Chapter 4 | Route 1 Transit Center and Bus Stops Program and Design Options

This chapter addresses the programming and conceptual site options for a new Alturas & Shasta Terminal transit center, as well as improvements at other Route 1 transit centers and bus stop locations. The other four key transit centers / transfer points along Route 1 do not require significant physical design improvements, to enhance operations. A summary of proposed improvements at each of these transit centers and at other bus stops along the Route 1 corridor is summarized in Sections 4.3 and 4.4. The feasibility and options to incorporate intelligent technology systems infrastructure at the major transit centers was also evaluated and is described in Section 4.5. Finally, Section 4.6 of this chapter evaluates the impact of the 5th Street Bridge improvement project on Yuba-Sutter Transit's service.

4.1 Alturas & Shasta Transit Center Program and Site Options

The Alturas & Shasta stop is the single transfer location that warrants a substantial physical improvement. This section evaluates site and design options for a new transit center at Alturas & Shasta. First, the recommended program for the facility is presented, followed by an evaluation of four potential sites and their associated concept designs.

4.1.1 Recommended Transit Center Program

Based on the existing and future uses and the design criteria presented in Chapter 3, the following program is recommended for a new Alturas & Shasta transit center facility:

- Space for a minimum of three buses at a time;
- Drop-off curb space for 2–3 vehicles;
- Sheltered waiting area for up to 30 passengers at a time;
- Outdoor waiting area with similar seating capacity;
- Single driver restroom;
- Custodial space;
- Bike lockers / lids;
- Lighting; and
- Good lines of sight for security purposes.

Since there is no additional land available at the current site, it is clear that a new site will be needed to accommodate this program. Based upon site visits and discussions with Yuba-Sutter Transit staff, four

potential replacement sites have been identified. Figure 4.1provides an overview map showing these four locations, as well as the existing transfer point site. The feasibility and advantages and disadvantages of each site option are summarized in the sections that follow.

4.1.2 Site Options

Aquarium Store Site

This site is located on the east side of Almond Street, from Colusa Avenue to Alturas Street and was previously the site of an aquarium supply store. The site is actually two parcels: a southern parcel adjacent to Colusa Avenue approximately 100 feet in depth and a northern parcel adjacent to Alturas Street, 60' in depth. Both are approximately 80 feet in width. The site is immediately west of a Chevron gas station, with which it shares an existing access driveway on Colusa Avenue.

Providing a separate access point for buses entering the site on Colusa Avenue would not be feasible, and closing the existing shared access would have too great of an impact on the gas station operations. Having buses enter at this existing shared access, however, would create conflicts with autos waiting to exit the site. It therefore would not be feasible for buses to enter the site directly from Colusa Avenue. However, the shared access could be used by autos dropping off/picking up passengers or Yuba Sutter Transit operational vehicles (such as supervisors).

A potential site plan is shown in Figure 4.2. The site's north-south dimension along Almond Street is not sufficient to accommodate three buses at a time. It would therefore, be necessary to make a separate bus lane to accommodate two buses (bays 1 and 2), with a third bay parallel to Almond Street. As there is not sufficient space for the buses in the separate bays to swing back to Almond Street, these buses would need to exit eastbound on Alturas Street. In order to avoid left turns from eastbound Alturas Street onto northbound Plumas Street, Bays 1 and 2 would be used by Route 1 and southbound Route 2 buses; while Bay 3 would be used by northbound Route 2 buses. Due to site constraints, it would not be possible to provide the necessary width for Bay 2 to pass a bus stopped in Bay 1.

A transit building would serve passengers waiting for buses using Bays 1 and 2 as well as accommodating the driver bathroom and custodial locker, while a separate standard shelter would be adjacent to Bay 3. In addition, the site could accommodate bike parking, outdoor seating areas and a modest amount of landscaping.

Alturas Street between Almond Street and Plumas Street is only 24 feet in width. With angled parking along the roadway on the private parcel to the north, the street functions as a low-volume alley. While not strictly necessary to accommodate buses, conversion to one-way eastbound along this block would reduce the potential for conflicts or delays, and would have little impact on overall circulation.

Figure 4.1: Potential New Alturas & Shasta Transit Center Sites

Source: LSC Transportation, Inc. modified by AECOM

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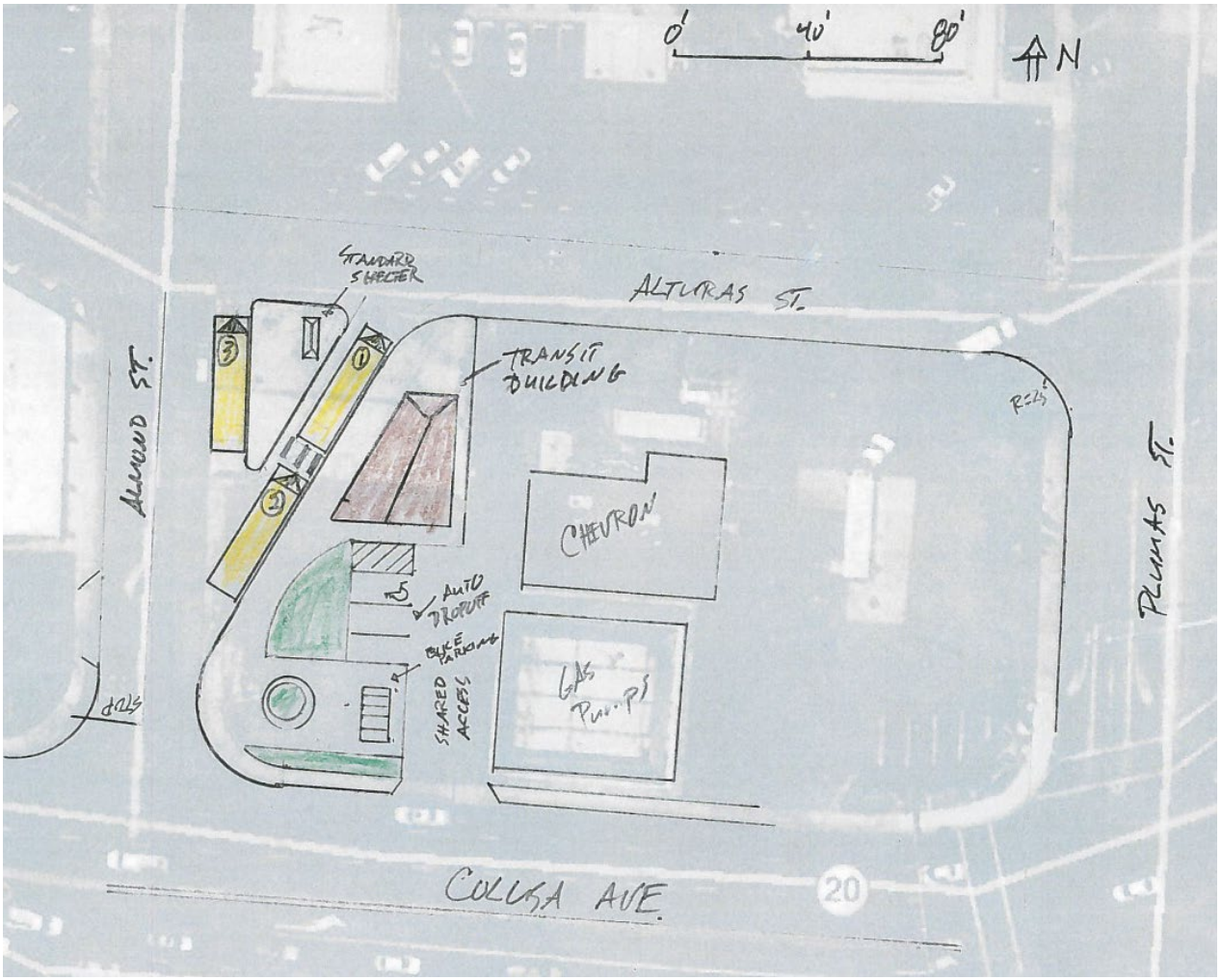
Figure 4.2: Aquarium Store Site



