TRAFFIC SIGNAL COMMUNICATION SYSTEM GAP ANALYSIS

DECEMBER 2021

PREPARED FOR

REGIONAL TRANSPORTATION COMMISSION OF SOUTHERN NEVADA
CITY OF LAS VEGAS PUBLIC WORKS

PREPARED BY:

GCW, INC.
1555 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146

ENGINEERS \ SURVEYORS

TABLE OF CONTENTS

I

Willie Felkins

Digitally signed by Willie Felkins
DN: C=US, E=wfelkins@gcwengineering.com, O="GCW, Inc.", CN=Willie Felkins
Reason: I am the author of this document
Date: 2021.12.29 13:53:02-08'00'

INTRODUCTION

The project goal was to develop a time-phased implementation plan to expand Arterial Management System (AMS) network connectivity via fiber optic communications to all traffic signal systems operated and maintained by the City of Las Vegas (City). As infrastructure complexity and data volume expands, communication via fiber optic is necessary due to data limitations of copper interconnect cable and wireless radio communications. The AMS is managed by the Regional Transportation Commission of Southern Nevada (RTC) Freeway and Arterial System of Transportation (FAST), in conjunction with each respective local agency, with the goal of achieving safe and efficient traffic flow on streets and arterials through the use of traffic signal systems and other advanced technologies. RTC FAST serves as an integrated Intelligent Transportation Systems (ITS) organization that is primarily responsible for the monitoring and management of traffic on both arterials and freeways in Southern Nevada.

The City currently owns, operates, and maintains over 632 signalized intersections within its boundaries, of which 458 are currently or proposed to be connected in the near future to the region's AMS via a reliable, high-speed fiber-optic communication network. Southern Nevada's current AMS communications network is comprised of fiber optic cable, copper interconnect, and wireless radios. This study inventoried the existing AMS communication network within the City, with a focus on providing fiber optic connections to signalized intersections by installing fiber optic trunklines along 80-foot and 100-foot right-of-way roadways. Prioritization recommendations will be developed for short and long-term improvements to enhance and expand the AMS fiber optic communications network to achieve 100% connectivity to the City's existing and future traffic signal systems, as well as to RTC FAST communication hubs. The study consisted of the following tasks:

1. Project Management and Coordination
2. Data Collection
3. Gap Analysis & Implementation

PROJECT MANAGEMENT AND COORDINATION

A Kick-off meeting was held on January 20, 2021 which included representatives of RTC, FAST and the City. Progress meetings were held on a monthly basis. Meeting notes for Kick-off and progress meetings are included in Appendix B. A presentation of the study was given to the Operation Management Committee (OMC) and Executive Advisory Committee (EAC) on September 21, 2021 and November 18, 2021, respectively. The project schedule consisted of a 12-month duration as shown in Figure 1:

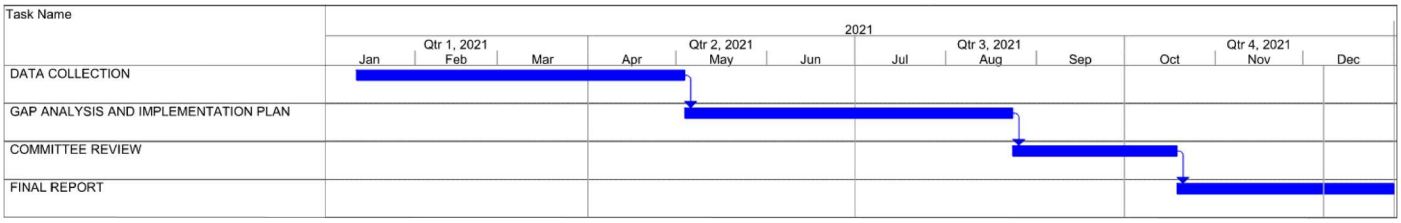

Figure 1. Project Schedule

DATA COLLECTION

Data collection consisted of obtaining and reviewing studies, plans, maps, datasets and documents related to the AMS and traffic signal systems with the City, including:

- RTC FAST Infrastructure Map
- City Traffic Signal Master Plan
- City Mobility Master Plan
- City Capital Improvement Projects (CIP) Planned Projects
- City Operations & Maintenance (O&M) Planned Projects
- City Arterial Rehabilitation Program (ARP) Planned Projects
- As-builts for 226 traffic signal intersections
- City of Las Vegas GIS Data Connections including:
    - Existing Traffic Signal Locations
    - Annual Daily Traffic (ADT) Count Station Data

The collection of data from these references presented the following challenges:

- Geocoded data from the City was dynamic and constantly updating throughout the project which made it difficult to identify new and updated information. Logging the updates as they are made would have helped capture the new and updated information more easily.
- Inconsistent and misnamed as-builts in the agency database made it difficult to narrow the research. Agencies should establish and enforce a consistent naming convention for as-builts.
- RTC FAST fiber network GIS layer was not updated with the most recent project information. A new position at RTC FAST has been established to assist in keeping this layer updated with more current information.

A list of existing and future traffic signals was provided by the City. Using the information collected, connection types of the existing traffic signals were determined and are summarized in Table 1. It was determined that approximately 25% of the existing and proposed traffic signals were found not to be connected via fiber optic communications by comparing known ITS locations with a list of signal switches provided by FAST indicating connection type. These signals are referred to as "*unconnected*" in this report.

Table 1. Existing Signal Connection

CONNECTION TYPE	QTY	PERCENT (%)
Fiber (Existing)	454	71.8
Copper	125	19.8
None/Unable to confirm	38	6.2
Fiber (*Proposed)	4	0.6
Radio	11	1.7
TOTAL	**632**	

* Planned to be connected as part of upcoming project

Average Daily Traffic (ADT) at unconnected signals was obtained through a GIS connection to the City's Geoview website.

GAP ANALYSIS AND IMPLEMENTATION PLAN

CORRIDOR DEVELOPMENT

Gaps in the fiber optic communication network of unconnected signals were grouped into continuous corridors by 80-foot and 100-foot right-of-way roadway widths. A total of 54 corridors were identified ranging in length from ¼ to 5 miles, totaling over 101 miles shown on Figure 2. A total of 11 unconnected signals were considered isolated and will be assumed to be connected from an extension of an existing/proposed fiber connected corridor via a communications distribution cable assembly (CDCA).

