	**$ 5,025,402**		FACTOR OF 2 - ESTIMATE FROM ZILLOW
		RIGHT-OF-WAY	1	778000	$ 800,000.00			