Bus Routing

From the existing routes, this site would be served as follows:

- **Route 1 Eastbound** -- From northbound Plumas Street, the route would turn west on Colusa Avenue, north on Almond Street, through the transfer center, east on Alturas Street, south on Plumas Street and east on Colusa Avenue. At times when the southbound queue on Plumas Street generated by the Colusa Avenue signal backs up past Alturas Street, the driver would need to wait for the signal to clear the queue before turning right onto southbound Plumas Street.
- **Route 1 Westbound** -- From westbound Colusa Avenue, the route would proceed west through the Plumas Street intersection, then north on Almond Street, through the transfer center, east on Alturas Street, and south on Plumas Street. Again, the driver would need to wait at times for the Colusa/Plumas signal to clear the southbound queue on Plumas Street.
- **Route 2A Clockwise** -- As it would not be possible to access any of the bus bays from southbound Almond Street, this route would need to proceed south on Plumas Street to Colusa Avenue, turning right and making a clockwise circuit of the Colusa/Almond/Alturas/Plumas block. Again, the driver would need to wait at times for the Colusa/Plumas signal to clear the southbound queue on Plumas Street.
- **Route 2B Counterclockwise** -- From northbound Plumas Street, the route would turn west on Colusa Avenue, north on Almond Street, stop at the transfer center Bay 1, then proceed north on Almond Street, east on Baptist Lane and north on Plumas Street.

Table 4.1 presents a comparison of the impacts of each site option on route length and estimated running times. As shown in Table 4.1, the Aquarium Store site would require an increase in the route length for eastbound Route 1, but decreases in the other routes and directions. Overall, considering the 24 to 25 daily number of runs on each route, the current site adds 20 miles of bus travel to serve the existing site, and a virtually equal mileage (18) to serve the Aquarium Store site. The impact on running time is estimated based upon the typical delays at the signals for various movements, as well as the change in roadway travel time (at an estimated average of 15 miles per hour, excluding delays at the signals).

As also indicated in Table 4.1, the running time on Route 2B would be reduced by an estimated 1.4 minutes (benefitted from reducing the number of signals by two) and Route 1 westbound would be reduced by 0.6 minutes, but Route 1eastbound would be increased by an estimate 1.4 minutes[1]. Over the day, total travel time associated with deviations from the base route to serve the transfer point would be reduced from the current 164 minutes to 148 minutes (a 10 percent reduction).

[1] As the on-time performance data presented in the 2015 Short Range Transit Plan indicates that Route 2A has the highest proportion of runs operating late out of the four routes/directions, this shift in travel times would be an overall benefit.

Aquarium Store Site Advantages and Disadvantages

Performance Metrics	Advantages	Disadvantages
Travel Performance-Impact on Route Length and Running Time	• Reduces overall travel distance and travel time from the current site.	• The impact on Route 1 eastbound travel time would need to be addressed through revisions to the schedule.
Transit Program and Operations	• Dedicated bus bays that are separated from vehicular travel. • Site could accommodate a fourth bus. • High visibility along busy Colusa Avenue provides greater awareness of the transit system in the community.	• Due to space constraints, buses parked in Bay 2 could not pass a bus stopped in Bay 1 • Narrow width of Alturas Street and the southbound queues on Plumas Street could lead to operational issues at times.
Visibility/Security	• Location next to a busy gas station and along a busy roadway provides more "eyes on the site" to aid security and increases the ability for law enforcement to patrol the site.	
Land Use/Neighborhood Compatibility	• Compatible with surrounding uses.	• Due to the visible location on Alturas Street the site may be more appropriate for a commercial use that activates the site.

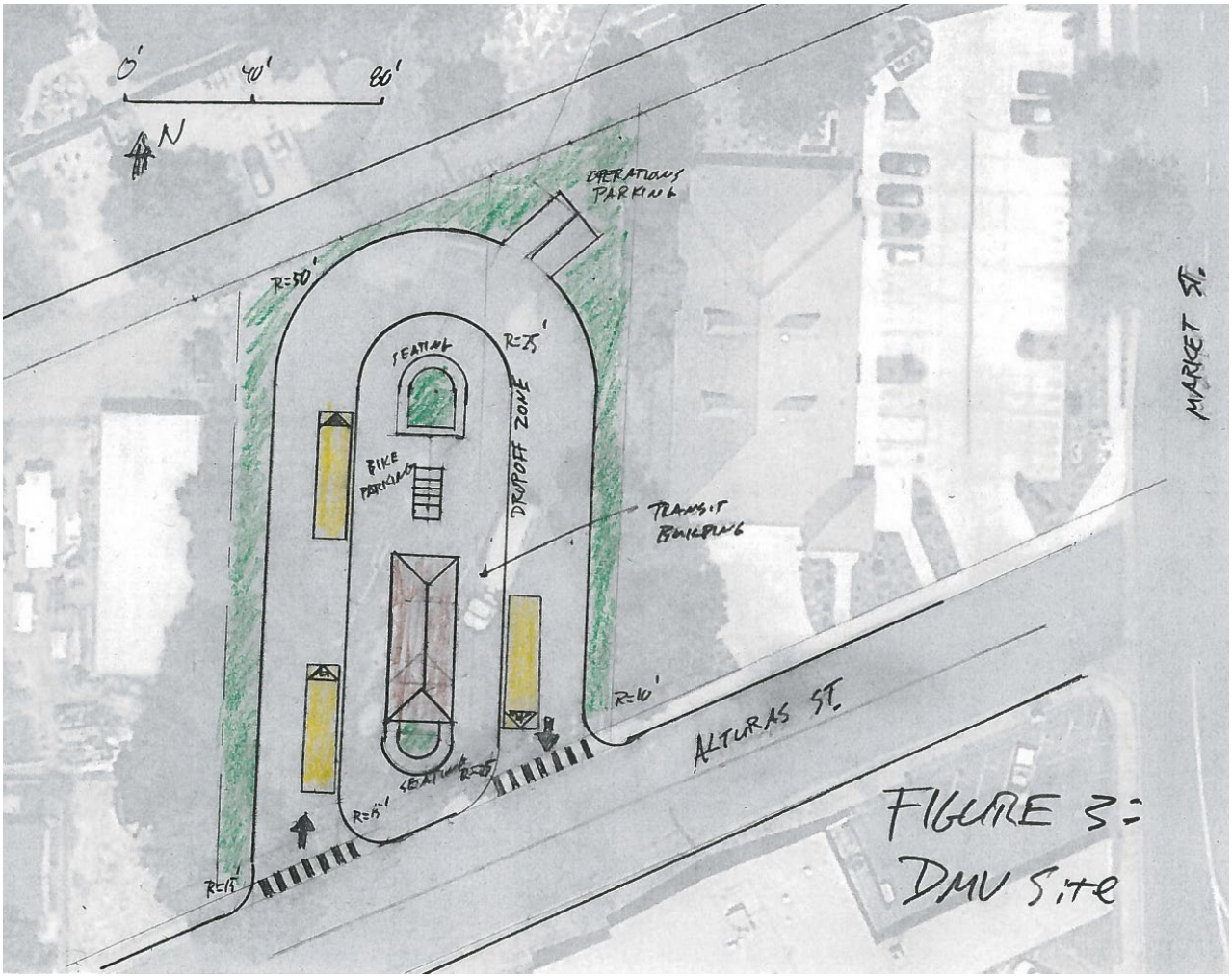
DMV Site

This site is on the north side of Alturas Street between Shasta Street and Market Street, a half-block east of the current transfer site. It consists of three individual trapezoidal parcels that are each approximately 178 feet in the north-south direction and approximately 40 feet in the east-west direction, for a total east-west dimension of roughly 120 feet. The site has been used recently as a truck inspection facility by the Department of Motor Vehicles (DMV). Adjacent land uses consist of a medical office building to the east, Caltrans office to the south, a workshop/storage yard to the west and residential uses to the north.