COST ESTIMATING

The estimated cost to connect the currently unconnected signals to fiber optic communication system was estimated utilizing cost estimates from previous ITS projects, including previous RTC FAST Furnish and Install projects, and are based on the following assumptions:

1. One 4-inch conduit on one side of the roadway.
2. P30 pull boxes spaced every 750 feet.

3. One Type 200 splice vault at each signalized intersection.
4. Fiber optic cable length includes 120 feet of slack at Type 200 splice vaults and 30 feet of slack at P30 pull boxes.
5. Design fees are 6% of construction cost.
6. New conduit and pull boxes/splice vaults to be installed. No existing conduit and pull boxes were assumed to be utilized based on the limited amount and unknown condition. The City requested not to utilize existing conduit smaller than 3 inches in diameter for cost estimating purposes.

Table 2 shows a breakdown of construction cost estimates per mile.

Table 2. Construction Cost Estimate per Mile

ITEM	UNIT	QTY	UNIT COST	$/MILE
4-Inch PVC Conduit	Linear Foot	5,800	$170	$986,000
P30 Pull Box	Each	8	$3,600	$28,800
Type 200 Splice Vault	Each	2	$10,500	$21,000
144-Strand Fiber Optic Cable	Linear Foot	5,800	$26	$150,800
Splice Enclosure and CDCA	Each	2	$5,600	$11,200
Layer 2 Ethernet Switch	Each	2	$2,750	$5,500
Aggregate Ethernet Switch	Each	2	$10,000	$20,000
ATC Controller	Each	2	$4,350	$8,700

It should be noted that during final design of the proposed corridors, field inventory of the existing infrastructure should be performed to determine the size and condition of conduit, pull boxes, and conduit sweeps of any existing ITS infrastructure that could be utilized instead of installing new. This would significantly reduce the proposed construction cost estimates.

SEGMENT PRIORITIZATION

The corridors of unconnected signals were prioritized as Low and High Priority and are shown on Figure 2. The Low Priority are shown in cyan and High Priority are shown in yellow. The prioritization were based on the following major factors:

1. Fiber needs identified by FAST due to fiber missing or capacity issues (bottlenecks). Bottlenecks and progression issues were determined based on age and capacity of copper AMS network in area.
2. Traffic progression needs identified by FAST and the City.
3. Traffic counts.

Other factors considered included:

1. Existing and proposed hub locations.
2. Construction cost estimates.
3. Upcoming project schedules.

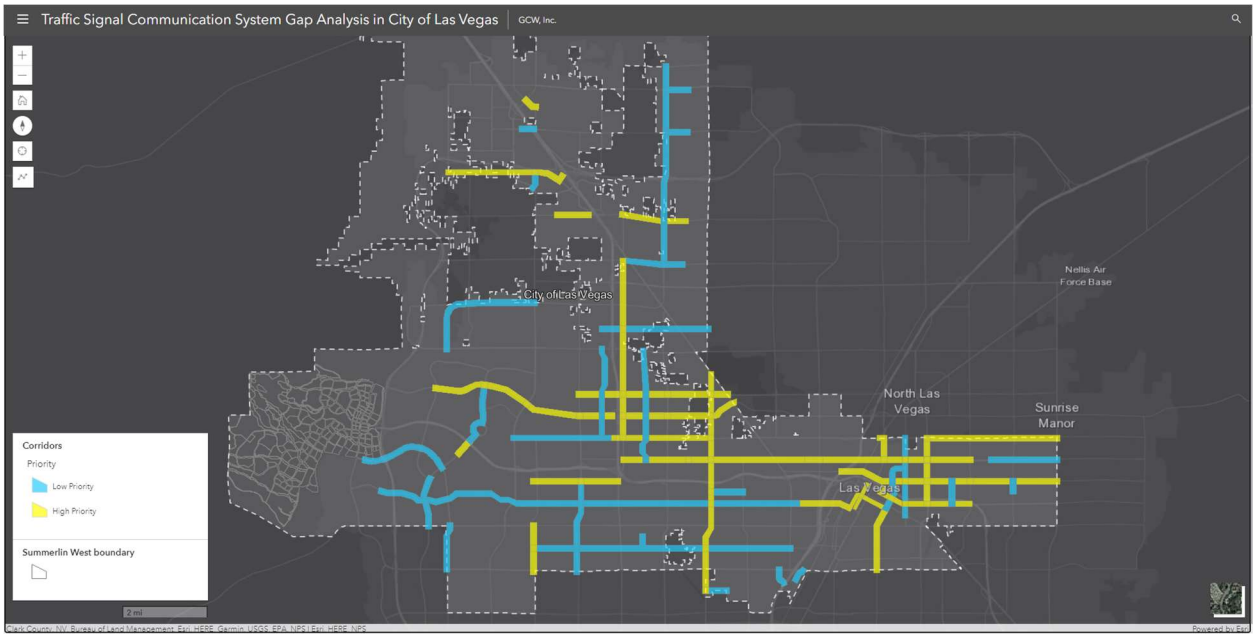

Figure 2. GIS WebApplication Segment Priority Color Coding

HIGH PRIORITY CORRIDORS

High priority corridors included segments that were identified by FAST as experiencing a fiber capacity/bottleneck or traffic signal progression challenges. Decatur Boulevard between Pennwood Avenue and Rancho Drive was ranked as the number one priority based on FAST recommendations. The remaining 29 high priority corridors were then ranked based on the ADT. The total cost for the high priority corridors is estimated at $60 million. Based on the current City budget forecast, these projects will be completed in 17 years. Three of the high priority corridors are included on the O&M future project lists.

LOW PRIORITY CORRIDORS

Low priority corridors were identified as not experiencing fiber capacity/bottlenecks or traffic signal progression challenges by FAST. The estimated construction cost of the 25 low priority corridors is $50 million, and based on current funding levels would take approximately 14 years to complete following the completion of high priority corridors. Nine of the low priority corridors are proposed CIP, ARP, or O&M projects.

ISOLATED

Traffic signals that are currently unconnected and not having any adjacent signals along the roadway are considered isolated. These isolated signals are typically within a mile of a fiber optic communication trunk line and can be connected to fiber via a CDCA. Typically CDCA lengths are less than ¼-mile in length but due to the feasibility of the installation of trunkline fiber optic communication, CDCA was determined to be a viable option. A total of 11 intersections have been identified as isolated. These isolated signals are recommended to be added to adjacent construction or rehabilitation projects. The existing data radio or copper interconnect connections to nearby signals are expected to be maintained until fiber connection can be established.

Future upcoming projects included on the City CIP, O&M, and ARP lists were identified. The fiber optic communication infrastructure along these corridors is assumed to be included in the upcoming project to take advantage of the significant savings of paving operations with the conduit trenching required. These planned projects lists include projects that are planned to be constructed within the next 5 years. A summary of the corridors and prioritization is included in Appendix A. The summary also includes:

- City Council Ward
- Right-of-Way
- Length
- Number of signals
- Estimated construction cost
- Hub No.
- CIP/O&M/ARP projects
- Priority

The City anticipates budgeting approximately $3,600,000 for the design and construction of ITS infrastructure projects each year.

GIS WEBAPPLICATION

A GIS WebApplication was developed to illustrate the gaps in AMS fiber optic communication network connectivity at existing and future traffic signal systems. The WebApplication is a geographic representation of the information gathered and developed during the study. The GIS WebApplication included layers from publicly available sources such as FAST, City, Clark County and Environmental Systems Research Institute (ESRI) consisting of the following:

- Traffic Signals: Connection type.
- ITS infrastructure: Type and size of conduit, pull boxes, and fiber optic cable.

- Contextual information: Roads, right-of-way, City wards, traffic count stations, CIP/O&M/ ARP maps, and imagery.

Figure 3 shows the GIS WebApplication which shows highlighted segments as the proposed corridors to complete the gaps in fiber AMS network. Corridor feature attributes indicate estimated cost, priority, unconnected signals. The WebApplication can be found at the following address: https://gcw.maps.arcgis.com/apps/Styler/index.html?appid=df7e4606ae5a42a5abcd6b0c4e20bfeb

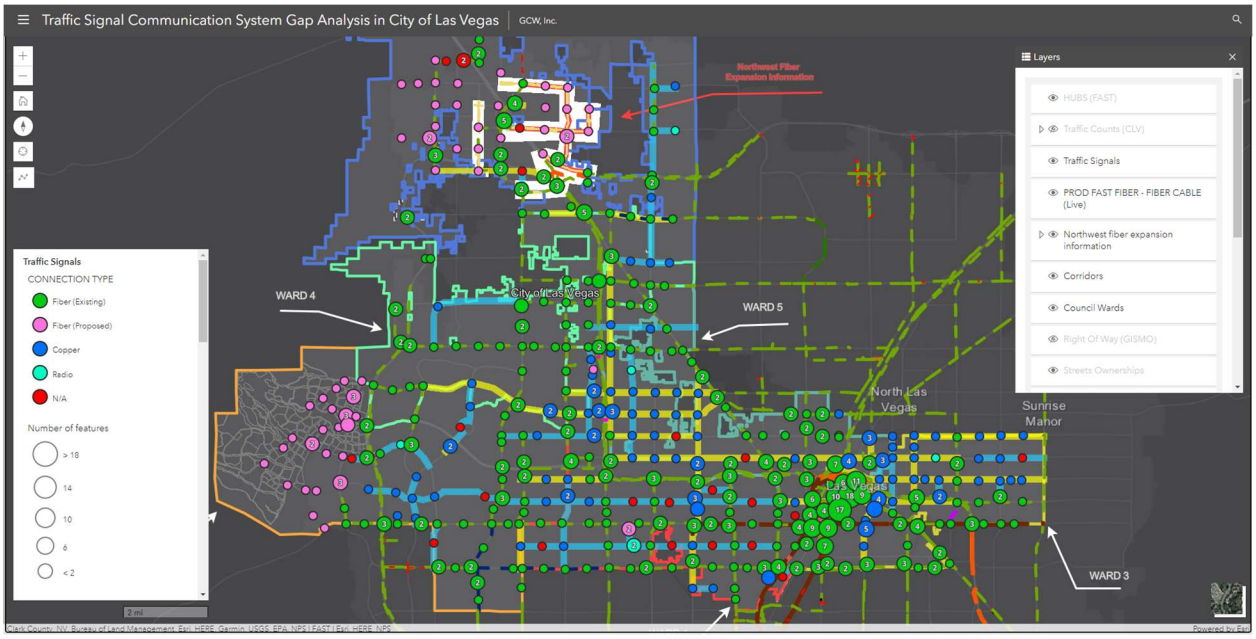

Figure 3. GIS WebApplication with Legend

RECOMMENDATIONS

The following recommendations will assist with the build out of ITS fiber optic communication network within the City:

1. City shall ensure that the proposed private developments include the construction of the ITS infrastructure required per Uniform Standard Drawings for Public Works' Off-Site Improvements, Clark County Area, Nevada (USDCCA) – Drawing No. 765.
2. FAST HUB Expansion. FAST noted that as fiber expansion and data demands increase current hub capacity will be insufficient. FAST has identified the following three new hub expansions to consider as part of the City fiber network:
    - Downtown (separate from current NDOT Hub #5)
    - Northwest area near Elkhorn Road and Fort Apache Road
    - Summerlin

    The proposed area required for each hub is approximately a 12-foot by 12-foot area.
3. Assign specific color of fiber optic strand to particular agencies and utilities. This is recommended in areas of dense splices, or sharing of infrastructure. Inconsistent color usage between agencies makes determining routing between splices difficult for data tracing purposes. Assigning colors would reduce this confusion and reduce cost of tracking and mapping paths.
4. The installation of ITS infrastructure shall be combined with roadway rehabilitation and maintenance projects. This would allow expediting the build-out of ITS infrastructure in parallel with roadway improvements and reduce the overall cost.
5. Establish standards for network design, system architecture, and fiber for different right-of-way roadways on a regional level to plan and provide a clear direction for future fiber design.

OPERATIONS AND MAINTENANCE

To build on the efforts completed during this study, the GIS WebApplication should be routinely updated so it can be effectively used to plan the proposed ITS infrastructure needs and coordinate with upcoming projects. Because the WebApplication consists of GIS layers developed by GCW, and GIS server connections utilizing publicly available data, the City will need to assemble the layers below:

GCW-Provided layers:

1. Traffic Signals: Color-coded points representing traffic signals within City. This layer consists of the City server signal list with added information for as-builts, connection types, and future signals.
2. Corridors: Proposed 54 corridors to fill in the missing ITS fiber optic gaps in the AMS network. This layer is controlled by an AutoCAD (.dwg) file.
3. City CIP/ARP Maps: PDFs that display and list planned roadway projects by City.
4. Summerlin West: Planned roadways in the proposed Summerlin West expansion.
5. Northwest Fiber Expansion: ITS infrastructure currently under construction in the City's northwest.