Using all three parcels, this site has sufficient space to accommodate a full off-street transit loop, as shown in Figure 4.3. Buses would enter the loop from Alturas Street on the west side, and travel clockwise around the loop to serve the three individual bus bays before exiting back onto Alturas Street. Auto traffic, consisting of transit operational vehicles and drivers picking up or dropping off a passenger, would also use this loop.[2] The center island area would be more than sufficient to accommodate a large custom shelter, outdoor seating and landscaping areas, and bicycle parking.

[2] Given the low level of auto traffic and the fact that the configuration will not allow high speeds, occasional use of the drive by auto traffic is not a significant safety hazard.

Figure 4.3: DMV Site



Bus Routing

Routing revisions to serve this site would as follows:

- **Route 1 Eastbound** -- From northbound Plumas Street, the route would turn east on Alturas Street, enter the transfer center, exit back onto Alturas Street westbound, then turn south on Shasta Street and east on Colusa Avenue.
- **Route 1 Westbound** -- From westbound Colusa Avenue, the route would turn north on Shasta Street and east on Alturas Street to access the center. Departing, the bus would travel west on Alturas Street and south on Plumas Street before turning right to retain Colusa Avenue westbound.
- **Route 2A Clockwise** -- From southbound Plumas Street, the route would turn onto eastbound Alturas Street to the transfer center. Departing the center, the route would parallel the Route 1 westbound routing via Alturas Street westbound, Shasta Street southbound, and Colusa Avenue westbound.

- **Route 2B Counterclockwise** -- From northbound Plumas Street, the route would turn east on Alturas Street to the transfer center, then return west on Alturas Street before turning north on Plumas Street.

As shown in Table 4.1, overall route lengths would be increased by this site (particularly for Route 1 eastbound), adding 31 vehicle-miles over the course of a weekday. However, the number of signals needed to be negotiated would be reduced for both Route 1 westbound and Route 2A. Total travel time would be increased by roughly 0.5 minutes for Route 1 eastbound and Route 2A, but reduced by almost a full minute for Route 1 westbound and 0. 6 minutes for Route 2B. Overall travel time would be reduced slightly (6 percent) from the current conditions.

DMV Site Advantages and Disadvantages

Performance Metrics	Advantages	Disadvantages
Travel Performance-Impact on Route Length and Running Time	• Reduces overall travel time from the current site.	• Increases overall travel length from the current site.
Transit Program and Operations	• Dedicated transit facility, with adequate space for buses to pass each other and to comfortably accommodate the transit program. • Site could accommodate a fourth bus.	
Visibility/Security		• As more of the transit activity is further from a public street, the site is less visible to passing drivers and more difficult to secure.
Land Use/Neighborhood Compatibility		• While the site plan avoids using Perkins Way, reducing the impact to nearby residences, the nearest bus bay would still be relatively close (approximately 150') from the nearest residence.

Market Street Site

This consists of two parcels on the northwest corner of Market Street and Perkins Way Street. Together these parcels total approximately 250 feet in the north-south direction and 220 feet parallel with Perkins Way (a total of 1.2 acres). Up until approximately 2013 the site was used as a construction materials storage yard. Adjacent land uses consist of a new medical office building to the south, single family residences to the west, an apartment building to the north, and light industrial uses to the east.

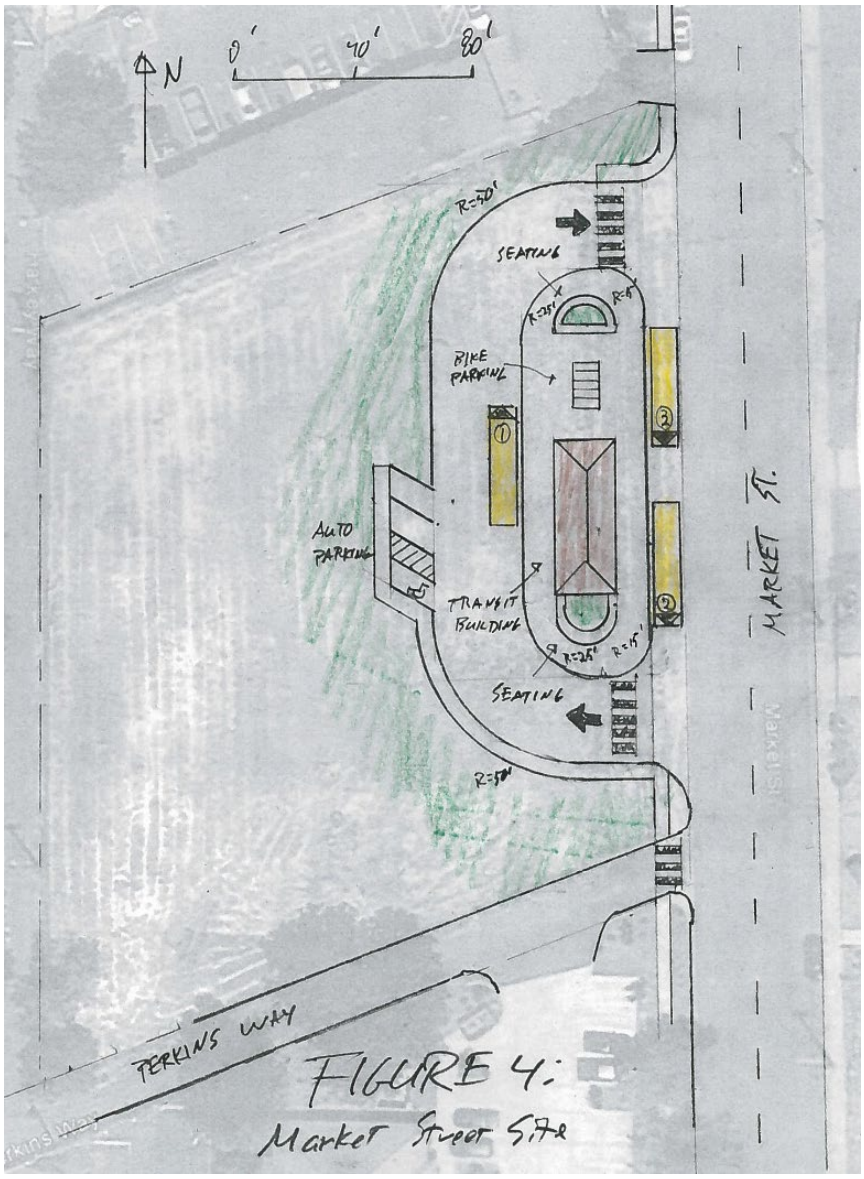


Figure 4.4: Market Street Site

Access to the parcel would be provided from Market Street. As shown in Figure 4.4, an efficient configuration would be to provide a one way (clockwise) loop entering the site at the south end and exiting back onto Market Street on the north end. The plaza area formed by this loop would provide straight curb space for one bus on the west side (with some flexibility for future expansion) and two buses on the east (Market Street) side. This plaza area would provide space for the transit building, bike parking and outside seating areas. Auto parking would be provided along the west side of the one-way loop.

Bus Routing

Routing revisions to serve this site would be as follows:

- **Route 1 Eastbound** -- From northbound Plumas Street, the route would turn east on Alturas Street, left on Market Street and enter the transfer center. It would probably be fastest to exit southbound onto Market Street and make the left turn onto the Frontage Road, turn onto southbound Sutter Street, pass under Colusa Avenue and turn right onto the eastbound Colusa Avenue on ramp.