GIS Layers from public server connections:

Agency GIS Server	Layer Information
Clark County OpenWeb (Gismo)	Roadway centerline, street names, right-of-way, and parcel boundaries.
RTC FAST Infrastructure Map	Existing AMS fiber optic cable and hub locations.
City of Las Vegas	Ward boundaries. Traffic signal data was exported from this server and modified for additional properties related to this project.

With the provided layers and above referenced server connections, City GIS technicians will have to rebuild the WebApplication. These layers and associated spreadsheets or drawings, should be updated as projects are completed or CIP/ARP programs are modified. A process to receive and update the WebApplication should be developed to ensure the most current information is included. A City staff member should be assigned to be responsible for the process. It is also recommended to incorporate the traffic signal spreadsheet into the CLV traffic signal layer, or vice versa. Doing this would prevent the need to maintain two sources of information, and allow the WebApplication to be linked to the live signal layer, reducing the update workflow.

APPENDIX A – PROPOSED CORRIDORS

PROPOSED CORRIDORS

Ward	Corridor	ROW Width	From	To	Length (mi)	ADT	Hub(s)	CIP/ARP	Priority	No. of Signals	Cost Per Mile	Notes
1, 5	Decatur Blvd	100	Pennwood Ave	Rancho Dr	5.00	37,510	1, 4	-	1	12	$ 1,071,840.00	FAST signal progression priority. FAST highest priority.
1, 4	Lake Mead Blvd	100	Buffalo Dr	Rock Springs Dr	0.75	35,521	15	-	2	3	$ 1,127,840.00	FAST bottleneck location list. FAST signal progression priority
1, 2	Durango Dr	100	Sahara Ave	Charleston Blvd	1.00	35,500	3	2020	3	1	$ 500,240.00	FAST bottleneck location list
3	Eastern Ave	100	Stewart Ave	Owens Ave	1.52	31,054	6	-	4	4	$ 1,079,661.05	FAST bottleneck location list
5	Lake Mead Blvd	100	Rainbow Blvd	Jones Blvd	1.00	29,909	15	-	5	4	$ 1,127,840.00	FAST bottleneck location list. FAST signal progression priority.
4, 6	Ann Rd	100	Rainbow Blvd	Bradley Rd	1.50	29,597	9	-	6	0	$ 992,640.00	FAST bottleneck location list
3, 5	Maryland BRT	100	Sahara Ave	Tonopah Dr	5.00	29,380	5, 7	-	7	9	$ 1,051,920.00	FAST bottleneck location on Bonneville from Grand Central PKWY to Main Street
1, 2, 4	Lake Mead Blvd	100	Rampart Blvd	Buffalo Dr	1.30	27,590	15	-	8	3	$ 1,070,547.69	FAST bottleneck location list. FAST signal progression priority
3	Bonanza Rd	100	Pecos Rd	Nellis Blvd	2.00	25,672	6	-	9	4	$ 1,059,640.00	FAST signal progression priority
2, 4	Lake Mead Blvd	100	Anasazi Dr	Rampart Blvd	2.25	25,463	15	-	10	1	$ 1,006,595.56	FAST bottleneck location list. A portion is included in O&M #23 (2022-2024). FAST signal progression priority
4, 6	Ann Rd	100	Cimarron Rd	Centennial Center Blvd	0.73	23,482	9	-	11	0	$ 995,829.04	FAST bottleneck location list
3, 5	Bonanza Rd	100	H Street	Pecos Rd	3.00	22,927	5	-	12	9	$ 1,092,240.00	FAST signal progression priority
5	Lake Mead Blvd	100	Jones Blvd	Rancho Dr	1.40	21,507	1	-	13	2	$ 1,039,382.86	FAST bottleneck location list. FAST signal progression priority.
1, 5	Rainbow Blvd	80	Vegas Dr	Lone Mountain Rd	4.00	20,121	15	-	14	4	$ 1,025,540.00	FAST bottleneck location list. A portion is included in O&M #21 (2022-2024)
3, 5	Washington Ave	100	Bruce Street	Eastern Ave	0.50	16,869	5	-	15	2	$ 1,127,840.00	FAST signal progression priority
3	Owens Ave	100	Eastern Ave	Nellis Blvd	3.00	16,413	6	-	16	2	$ 1,014,773.33	FAST signal progression priority
3	Washington Ave	100	Eastern Ave	Pecos Rd	1.00	15,807	6	-	17	3	$ 1,094,640.00	FAST signal progression priority
1, 4, 5	Smoke Ranch Rd	100	Buffalo Dr	Jones Blvd	2.00	14,525	15	-	18	5	$ 1,076,240.00	FAST signal progression priority
5	Smoke Ranch Rd	100	Jones Blvd	Rancho Dr	1.40	13,425	1	-	19	3	$ 1,063,097.14	FAST signal progression priority
5	Washington Ave	100	Cornstock Dr	Martin L King Blvd	0.25	13,288	1	-	20	3	$ 1,393,440.00	FAST signal progression priority
3	Washington Ave	100	Sandhill Rd	Nellis Blvd	1.50	12,363	6	2026	21	4	$ 1,081,173.33	O&M #24 (2022-2024). FAST signal progression priority
1, 3, 5	Washington Ave	100	Michael Way	Bruce Street	5.00	12,085	1, 5	-	22	10	$ 1,058,560.00	FAST signal progression priority
1, 5	Vegas Dr	100	Rock Springs Dr	Decatur Blvd	2.25	11,367	15	-	23	3	$ 1,036,106.67	FAST bottleneck location list. O&M #12 (2022-2024)
3, 5	Stewart Ave	100	Bruce Street	Pecos Rd	1.50	11,288	6	-	24	3	$ 1,059,040.00	FAST bottleneck location list
1, 5	Washington Ave	100	Rainbow Blvd	Michael Way	1.50	10,800	1	-	25	3	$ 1,059,040.00	FAST signal progression priority
3,5	Stewart Ave	80	8th Street	Bruce Street	0.83	8,157	5	-	26	2	$ 1,072,264.10	FAST bottleneck location list
6	Centennial Center Blvd	100	Hualapai Way	Hub 9	2.75	7,921	9	-	27	3	$ 1,028,640.00	FAST bottleneck location list
5	Las Vegas Blvd	100	Washington Ave	Owens Ave	0.50	7,350	5	-	28	1	$ 1,061,440.00	FAST bottleneck location list
1, 2	Westcliff Dr	100	Durango Dr	Rainbow Blvd	1.87	5,542	16	-	29	2	$ 1,028,699.89	FAST bottleneck location list
3, 5	3rd Street	80	Clark Ave	Stewart Ave	0.55	4,533	5	-	30	3	$ 1,173,512.73	FAST bottleneck location list
6	Farm Rd	80	Durango Dr	Tule Springs Rd	0.28	24,500	9	-	31	2	$ 1,229,097.14	
2	Town Center Dr	100	Covington Cross Dr	Summerlin Pkwy	0.20	23,018	16	-	32	1	$ 1,168,240.00	
1, 2	Buffalo Dr	100	Sahara Ave	Westcliff Dr	2.15	22,288	3	-	33	4	$ 1,054,798.14	A portion of this will be included in a CIP Buffalo, Charleston to Sahara (no date). Also, O&M #13 (2022-2024)
2	Town Center Dr	100	Charleston Ave	Anasazi Dr	1.20	21,354	16	-	34	3	$ 1,076,240.00	
6	Jones Blvd	80	CC 215	Elkhorn Rd	1.00	18,353	9	2023	35	1	$ 1,028,240.00	O&M #15 (2022-2024)
1, 5	Torrey Pines Dr	80	Washington Ave	Cheyenne Ave	2.57	8,004	15	-	36	5	$ 1,057,446.23	
1, 4	Tenaya Way	80	Vegas Dr	Cheyenne Ave	2.10	17,802	15	2021	37	5	$ 1,071,001.90	A portion is included in O&M #10 (2022-2024)
4, 5	Gowan Rd	80	Tenaya Way	Decatur Blvd	2.46	5,660	15	-	38	2	$ 1,019,573.33	
4, 6	Jones Blvd	80	Lone Mountain Rd	CC 215	2.00	17,800	9	2023	39	1	$ 1,009,840.00	O&M #17 (2022-2024)
2	Hualapai Way	100	Sahara Ave	Charleston Blvd	1.00	14,488	16	-	40	1	$ 1,028,240.00	
3	Mojave Rd	125	Stewart Ave	Bonanza Rd	0.50	13,300	6	-	41	3	$ 1,194,240.00	
6	Jones Blvd	80	Elkhorn Rd	Horse Dr	1.53	13,258	9	2023	42	3	$ 1,057,220.39	O&M #16 (2022-2024)
4, 6	Lone Mountain Rd	100	Rancho Dr	Los Prados Blvd	1.24	13,144	9	-	43	3	$ 1,072,691.61	
2, 4	Hills Center Dr	80	Summerlin PKWY	Lake Mead Blvd	1.50	11,781	16	-	44	3	$ 1,059,040.00	
3, 5	Bruce Street	80	Fremont Street	Owens Ave	1.80	11,626	5	-	45	5	$ 1,084,462.22	
1, 2	Alta Dr	80	Park Vista Dr	Tonopah Dr	9.75	10,697	4, 16	-	46	15	$ 1,042,793.85	
1, 2	Oakey Blvd	80	Durango Dr	Rancho Dr	6.00	10,671	3, 4	-	47	10	$ 1,047,373.33	
2	Far Hills Ave	100	RidgePine Street	CC 215	0.46	9,609	16	-	48	1	$ 1,069,718.26	A portion is included in O&M #8 (2022-2024)
1, 2	Vegas Dr	100	Rampart Blvd	Rock Springs Dr	2.25	8,658	15	2021	49	3	$ 1,036,106.67	O&M #11 (2022-2024)
2	Far Hills Ave	100	CC 215	Anasazi Dr	0.50	7,993	16	2022	50	1	$ 1,061,440.00	O&M #8 (2022-2024)
3, 5	Maryland Pkwy	100	Carson Ave	Bruce Street	1.25	7,708	5	-	51	6	$ 1,151,520.00	
2	Far Hills Ave	100	Anasazi Dr	Town Center Dr	0.50	7,578	16	2022	52	1	$ 1,061,440.00	O&M #9 (2022-2024)
1	Penwood Ave	80	Decatur Blvd	Arville Street	0.50	7,532	4	2025-2027	53	2	$ 1,127,840.00	Pennwood and Decatur is included within a new project (FY26-27) Decatur, Tropicana to Sahara.
4	Hualapai Way/Alexander Rd	100	Cheyenne Ave	Fort Apache Rd	1.88	6,422	15	2021	54	1	$ 1,010,708.09	
Total					**101.47**							

ISOLATED INTERSECTIONS

Ward	Corridor	ROW Width	From	To	Length (mi)	Ex. Conduit (Inch)	CIP/ARP	Priority	No. of Intersections	Construction Cost With New Conduit ($)	Notes
1	Teddy Dr	80	Rancho Dr	Charleston Blvd	0.35	-	-	60	1	$ 396,728	
1	Meadows Ln	80	Decatur Blvd	Valley View Blvd	0.75	-	-	57	1	$ 783,224	
3	Lamb Blvd	100	Cedar Drainage Trail	Bonanza Rd	0.25	2	-	55	4	$ 399,704	
6	Elkhorn Rd	100	Grand Monticeto Pkwy	US-95	0.30	-	-	56	1	$ 348,416	
6	Elkhorn Rd	100	Jones Blvd	Bradley Rd	0.50	-	2023	59	1	$ 541,664	
6	Grand Teton Dr	100	Jones Blvd	Bradley Rd	0.50	-	2023	58	1	$ 541,664	
1	Highand Dr	80	Presidio Ave	Sahara Ave	0.27	-	-	61	1	$ 319,429	
6	Grand Monticeto Pkwy	100	Durango Dr	Centennial Center Blvd	0.36	-	2024	62	1	$ 406,390	
Total					**3.28**					**$ 3,737,219**	

Notes:
1. Costs are estimated using RTC RFP # 18-062DB 2018 FAST Arterial and 215 Beltway ITS bid proposal pricing.
2. Locations of RTC FAST bottleneck locations and areas are included, with some locations containing existing fiber and connected signals.