- **Route 1 Westbound** -- Exiting the 10th Street Bridge, the route would use the Sutter Street off ramp, turn right onto northbound Sutter Street, left onto southbound Market Street and serve the stop on the east side of the transit building. Departing, the route would travel south on Market Street and right on the Colusa Avenue frontage road, where the driver would have two blocks to shift over to the westbound left turn lane at Plumas Street.
- **Route 2A Clockwise** -- From southbound Plumas Street, the route would turn onto eastbound Alturas Street and north on Market Street to the transfer center. Departing the center, the route would turn south on Market Street and east on the Colusa Avenue Frontage Road.
- **Route 2B Counterclockwise** -- From northbound Plumas Street, the route would turn east on Alturas Street, north on Market Street to enter the transfer center, then turn right onto southbound Market Street and return west on Alturas Street before turning north on Plumas Street.[3]

Table 4.1 indicates that overall route lengths would be increased by use of this site for Route 1 in the eastbound direction and Route 2 in both directions, though Route 1 would be slightly shorter in the westbound direction. Total operating miles would be increased by a net of 22 per weekday. Considering signal and other intersection delay, the total travel time would be increased by roughly 2 minutes on eastbound Route 1, partially offset by a reduction of roughly 1 minute in the westbound direction. Overall, running time would be increased by approximately 21 minute per weekday.

Market Street Site Advantages and Disadvantages

Performance Metrics	Advantages	Disadvantages
Travel Performance-Impact on Route Length and Running Time		• Increases overall route running distance and travel time the greatest amount among the four site options.
Transit Program and Operations	• Dedicated transit facility, with adequate space for buses to pass each other and to comfortably accommodate the transit program. • Site could accommodate a fourth bus.	
Visibility/Security	• Site configuration makes the site easy to patrol, enhancing its security.	
Land Use/Neighborhood Compatibility	• Based on the current assessed valuation, this is probably the least costly site in terms of land acquisition.	• Leaves a remnant area of approximately 0.6 acres west of the transit center. • Nearby residences could raise concerns about noise & lighting.

[3] While it would be shorter and faster to exit northbound on Market Street and west on Del Norte Avenue, this would miss the Fremont Hospital stop.

As an aside, another potential site option would be to use only the northern existing parcel (approximately 150 feet in width) rather than both parcels. A site plan similar to that shown for the DMV site option (turned approximately 80 degrees, with all access via a single driveway on Market Street) would be possible. While this would probably reduce the land acquisition cost, it would increase transit delays (all buses would need to circulate around the bus loop), put more bus activity close to the existing apartment building, and reduce the security of the site by placing more activity further from passing traffic (and police patrols) on Market Street.

Almond/Baptist Site

This site is along the west side of Almond Street, south of and adjacent to Baptist Lane. Two bus bays would be provided along the west side of Almond Street. Similar to the Market Street site layout, a one-way transit drive would loop northbound around the west side of a transit plaza, exiting as a fourth (west) leg of the Almond/Baptist intersection. As shown in Figure 4.5, this would provide space for two buses on the west side of the transit plaza and one bus on the east side.

This site is a portion of a larger parcel (extending as far north as Del Norte Avenue) formed from older individual parcels as part of a previous plan to expand the Fremont Hospital. The overall site used for the transit center is approximately 120 feet in the east-west dimension and 210 feet in the north-south dimension (a total of approximately 0.6 acres).

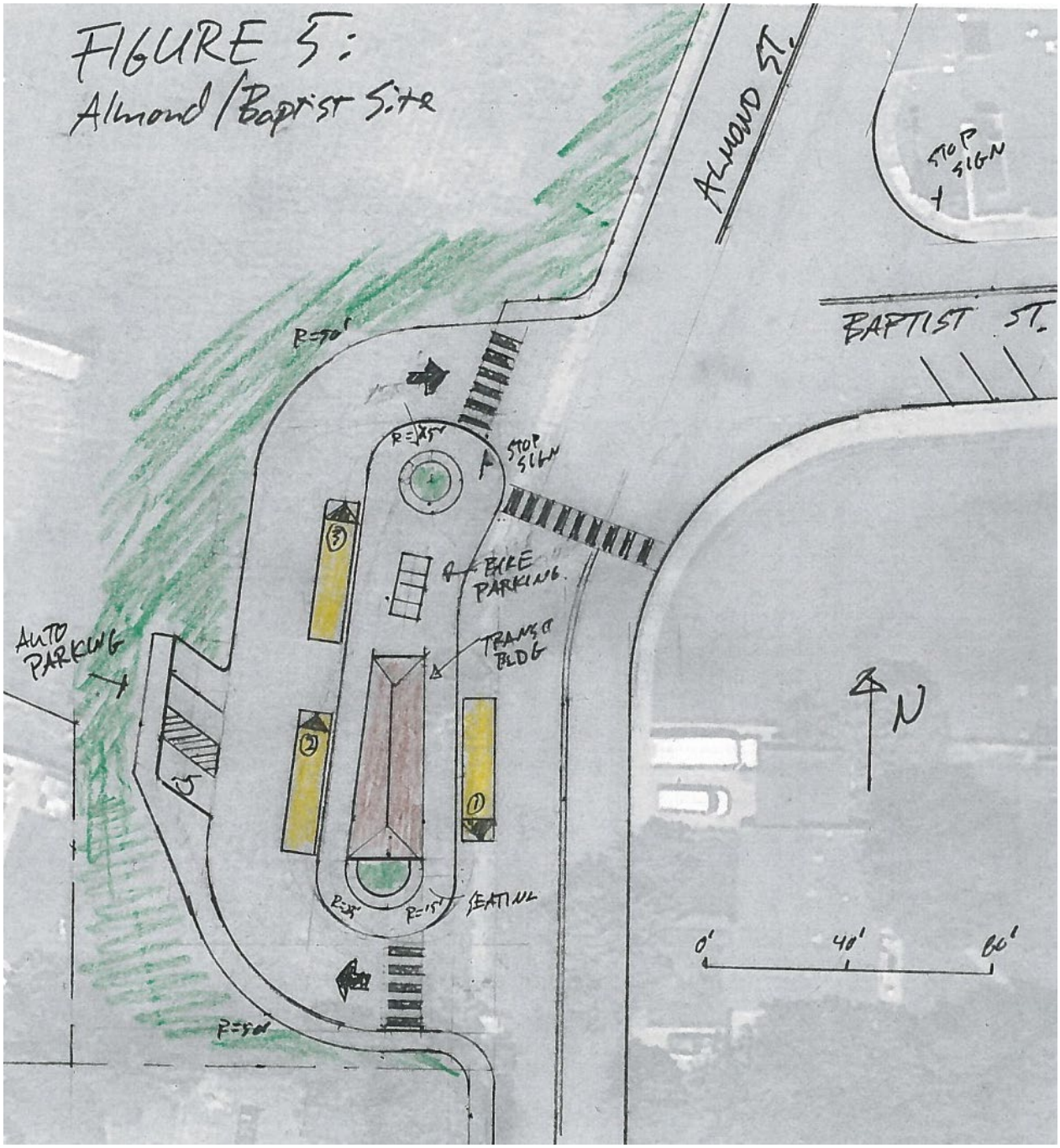
There are residential uses to the west, south and east, while the area to the north is currently undeveloped.

Bus Routing

Routing revisions to serve this site would be as follows:

- **Route 1 Eastbound** -- From northbound Plumas Street, the route would turn west on Colusa Avenue, north on Almond Street, through the transfer center, east on Baptist Street, south on Plumas Street and east on Colusa Avenue.
- **Route 1 Westbound** -- From westbound Colusa Avenue, the route would proceed west through the Plumas Street intersection, then north on Almond Street, through the transfer center, east on Baptist Street, and south on Plumas Street.
- **Route 2A Clockwise** -- The route would turn right onto Baptist Street and left onto southbound Almond Street to stop at the bus bay along the west side of Almond Street. Departing the stop, the bus would loop through the transit center drive and head east on Baptist Street and south on Plumas Street.
- **Route 2B Counterclockwise** -- From northbound Plumas Street, the route would turn west on Colusa Avenue, north on Almond Street, stop at the transfer center, then exit east on Baptist Lane and north on Plumas Street.

Figure 4.5: Almond/Baptist Site



As shown in Table 4.1, overall route lengths would be increased by this site for Route 1 in both directions and a reduction in Route 2 in both directions. Total operating miles would be increased by a net of 9 per weekday. Considering signal and other intersection delay, the total travel time would be increased by roughly 1.7 minutes on eastbound Route 1, partially offset by a reduction of roughly 1.3 minutes on Route 2B. Overall, running time would be reduced by approximately 16 minute per weekday.

Almond/Baptist Site Advantages and Disadvantages

Performance Metrics	Advantages	Disadvantages
Travel Performance-Impact on Route Length and Running Time	• This site provides the most benefit in terms of reduction in route running time of the four site options.	
Transit Program and Operations	• As access to and from Plumas Street is further from the Plumas/Colusa signal, traffic queues and delays are better at this site than at the Aquarium Site. • Site could accommodate a fourth bus.	
Visibility/Security	• The configuration makes this site relatively easy to patrol, enhancing its security.	
Land Use/Neighborhood Compatibility	• Provides a transit stop more convenient to residential areas to the west than the current stop.	• Would require splitting an existing parcel (for purchase) or negotiation of a long-term lease of a portion of the existing parcel. • Nearby residences could raise concerns about noise and lighting.

Table 4.1, below, presents a comparison of the impacts of each site option on route length and estimated running times.

Table 4.1: Alternative Alturas & Shasta Transfer Center Site Options

Performance Criteria	Existing	Aquarium Store	DMV	Market St.	Almond/Baptist
Impact on Route Length (Miles per Trip)					
Route 1 EB	0.08	0.2	0.27	0.45	0.4
Route 1 WB	0.25	0.2	0.27	0.18	0.4
Route 2A Clockwise	0.21	0.2	0.35	0.54	0.2
Route 2B Counterclockwise	0.25	0.12	0.35	0.54	0.16
Total Additional Miles per Weekday	20	18	31	42	29
Impact on Route Running Time (Minutes per Trip)					
Route 1 EB	0.8	2.2	1.4	2.7	2.5
Route 1 WB	2.3	1.7	1.4	1.4	2.3
Route 2A Clockwise	1.7	1.7	2.2	2.3	0.7
Route 2B Counterclockwise	1.8	0.4	1.2	1.8	0.5
Total Additional Minutes per Weekday	164	148	154	202	148
Acreage		0.29	0.6	1.2	2.44 (1)
Street Address		529 Colusa Avenue	363 Alturas St.	894 Market St.	961 Almond St.
Existing Assessment		$373,103	Not Available	$73,942	$778,858
Use Type		Retail Sales / Vacant	State Government	Vacant	Vacant

Note 1: Acreage and assessment figures for total parcel. Approximately 0.6 acres would be required for the transfer center.
Proportional assessment for 0.6 acres is $191,522.

4.2 Alturas & Shasta Transit Center Preferred Options

The four site options were evaluated based on the performance criteria identified in Sections 4.1.2. Yuba-Sutter Transit coordinated with the property owners of the potential site options and with the City of Yuba City to obtain input and understand the planning requirements that may be required to develop a new transit center at these locations.

These site options were then presented to stakeholders and the Yuba-Sutter Transit Board of Directors at the second community workshop held on February 15, 2018. Based on the feedback received at this meeting, it was determined that the Aquarium Store site was not an ideal location for a future Alturas & Shasta transit center location and was therefore not carried forward in the planning process as a potential preferred option.

Table 4.2 provides a preliminary indication of the suitability of the three preferred site options based on the key performance criteria identified by the bus transit center program and route operations in Table 4.1, including:

- Travel efficiencies, measured by overall route length and running times;
- Accommodation of program elements, including:
  - Adequate queuing and spaces for buses;
  - Adequate sheltered and outdoor waiting areas;
  - Adequate site access and a place for bikes;
  - Restroom and custodial spaces;
  - Convenient passenger drop-off space; and
- Site visibility for security;
- Impact of bus operations on surrounding land uses.

Table 4.2: Site Suitability Based on Performance Metrics

Performance Metrics	Sites Suitability* by Metric		
	DMV	Market	Almond/ Baptist
Route Length (miles)	3	4	2
Route Running Time (minutes)	2	3	1
Bus Operations	2	1	1
Site Sized for Program	2	1	1
Visibility/Security	4	2	3
Land Use Compatibility	4	3	2
Average Score	2.8	2.3	1.7

Note:
* Rankings are in order from 1 to 4, with 1 being the highest ranked for performance.

Table 4.2 suggests that the Almond/Baptist site performs best in travel performance, including impacts on overall route length and running time and in terms of accommodating the transit program and bus and transit center operational demands. The Almond/Baptist, Market and DMV site all provide adequate space and a design configuration that will allow buses to pass each other and avoid queuing. The Almond/Baptist and Market sites are comparable in the areas of land use compatibility and site visibility and security.

The selection of a new Alturas & Shasta transit center will be contingent on the availability of funding and the ability to successfully negotiate a sale or long-term lease with the property owner. As a note, the Almond/Baptist and Market parcels are likely larger than would be required for a future Alturas & Shasta transit center and therefore the parcel may need to be sub-divided and sold or leased for another use.

4.2.1 Preferred Site Plan and Illustrative Conceptual View

Figure 4.6 shows the preferred site plan for the each of the three preferred site options for the future Alturas & Shasta transit center. The illustrative conceptual view as shown in Figure 4.7 can be accommodated on the three preferred sites (i.e., DMV, Market, or Almond/Baptist). Appendix C includes five different views of the illustrative concept for the future Alturas & Shasta transit center.