APPENDIX B – MEETING MINUTES

MEETING NOTES
By: Jonathan Sorola

Project No. 680-132
Date: January 20, 2021

SUBJECT:	CLV Traffic Signal Communications System Gap Analysis Kick-Off Meeting	
PLACE:	Internet Zoom Meeting	
TIME:	10:30 am	
DATE:	January 20, 2021	
ATTENDING:	Sean Robinson, CLV Grant Shirts, RTC Joanna Wadsworth, CLV Joseph Norby, CLV Lia Grimaldi, CLV	Tim McCoy, GCW John Tobin, GCW Willie Felkins, GCW Jonathan Sorola, GCW Masih Edalat, GCW

A kickoff meeting was held to discuss scope, deliverables, and coordination. The following items were discussed:

1. Introductions were made. The project will be managed jointly by the RTC (Grant) and CLV (Sean). Both should be copied on all correspondence. Grant will handle billing/administration, and Sean will be responsible for managing technical aspects of the project. Willie Felkins will be the GCW PM, with Jon leading the data collection, Masih leading web-based GIS data management, John will be the QA/QC Manager, and Tim as the Principal-in-Charge.

2. The project area includes signals that would be isolated to about 200 signalized intersections located on 80/100-ft roadways. CLV indicated that they would want to look at intersections on a ward to ward basis to equally distribute improvements.

3. The project scope includes:

<u>Task #1: Project Management and Coordination</u>

- Monthly progress meetings
- Detailed schedules within 60 days

<u>Task #2: Data Collection</u>

- Review information
- Inventory existing infrastructure (FO, copper, wireless radio).
- Comments:
    i. CLV indicated they were more looking at as-built information being utilized for verification of existing infrastructure.
    ii. CLV indicated that they would revise their GIS layering to be current.
    iii. GCW indicated that they would request as-built information that is not found through web portals to CLV.

Task #3: Gap Analysis and Implementation Plan

- Develop phased prioritized implementation plan
- Develop GIS –based mapping
- Identify and prioritize recommendations for short and long-term
- Construction cost estimates and quantities
- City and FAST Coordination
- Guidelines to incorporate improvements into public and private projects
- Review CIP and identify short-term opportunities for improvements
- Comments:
    i. Masih presented the web based GIS website. It uses live data from the CLV GIS data such as R/W, public streets, signals, and ITS infrastructure.
    ii. GCW is to add City Wards as this may be how the data is broken down into groups.
    iii. For connected intersections, different colors need to be used to identify signals connected by Fiber optic, copper, wireless radio, etc.

Task #4: Committee Review

b. City, RTC EAC, RTC OMC and RTC Board Presentations

Task #5: Final Report

Task #6: Deliverables

- Excel spreadsheet with intersection details in addition to the GIS mapping.
- List of signals connected and unconnected.
- Review existing for needs analysis and determine what is needed.
- Joe Norby will be contacted for requested field information. He requested at least one week notice.

4. Tim discussed coordinating with the NW Area Fiber Optic Communication and ITS Improvements (By Westwood) which includes 10 roadway segments.

5. Monthly meetings were tentatively scheduled for the 3rd Wednesdays at 3:00pm.

6. The project schedule is as follows:

NTP	January 12, 2021
Project Complete	January 12, 2022

7. Tim noted that upcoming tasks for GCW will include:
    a. Prepare detailed schedule
    b. Request existing info and as-builts
    c. Define roadways and limits
    d. Identify non-connected signals
    e. Develop segments to be inventoried

Action Items:

210120.01 **GCW to provide link to GIS web map. (Emailed 1/20/2021) (Use Google Chrome). GCW to add City Wards to GIS web map.**

210120.02 **CLV to provide updated GIS mapping information.**

cc: Attendees

MEETING NOTES
By: Jonathan Sorola

Project No. 680-132
Date: February 24, 2021

SUBJECT:	CLV Traffic Signal Communications System Gap Analysis Progress Meeting #1	
PLACE:	Virtual Meeting	
TIME:	10:00 am	
DATE:	February 24, 2021	
ATTENDING:	Sean Robinson, CLV Grant Shirts, RTC Joanna Wadsworth, CLV Joey Paskey, CLV Lia Grimaldi, CLV	Tim McCoy, GCW John Tobin, GCW Willie Felkins, GCW Jonathan Sorola, GCW Masih Edalat, GCW

A progress meeting was held to discuss scope, deliverables, and coordination. The following items were discussed:

1. **Action Items from Kickoff Meeting:** All items were addressed. Sean will verify that the CLV GIS mapping is current.

2. **As-built and Data Collection**:
    a. GCW is researching as-builts for the unconnected traffic signals.
    b. GCW asked how often do the ARP & CIP maps get updated so the team can be aware of new projects. Sean noted that he will try to review each month for updates and provide to GCW when updated.

3. **Project Status**:
    a. GCW identified and complied a spreadsheet of the connected and unconnected traffic signals.
    b. GCW asked RTC and CLV to confirm the list of FO-connected signals. GCW noted that 380 signals were connected via Fiber and 223 were not connected by Fiber. Of the 223 signals, 67 were believed to not be connected by copper or data radio. Sean indicated that he would look into the signals that are connected and determine whether a list can be generated that breaks out which signals are connected by fiber, copper, or data radio. Willie mentioned that the GIS web app has been updated to show a red signal display for non-connected signals and green for signal connected by fiber. In addition, once connection types are determined, GCW will add two additional colored symbols to identify copper or data radio.
    c. GCW also asked if RTC or CLV can determine what type of connection (copper or data radio) at each signal that is non-FO connected.
    d. GCW inquired how often the RTC FAST and CLV GIS maps are updated. It was noted that the spreadsheet provided by Joe Norby included more signals than what is currently shown in the CLV GIS data. GCW is aware of two ITS corridors recently

installed that are not shown. Sean and grant will coordinate with FAST and CLV to get GIS layers updated.

e. GCW displayed the summary spreadsheet that has been exported from the GIS map that includes information for each signal.

4. **Upcoming Tasks:**
   - **a.** Based on the information being gathered and requested from RTC and CLV, GCW will complete the list of signals to be included in the project.
   - **b.** For the non-FO connected signals, GCW will be identifying existing infrastructure or to be constructed by upcoming projects. GCW will also determine which roadway segments need to be field inventoried to confirm existing infrastructure.
   - c. It was noted that some signals may not be connected to an adjacent ITS truck line and connected via a long CDCA. These should be identified to determine if this is a short-term or permanent condition. CDCA connection will be noted in the spreadsheet based on information provided by RTC FAST and CLV.