Figure 4.6: Alturas & Shasta Transit Center Preferred Site Plan

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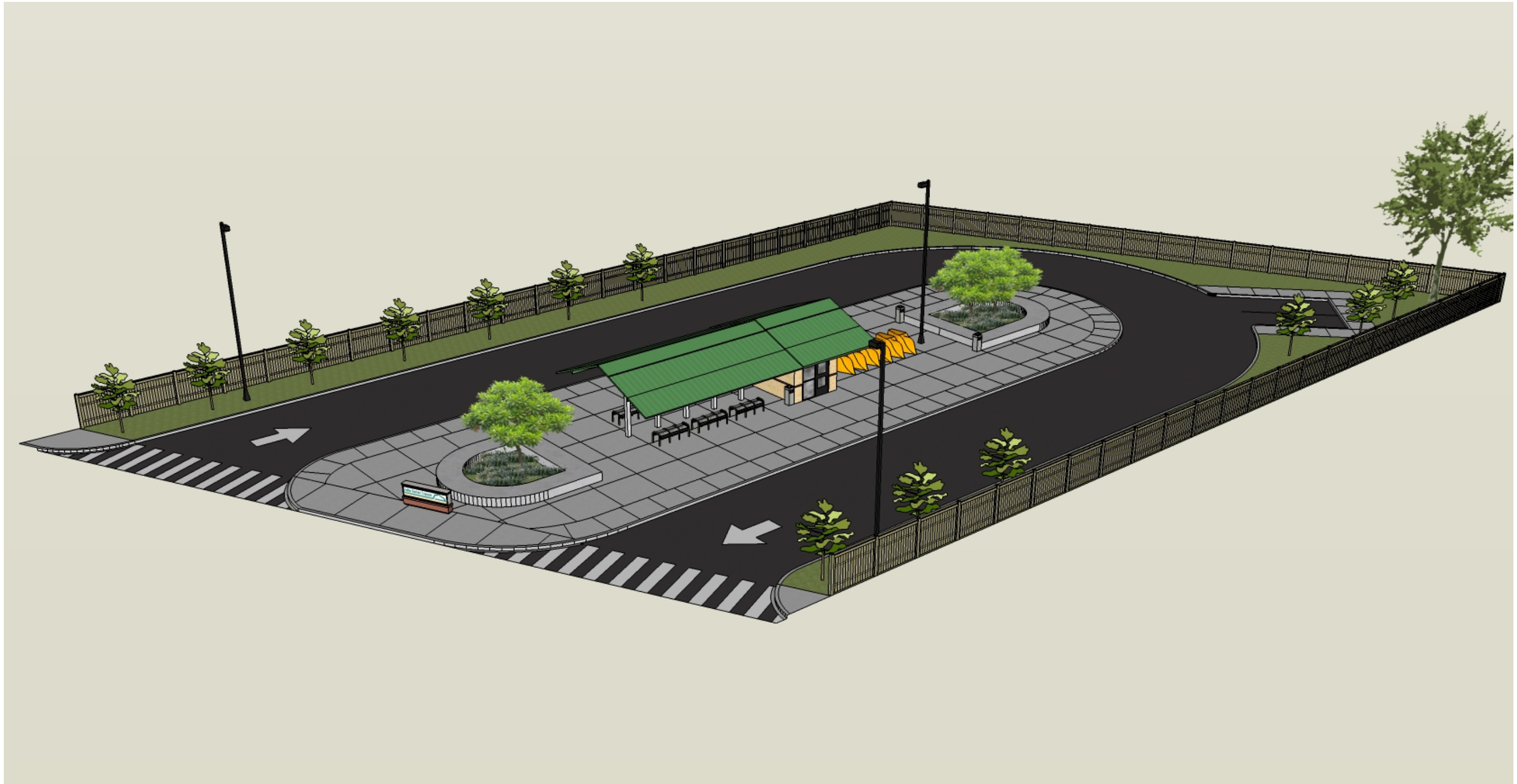
Figure 4.7: Alturas & Shasta Transit Center Conceptual View 1



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4.2.2 Conceptual Cost Estimate

A conceptual cost estimate has been developed to construct the new Alturas & Shasta transit center as shown above in Figures 4.6 and 4.7. It is anticipated that the total project cost including contingency, will be approximately $1,160,000. Please see Table 4.3, for the detailed conceptual cost estimate for a future Alturas & Shasta transit center.

Table 4.3 Conceptual Cost Estimate

Conceptual Cost Estimate
11-Jun-18

ITEM	UNIT	QUANTITY	UNIT PRICE	COST
General				
Mobilization	LS	1	$100,000	$100,000
Construction Project Information Sign	EA	1	$600	$600
Prepare Water Pollution Control Program	LS	1	$2,500	$2,500
Water Pollution Control	LS	1	$5,000	$5,000
Traffic Control System	LS	1	$5,000	$5,000
Demolition / Site Preparation				
Clearing & Grubbing	LS	1	$3,000	$3,000
Earthwork / Site Grading	CY	950	$40	$38,016
AC and Base Removal	SF	21,921	$2.50	$54,803
Sidewalk / Concrete Removal	SF	828	$3.50	$2,898
Curb / Curb and Gutter Removal	LF	753	$5	$3,765
Fence Removal	LF	300	$8	$2,400
Utilities				
Electric Service	LS	1	$10,000	$10,000
Water Service Connection (Irrigation)	LS	1	$6,500	$6,500
Water Service Connection (Building)	LS	1	$7,500	$7,500
Sewer Service Connection (Building)	LS	1	$10,000	$10,000
Drainage	LS	1	$25,000	$25,000
Lighting	LS	1	$40,000	$40,000
Facilities				
PCC Paving w/AB (Bus)	SF	10,539	$20	$210,780
PCC Paving w/AB (Sidewalk)	SF	6,979	$8	$55,832
Full Depth AC Paving (Street)	SF	306	$20	$6,120
Curb / Curb and Gutter w/AB	LF	892	$25	$22,300
Landscaping and Irrigation	SF	8,098	$12	$97,176
Planter Seat Wall	LF	158	$200	$31,600
Bus Shelters with Support Building	LS	1	$75,000	$75,000
Site Furniture	LS	1	$15,000	$15,000
Bike Lockers	EA	6	$2,000	$12,000
Signing and Striping	LS	1	$5,000	$5,000
Site Monument / Identifier	EA	1	$5,000	$5,000
Perimeter Fence	LF	527	$75	$39,525
			SUBTOTAL -	$892,315
			CONTINGENCY (30%) -	$267,694
			TOTAL PROJECT CONSTRUCTION COST -	**$1,160,009**

4.3 Recommended Improvements at Other Transit Centers

The Corridor Enhancement Plan team observed the key transfer centers and conducted a detailed review of the existing improvements and passenger activity in order to gain an understanding about passenger access, passenger waiting conditions, and operational conditions to formulate recommendations for near- and longer-term improvements. As described in Chapter 1 – Introduction, the input received through the public survey and at the two public workshops also helped inform the recommended improvements. Section 2.4.2 of Chapter 2 – Existing Conditions, provides a detailed description of the existing passenger amenities at each of the key transfer centers. The following improvements are recommended for the key transfer centers:

Transfer Center	Near-Term Improvements	Longer-Term Improvements
Walton Terminal	Western Bus Stop • Replace two existing small shelters with larger shelter with solar lighting to accommodate peak passenger boardings with shade and rain cover.	Eastern Bus Stop • Replace existing shelter with larger shelter to accommodate additional passengers.
North Beale Transit Center	• No near-term improvements recommended.	Southern Bus Stop • Replace existing shelters with larger ad shelters with solar lighting to match the shelters that were recently installed at the northern bus stop. • Enhance landscaping.
Yuba County Government Center	• Install between two and three benches outside of the shelter for additional passenger seating.	• Replace existing shelter with larger shelter to accommodate local fixed route, Sacramento route and Amtrak Thruway Bus passengers.
Yuba College Transit Center	• No near-term improvements recommended.	• No longer-term improvements recommended.

4.4 Improvements at Other Bus Stops along the Corridor

While the focus of the Corridor Enhancement Plan is on the five major transfer centers, there are another 47 bus stops along the study corridor that also need to be considered. A review was conducted of existing improvements and passenger activity at each stop, and compared against the criteria identified in Chapter 3 – Design Parameters (benches at stops with 5 or more boardings per day, and shelters at stops with 10 or more boardings per day). In addition, each bus stop was visited by the planning team to review access and traffic safety conditions. Based upon this evaluation, the recommendations shown in Table 4.4 were identified.

Other specific recommendations are as follows:

- No Parking zones should be signed and red curbs denoting no parking areas should be painted at the eastbound Forbes Avenue stop in front of the Library near Clark Street (particularly important given the potential for wheelchair users at this stop) and at the two bus pullouts along both sides of Plumas Street at Church Street.

- The existing bus stop sign at the stop on Lassen Boulevard just west of Walton Avenue should be moved at least 100 feet to the west, in order to give transit drivers pulling out of the stop a better opportunity to identify gaps in traffic turning onto Lassen Boulevard from Walton Avenue.

- Two existing diagonal parking spaces should be eliminated on either side of the D Street/2nd Street (old Mervyn's) stop, in order to allow the bus to pull up against the curb. The current situation requires passengers (including wheelchair users) to enter the street to board or deboard the bus. It appears that parking needs in the area can be well accommodated with the loss of these four spaces.

- The traffic volumes on Stabler Lane (approximately 12,100 vehicles per day, on a four-lane roadway) and the passenger activity at the stop just to the south of Butte House Road (serving the Feather Down shopping area) warrant a bus pullout to avoid stopping in the curb lane. At the stop to the south on Stabler Lane at Starr lane, a pullout is not recommended given the low ridership activity (9 total boardings/alightings per day) and the lack of available right-of-way.

- The Yuba City Marketplace stop along Harter Road has been observed to have up to 13 passengers waiting for a specific run. A larger or second shelter is warranted.

In addition, there are two locations where boarding levels do not warrant existing shelters (at Butte House Road/Harter Road and at F Street/2nd Street). However, both of these are ad shelters and in high visibility locations.

A total of ten additional shelters are warranted, along with five additional benches. At average unit prices (installed) of $600 per bench and $20,000 per shelter, the estimated cost of these improvements is $203,000. The cost of the bus pullout on the west side of Stabler Lane south of Butte House Road will depend on the location of utilities and necessary drainage modifications; a typical cost for a pullout is approximately $120,000. Including this figure, the overall costs of improvements at the stops other than the transfer locations is an estimated $323,000.

Table 4.4: Recommended Improvements at Other Route 1 Bus Stops

Transfer Stops (Addressed Elsewhere) Shown Shaded

					Existing			Warranted Improvements		
ID	Street	Cross Street	Corner	Dir	Bench	Shelter	Daily Boardings	Bench	Shelter	Other Recommendations
1	Walton Ave.	Sam's Club Entrance	SW	EB			87.5			
2	Lassen Boulevard	Walton Avenue	NW	EB	☐	☐	8.5	☑	☐	Consider Moving Stop to the West
3	Lassen Boulevard	Tharp Rd.	NW	EB	☐	☐	6	☑	☐	
4	Lassen Boulevard	Klamath	NW	EB	☑	☐	11.5	☐	☑	
5	Harter Road	Spirit Way	NE	EB	☐	☑	18.5	☐	☐	
6	Harter Road	Yuba City Marketplace	NE	EB	☐	☑	63	☐	☑	Larger or Second Shelter
7	Butte House Rd.	Harter Road	SE	EB	☐	☑	1.5	☐	☐	Existing Shelter Not Warranted
8	Butte House Rd.	Tharp Rd.	SE	EB	☐	☐	1	☐	☐	
9	Stabler Ln.	Butte House Rd.	SW	WB	☐	☑	15	☐	☐	Pullout
10	Butte House Rd.	Stabler Ln. (Rite-Aid)	SE	EB	☐	☑	31	☐	☐	
11	Stabler Ln.	Starr Drive	SW	WB	☐	☐	1.5	☐	☐	
12	Butte House Rd.	Civic Center Blvd.	SE	EB	☐	☑	6	☐	☐	
13	Butte House Rd.	El Dorado Lane	NW	WB	☑	☐	5.5	☐	☐	
14	Butte House Rd.	Yuba City Mall Signal Ent.	SE	EB	☐	☑	29	☐	☐	
15	Butte House Rd.	Target Entrance	NW	WB	☐	☑	16	☐	☐	
16	Gray Ave.	Ainsley Ave.	NE	WB	☑	☐	5.5	☐	☐	
17	Gray Ave.	Ainsley Ave. (Yuba Sutter M	SW	EB	☐	☑	32.5	☐	☐	
18	Gray Ave.	Louise Ave. (Old K-Mart)	SW	EB	☐	☑	27	☐	☐	
19	Gray Ave.	Louise Ave. (Palisade Mote	NE	WB	☐	☑	15	☐	☐	
20	Forbes Ave.	Gray Ave.	SE	EB	☑	☐	21.5	☐	☑	
21	Forbes Ave.	Gray Ave.	NE	WB	☑	☐	4.5	☐	☐	
22	Forbes Ave.	Clark Ave. (Library)	SE	EB	☑	☐	31	☐	☑	Paint Red Curb
23	Forbes Ave.	Clark Ave.	NE	WB	☐	☐	12	☑	☐	
24	Forbes Ave.	Orange St.	NW	WB	☐	☐	1	☐	☐	
25	Forbes Ave.	Orange St.	SE	EB	☐	☐	4	☐	☐	
26	Forbes Ave.	Almond St.	SE	EB	☐	☐	2	☐	☐	
27	Forbes Ave.	Almond St.	NW	WB	☐	☐	5.5	☑	☐	
28	Plumas St.	Church St.	NE	WB	☑	☐	16	☐	☑	Paint Red Curb
29	Plumas St.	Church St.	SW	EB	☑	☐	26.5	☐	☑	Paint Red Curb
30	Alturas St.	Shasta St.	SW	Both			144.5			
31	Yuba Co. Govt Center*	I & 9th Streets	SW	WB			124			
32	H Street	7th Street	SW	EB	☐	☐	0.5	☐	☐	
33	H Street	7th Street	NE	WB	☐	☐	3.5	☐	☐	
34	H Street	4th Street	NW	EB	☑	☐	12.5	☐	☑	
36	Third Street	Rideout Hosp. Emergency	Midblock	WB	☐	☑	New Stop	☐	☐	
37	Third Street	F Street	SW	EB	☑	☐	4	☐	☐	
38	D Street	2nd Street (Old Mervyn's)	----	EB	☐	☑	126	☐	☐	Eliminate 4 Angled Parking Spaces
39	F Street	2nd Street (Buttes Manor)	NE	WB	☐	☑	2	☐	☐	Existing Shelter Not Warranted
40	North Beale Road	Rio Rancho Motel	SE	WB	☐	☐	7	☑	☐	
41	North Beale Road	Feather River Blvd.	NW	EB	☑	☐	2.5	☐	☐	
42	North Beale Road	Wal-Mart	NW	WB			**173**			
43	North Beale Road	SouthSide	SW	EB			**31**			
44	North Beale Road	Lowe Avenue	SE	EB	☐	☐	2.5	☐	☐	
45	North Beale Road	Lowe Avenue	NE	WB	☐	☑	41.5	☐	☐	
46	North Beale Road	Park Avenue	SE	EB	☐	☐	1.5	☐	☐	
47	North Beale Road	Between Alpine and Park	NW	WB	☐	☐	20	☐	☑	
53	North Beale Road	Hammtn-Smtvl Road	SE	EB	☐	☐	2	☐	☐	
48	North Beale Road	Albrecht Avenue	SE	EB	☐	☐	2	☐	☐	
49	North Beale Road	Albrecht Avenue	NW	WB	☐	☐	14	☐	☑	
50	North Beale Road	Woodland Drive	SE	EB	☑	☐	0.5	☐	☐	
51	North Beale Road	Woodland Drive	NE	WB	☑	☐	32.5	☐	☑	
52	Yuba College Terminal	East Parking Lot	----	Both			137.5			
							TOTAL	5	10	

4.5 Feasibility and Assessment of Real Time Information Systems

This section presents options and considerations for incorporating real-time signs (RTS) and web-based technologies in implementing a real-time transit arrival information system at the five transit centers on the Route 1 corridor. Real-time technology enables passengers to track buses and receive real-time information on arrivals through the web, or with electronic display signs installed on bus signs or shelters. In assessing the technology options and requirements, several vendors were contacted for information on their products, approach, and estimated costs.

A key component of real-time technology is an Automated Vehicle Locator (AVL). AVL uses a Global Positioning System (GPS) to track the location of buses via the Internet. Prior to procuring an AVL system, Yuba-Sutter Transit should consider the following technical requirements.