5. **Schedule:** GCW noted that project is on schedule as follows:

NTP	January 12, 2021
Data Collection	May 3, 2021
Gap Analysis & Implementation Plan	August 23, 2021
Committee Review	October 18, 2021
Final Report	January 12, 2022

Action Items:

210224.01 ***GCW to provide CLV with current summary spreadsheet.***

210224.02 ***Sean to verify CLV GIS layers and ARP/CIP project maps are updated.***

210224.03 ***Grant to verify FAST GIS information are updated and request recent additions designed by GCW.***

210224.04 ***RTC and CLV will confirm the FO connected signals and the type of connection for the non-FO connected signals.***

cc: Attendees

MEETING NOTES
By: Jonathan Sorola

Project No. 680-132
Date: March 17, 2021

SUBJECT:	CLV Traffic Signal Communications System Gap Analysis Progress Meeting #2	
PLACE:	Virtual Meeting	
TIME:	10:00 am	
DATE:	March 17, 2021	
ATTENDING:	Sean Robinson, CLV Grant Shirts, RTC Joanna Wadsworth, CLV Lia Grimaldi, CLV	Tim McCoy, GCW Willie Felkins, GCW Jonathan Sorola, GCW

A progress meeting was held to discuss scope, deliverables, and coordination. The following items were discussed:

1. **Action Items from Progress Meeting #1:**
   a. 210224.03 Grant to verify FAST GIS information is updated and request recent additions designed by GCW. Grant indicated that he talked with Lonnie at FAST regarding updating the FAST GIS layer. Sean mentioned that CLV TEFO was working with Tom Theisen at FAST to coordinate providing record as-builts for updating.

   b. 210224.04 RTC and CLV will confirm the FO connected signals and the type of connection for the non-FO connected signals. GCW indicated FAST had given a spreadsheet listing CLV intersections and switch type. Willie noted that intersections with a switch doesn't necessarily note fiber connection. GCW to follow up with Gang Xie at FAST to coordinate connection type.

2. **As-built and Data Collection**:
   a. GCW indicated that they are proceeding with determining signal connectivity status and will update map accordingly.

3. **Project Status**:
   a. GCW showed the revised GIS map identifying the potential corridors to connect multiple signals. Isolated signals were noted and questioned if included in scope. CLV and RTC mentioned that all signals were part of the project, but isolated signals were considered low priority. It was agreed that meetings with CLV TEFO will be scheduled to review corridors and possible connection routes after data collection and connection types have finished. Each meeting will review a segment of the City.

b. CLV requested that signalized intersections that will be installed before project completion, to be shown as existing on GIS mapping.

c. CLV requested that future signalized intersections and future signalized intersections without funding be shown with different colors in GIS mapping.

4. **Upcoming Tasks:**
   a. GCW to finish confirming signal types and revise GIS map with coloring, potential connection corridors, and determine isolated signals.
   b. GCW to add notes to GIS map for ARP/CIP projects in corridors and possible interagency coordination that are along the City boundary.

Action Items:

210317.01 Sean to work with TEFO to provide as-built information for FAST GIS update.

cc: Attendees

MEETING NOTES
By: Jonathan Sorola

Project No. 680-132
Date: April 21, 2021

SUBJECT:	CLV Traffic Signal Communications System Gap Analysis Progress Meeting #3	
PLACE:	Virtual Meeting	
TIME:	10:00 am	
DATE:	April 21, 2021	
ATTENDING:	Sean Robinson, CLV Grant Shirts, RTC Joey Paskey, CLV Joseph Norby, CLV Lia Grimaldi, CLV	John Tobin, GCW Jonathan Sorola, GCW Masih Edalat, GCW Willie Felkins, GCW

A progress meeting was held to discuss scope, deliverables, and coordination. The following items were discussed:

1. **As-built and Data Collection**:
    a. GCW indicated that they are finishing data collection for the project and will concentrate on the unconfirmed signals. It was also noted that data collection will likely be ongoing as needed during the Gap Analysis task. Sean mentioned to let him know if there are specific locations that we need as-builts for and cannot locate and he will try to locate them.

2. **Project Status**:
    a. GCW showed the revised GIS map identifying signal connection types. Signals labeled future were discussed. Sean noted that future signals should be ITS connected, but as-builts should be verified to confirm.

    b. GCW indicated that current ARP projects in construction are in areas of missing ITS. Sean requested a list of corridors for package 8 and 9 to discuss internally if ITS can be included.

3. **Upcoming Tasks:**
    a. GCW to finish confirming signal connection types and revise GIS map with coloring, identify potential connection corridors, and determine isolated signals.

    b. GCW to add notes to GIS map for ARP/CIP projects in corridors and possible interagency coordination that are along the City boundary.

    c. GCW to determine project corridors outside of planned ARP/CIP projects. CLV would like to hold workshop meeting to discuss corridor priority once list is generated.

Action Items:

210421 ***GCW to provided list of non-fiber connected signals located within ARP packages 8 and 9. Completed 4/26/2021***

210421 ***GCW to provide list of located plans to RTC. Completed 4/21/2021***

cc: Attendees

MEETING NOTES
By: Jonathan Sorola

Project No. 680-132
Date: May 19, 2021

SUBJECT:	CLV Traffic Signal Communications System Gap Analysis Progress Meeting #4	
PLACE:	Virtual Meeting	
TIME:	10:00 am	
DATE:	May 19, 2021	
ATTENDING:	Sean Robinson, CLV Grant Shirts, RTC Joe Norby, CLV John Tobin, GCW	Jonathan Sorola, GCW Tim McCoy, GCW Willie Felkins, GCW

A progress meeting was held to discuss scope, deliverables, and coordination. The following items were discussed:

1. **As-built and Data Collection**:
    a. GCW indicated that data collection is mostly complete, but will continue as needed for corridor gap analysis.