1. Choice of sign technology options – E-Paper or LED Display Signs.

LED display is a flat panel display, which uses an array of light-emitting diodes as pixels for video display. In contrast to the backlit LED displays, electronic paper (E-Paper) displays reflect light like paper, to mimic the appearance of ordinary ink on paper. E-Paper display presents information on electronic tablets, using solar power. E-Paper display has become widely deployed in recent years, due to its lower power draw than the more traditional LED or liquid crystal display (LCD) type of real-time signs (RTS) display. Some vendors provide a solar power panel built in with the E-Paper display, while others draw power from on-site solar panel already present at the shelter location. Use of existing solar panels over electrical sources can reduce the overall cost of RTS at transit center locations.

To take advantage of cost savings of using solar power panels, it is recommended that the operational status of existing or future installation of solar power panels be assessed for the transit center locations.

Technology Considerations

- Format for exporting data from the AVL system to real-time signs
- Procuring RTS from the AVL vendor
- Solar power for RTS displays
- E-Paper or LED displays
- Use of cellular or radio-based communications

Solar Powered LED Displays
Vendor: WaySine

Solar Powered
E-Paper Displays
Vendor: GDS

2. Choice of GTFS or JSON Feed Technology for Exporting Data from the AVL System

All of the RTS vendors interviewed noted the importance of having an AVL vendor make real-time transit information available from a central server through either General Transit Feed Specification (GTFS)-Realtime specification, developed by Google in 2006, or as data exported through a JavaScript Object Notation (JSON) or Extensible Markup Language (XML) feed from the AVL system to the real-time transit information sign.

GTFS-Realtime reads data reported from an agency's AVL system, to communicate the location and estimated arrivals at specific bus stops, at frequent intervals that are pre-defined by the agency (i.e., once every 15 or 30 seconds). This specification is published under the Apache 2.0 license. Some AVL vendors choose to export their data via a JSON or XML feed, made available to the transit agency. Use of either feeds enables real-time transit information on a transit agency's vehicle fleet to be exchanged from an AVL server to another server communicating with the real-time sign. The

JSON/XML is similar to the approach of the GTFS-Realtime, but may inhibit third-party application developers from working with the transit data.

Thus, in implementing RTS technology, it is recommended to request that the AVL Vendor make real-time transit vehicle location data available either through a GTFS-Realtime specification, or through a JSON or XML for the purposes of presenting real-time transit information on future real-time signs at transit center locations.

3. Choice of Cellular or Radio-Based Communications

There is the option of using cellular or radio-based communications for communicating real-time transit arrival information. Cellular communications are more widespread among transit agencies with RTS, but require a monthly cost for communications, per location, which is either managed by the RTS vendor or transit agency. Radio-based communications is an option with one of the RTS manufacturers interviewed, Connexionz, using a 450 megahertz (MHz) radio band for communications from a central location to the RTS installed at transit center locations. While this option would require an investment upfront for the infrastructure required to support radio communications (i.e., radio towers to relay information from a central office to sign locations), there would not be any monthly cellular costs required for transmitting data to the RTS.

An assessment should be made whether to invest in radio-based communications to support the communication of real-time transit arrival data to the RTS.

4. Procuring Real-Time Signs from the AVL System

As part of the future AVL system procurement process conducted by Yuba-Sutter Transit, the agency could also request optional bid items for the installation of a specific quantity of RTS at transit centers in the transit service area. These bid items could be acted upon by Yuba-Sutter Transit at the time of the AVL system installation or in the future as part of the contract entered into with the AVL system vendor.

Procuring real-time signs from the same provider of a transit agency's AVL system can reduce the processing time of exporting data to another server location (through GTFS Realtime or JSON/XML, noted above) from the AVL system, using cellular or radio-based communication. This length of time for the data transfer, or perceived latency in terms of "real-time" transit data, could range from 30 seconds to 2 minutes or more, based on the points in time when data is exported by the AVL system and then received by the RTS manufacturer and sent to the RTS in the field. This delay could be perceived by riders that the RTS is not entirely accurate or reliable.

To reduce the delay in the transfer of data, it is recommended that optional bids be requested as part of the future AVL system procurement to either purchase RTS at the same time as the AVL system or in the future from an AVL vendor.

The cost ranges for the various types of RTS are presented in Table 4.5, below, for consideration in the planning and procurement of RTS. Generally, vendors have noted purchasing larger quantities of signs will result in lower per sign costs.

Table 4.5: Real-Time Sign Cost Estimates

Real Time Sign by Communication Type	Per Sign Estimate	Notes
E-Paper Signs		
Cellular	$10,000 to $15,000	Cellular communications approach; assumes 10-inch or 13-inch E-Ink display at the shelters. Plus monthly cellular service costs.
Radio-based	$3,000 to $5,000	Would require radio-based infrastructure in place to support sign-to-server communications. Recommended for higher quantity of real-time signs (approximately 40).
LED Signs		
Cellular	$10,000 to $20,000	Cost range is for 2-line sign/4-line signs with either 16 or 24 characters per line. Wide range in cost reflects differences in how vendors incorporate solar power into the sign and text-to-speech annunciators are provided with the sign. Cost may be lower if either existing solar power or existing AC power is used on-site. Plus monthly cellular service costs.
Radio-based	$5,000 to $10,000	Would require radio infrastructure in place to support sign-to-server communications. Also recommended for higher quantity of real-time signs.

4.6 Impact of the 5th Street Bridge Improvements

There is currently a single Yuba Sutter Transit route crossing the Feather River, which uses the 10th Street (SR 20) Bridge. An improvement project is currently underway that will replace the existing 2-lane 5th Street Bridge (roughly a third of a mile south of the 10th Street Bridge) with a new four-lane structure. This will also improve connections to the Yuba City street grid, providing a direct connection to Bridge Street to the west. Given this substantial improvement, it is worth considering whether the improved bridge makes sense as part of the Yuba Sutter Transit route network.

In uncongested conditions, the travel time between the Alturas & Shasta transit stop in Yuba City and the 3rd St./E St. intersection in Marysville are very similar, providing little benefit in terms of travel time or on-time performance. The expanded 5th Street Bridge may reduce travel times on the Bridge Street/5th Street corridor during congestion periods, but will also divert a substantial amount of traffic (up to 30,000 cars per day at buildout) from the 10th Street Bridge, thereby reducing travel times on the existing route.

One benefit of shifting to the 5th Street Bridge would be that it would allow provision of transit service along Sutter Street between the 10th Street and 5th Street bridges. Currently, the closest stop to this area is roughly 0.5 miles away at Plumas Street/Church Street. However, the majority of the land uses in this area are light industrial (such as building supply stores), indicating that the transit ridership generated by this area would be modest.

The key consideration is the importance to continue to serve a stop at the Yuba County Government Center, which is the 4th busiest stop in the system. In addition to serving nearby trip destinations, this stop is the key transfer point between Routes 1 and 4, and also serves as a transfer point to regional services. While serving this stop using the 10th Street Bridge requires little out-of-direction travel, adding this stop to Route 1 using the 5th Street Bridge requires the buses to travel 4 blocks out of direction, adding 0.76 miles and approximately 4 minutes of running time to the route in each direction. Given the existing on-time performance problems on Route 1 (with 31 percent of runs operating more than 5 minutes behind schedule), providing this additional running time is not feasible with the current 4-bus Route 1 service plan. Two additional buses would need to be operated under a revised schedule, with a significant accompanying cost impact.

Overall, Route 1 should remain on the 10th Street Bridge. The 5th Street Bridge replacement project, however, will substantially benefit this route (and the system as a whole) by reducing traffic delays on 10th Street/Colusa Avenue and allowing route on-time performance to improve.

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