2. **Project Status**:
    a. GCW displayed the updated GIS map identifying corridors sorted by right of way width. CLV requested seeing the corridors based on right of way and identifying the locations with existing conduit.
        i. GCW asked if 2-inch conduit was acceptable. It was noted that 2-inch conduit corridors would need further inspection due to 90 degree bends common in copper interconnect routing. GCW noted that often the 90 degree bends can be removed with P30 pull box installation. Joe indicated that 2-inch conduit wasn't preferred and 3- and 4-inch conduit is preferred, but still wants to know where conduit is available.

    b. The FAST corridor priority list for fiber installation was discussed (provided via email 5/18/2021). GCW noted that many of the locations overlap with the corridors currently being evaluated.
        i. GCW displayed the CLV ITS Gap Corridor summary table and mentioned the list needs to be evaluated further to determine additional corridors to add to the list based on the FAST request.

    c. GCW discussed priority and phasing for the GAP Analysis based on existing infrastructure, cost estimate, funding levels/per year, future CLV CIP, and O&M projects schedule.

d. Breakout meetings were discussed for possible corridors. Meetings are necessary to determine priorities and phasing for corridors. It was suggested FAST be invited to determine hub loadings and connections for fiber. CLV requested a list of corridors and plans to discuss phasing and criteria to be discussed in progress meeting #5.

e. GCW requested information on how CLV wants to connect isolated signals with fiber. Joe noted that a lower strand, such as 24-strand, could be used for future data expansion over using a CDCA. CLV to determine how they would prefer connection for price estimating.

3. **Upcoming Tasks:**
   a. GCW to finish identifying corridors and incorporate FAST requested corridors.

   b. Sean to provide NW Area Fiber Optic Communications and ITS Improvements information to GCW.

Action Items:

210519.01 Sean to provide NW fiber information to GCW to incorporate into data set.

210519.02 GCW to provide proposed corridor spreadsheet to CLV.

cc: Attendees

MEETING NOTES
By: Jonathan Sorola

Project No. 680-132
Date: June 16, 2021

SUBJECT:	CLV Traffic Signal Communications System Gap Analysis Progress Meeting #5	
PLACE:	Virtual Meeting	
TIME:	10:00 am	
DATE:	June 16, 2021	
ATTENDING:	Sean Robinson, CLV Grant Shirts, RTC Lia Grimaldi, CLV Tom Kruse, CLV	Tom Theisen, FAST Jonathan Sorola, GCW Willie Felkins, GCW

A progress meeting was held to discuss scope, deliverables, and coordination. The following items were discussed:

1. **As-built and Data Collection**:
    a. GCW mentioned it will be performing site visits at some segments to confirm as-built information.
    b. GCW noted that the budget allows for approximately 5 miles of field inventory by LVE and asked if CLV/FAST have a priority on the segments to inventory. GCW suggested not including the segments that have existing 2-inch conduit as CLV has preference to not utilize it. CLV agreed that it would be best to verify 3 and 4 inch conduit over 2 inch.

2. **Project Status**:
    a. The project corridor spreadsheet and methodology were discussed.
        i. CLV requested that assumptions be indicated in footnotes on spreadsheet.
    b. FAST bottleneck locations were discussed.
        i. Tom clarified that the bottleneck locations were areas of extensive fiber utilization, and new fiber optic cable is needed to meet increased future demand.
    c. Tom mentioned that FAST would like a new hub in the NW region to facilitate increased capacity of its fiber optic system. Hub 5 was also mentioned in the context of moving CLV fiber out of the state building to keep fiber outside of state hubs.
    d. GCW noted that they were incorporating NW fiber communication information into the GIS web map.

3. **Upcoming Tasks:**
    a. GCW recommended scheduling workshops (approximately 1 hour) to review and discuss proposed corridors by Ward. CLV requested that FAST attend and agreed that a meeting duration of one hour would work.

b. GCW requested that CLV confirm that GCW is using the latest CIP/ARP project list as it hasn't been updated. Sean will check.
c. CLV requested that an RTC committee meeting for October 2021 be scheduled by mid-August, to review project.

Action Items:

210616.01 Sean to verify which corridors may be part of CLV rehabilitation project list.

210616.02 GCW and Sean to coordinate scheduling workshops for proposed corridor review.

210616.03 GCW and CLV to coordinate scheduling committee meeting for October 2021.

cc: Attendees

MEETING NOTES
By: Jonathan Sorola

Project No. 680-132
Date: August 18, 2021

SUBJECT:	CLV Traffic Signal Communications System Gap Analysis Progress Meeting #7	
PLACE:	Virtual Meeting	
TIME:	10:00 am	
DATE:	August 18, 2021	
ATTENDING:	Grant Shirts, RTC Joey Paskey, CLV Sean Robinson, CLV Lia Grimaldi, CLV	Tim McCoy, GCW John Tobin, GCW Willie Felkins, GCW Jonathan Sorola, GCW Masih Edalat, GCW

The following items were discussed:

8. **Project Status**:
    a. **GCW stated that the draft report will be submitted on 9/16/2021. GCW will provide the draft table of contents to RTC and CLV for review and comment**.
    b. GCW presented and discussed the updated GIS webmap.
        i. CLV indicated they have no additional information they want shown.
        ii. Possible future FAST hubs were discussed as possible additions. **CLV to follow up and determine locations.** GCW noted FAST suggested that hubs be installed in the northwest and near downtown. Willie mentioned that Joe Norby had indicated that it would be easiest to place the future hubs in CLV-owned land, such as parks. GCW will insert on webmap when determined by CLV.
        iii. GCW noted the FAST Infrastructure Map provided appears not to be up-to-date and noted that infrastructure constructed 3 years ago is not shown. RTC noted that there is now a dedicated department to update.
        iv. The GIS webmap will be maintained by CLV following this project. CLV requested the report include instructions on maintenance of the webmap.

9. **Upcoming Tasks:** Presentations at the FAST Operations and Maintenance Committee (OMC) and Executive Advisory Committee (EAC) were discussed. It was planned to present at the OMC on 10/07/21 and EAC on 10/28/2021. The presentation should be a maximum of 10 minutes. Sean will provide an introduction and GCW will present the remaining portion. **The presentation will be reviewed at the next progress meeting in September.** The presentation shall be provided to Grant at least two weeks prior to the scheduled committee meetings. It was agreed that presentation to the RTC Board is not required unless requested by EAC.

Action Items:

210818.01 ***GCW to send report table of contents to RTC and CLV for review and comment. Completed.***

210818.02 ***CLV to follow up with FAST and determine future hub locations.***

210818.03 ***GCW will submit draft report by 9/16/2021.***

210818.04 ***GCW to prepare draft presentation for discussion at September progress meeting.***

cc: Attendees