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MEMORANDUM

To: Matt Hertel, AICP, AECOM

From: Gordon Shaw, PE, AICP, LSC Transportation Consultants, Inc.

Date: August 14, 2017

RE: Yuba-Sutter Transit Corridor Study Design Parameters

This memorandum presents design parameters to be applied in the Yuba-Sutter Transit Corridor Study regarding the design of bus stop and transfer center improvements. Sidewalk and bicycle facilities are first discussed, followed by a discussion of bus pullout design, passenger facility design, and bus turning path requirements.

Minimum Sidewalk and Bicycle Facility Parameters

Sidewalks

Americans with Disabilities Act Standards

All facilities will conform to the standards required by the Americans with Disabilities Act (ADA) as well as the associated *Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way* published by the United States Access Board.

ADA sidewalk widths require a minimum of 4 feet of width. Where sidewalks are less than 5 feet in width, a passing area at least 5' long and 5' wide is required at least every 200 feet.

Any drop greater than one-half inch and any surface steeper than 1:20 (5 percent) requires a ramp.

Obstacles that protrude into the access path might restrict wheelchair movements. Obstacles that are higher than 27 inches or lower than 80 inches may cause problems for a person with a vision impairment, who may not be able to detect an obstacle with a cane.

Local Standards

Yuba County standards call for a minimum sidewalk width of 4 feet along an urban residential (local) road, 6 feet along an urban collector or industrial/commercial road, and 8 feet along an urban arterial road. If detached, the landscaping strip shall be 8 feet in width.

Yuba City sidewalk standards call for a minimum width of 4 feet along residential streets, 5 feet along collector streets and 6 feet along arterial streets. No specific requirement for the width of the landscaping strip is identified.

The City of Marysville Municipal Code defers to Caltrans standards regarding sidewalk width requirements.

State Standards

The Caltrans Highway Design Manual (Sept 22, 2016 revision) indicates the following regarding sidewalk width (Section 105.2) "*The minimum width of a sidewalk should be 8 feet between a curb and a building when in urban and rural main street place types. For all other locations the minimum width of sidewalk should be 6 feet when contiguous to a curb or 5 feet when separated by a planting strip*."

Caltrans has also adopted standards to implement the ADA requirements, as documented in *Design Information Bulletin 82-05: Pedestrian Accessibility Guidelines for Highway Projects*. These parameters are consistent with those of the ADA.

Bicycle Facilities

Bicycle lane (Class II) width is governed by the California Highway Design Manual (12/16/16), for all public streets, which states (Section 301.3) that:

The minimum Class II bike lane width shall be 4 feet, except where:

- *Adjacent to on-street parking, the minimum bike lane should be 5 feet.*
- *Posted speeds are greater than 40 miles per hour, the minimum bike lane should be 6 feet, or*
- *On highways with concrete curb and gutter, a minimum width of 3 feet measured from the bike lane stripe to the joint between the shoulder pavement and the gutter shall be provided.*

Bus Pullout Design Parameters

Need for a Bus Pullout

A bus pullout is a specially constructed area off the normal roadway section provided for bus loading and unloading. Typically at stops located on low-speed, low-volume roadways without unusually high passenger activity, it is appropriate for transit buses to stop in the travel lane. This condition applies to many of the Yuba-Sutter Transit Local

Route stops located off of the state highways or urban arterial roadways. A bus pullout is necessary at locations where it may be hazardous to stop the bus in the travel lane and no shoulder or parking lane is available. Based on design guidelines in similar areas throughout the country, bus stops along roadways with a speed limit of 35 miles per hour (MPH) or higher and a peak-hour volume of 250 or higher in the lane of travel warrant a bus pullout[1]. Assuming a typical traffic pattern in which 10 percent of daily traffic occurs in the peak hour and daily volumes are balanced between the two directions, this corresponds to a daily two-way traffic volume of 5,000 vehicles for a two-lane roadway and 10,000 for a four-lane roadway.

Pullouts are also appropriate in the following circumstances:

- Where the potential for conflicts between transit and passenger vehicles warrants separation of the two. For example, a bus stop located in a travel lane just beyond a signalized intersection often requires a pullout to prevent the stopped bus from causing traffic to queue through the intersection.
- Under conditions with high or increasing bus or passenger volumes or on high speed roads.
- At locations where it may be hazardous to stop the bus in the travel lane and no shoulder or parking lane is available, such as where objects or the roadway geometry unduly obstructs sight distances for oncoming drivers.

Bus Pullout Design Specifications

The City of Marysville and Yuba County do not have any standards regarding bus pullout design. The City of Yuba City's Standard Details does include requirements for a bus pullout, indicating a minimum of 60' in length with 45' tapers on either side and a minimum width of 9' 9.5" between the face of curb and the roadway section. A concrete surface is required.

The Caltrans Highway Design Manual defers to the American Association of State Highway and Transportation Officials (AASHTO) guidelines. These guidelines are presented in the *Guide for Geometric Design of Transit Facilities on Highways and Streets*, published in July 2014. They call for a minimum pullout width of 12 feet, with length dimensions as shown in Table 1.

The Caltrans Highway Design Manual (December 16, 2016 revision) Section 626.4 indicates that concrete bus pads shall be a minimum of 4 feet wider than the width of the bus, and a minimum of 20 feet longer than the length of the bus. If the bus pad extends into the travel way, it should extend to the full width of the travel lane. The Highway Design Manual also refers the reader to the *Guide for Geometric Design of Transit Facilities on Highways and Streets* (American Association of State Highway and Transportation Officials, July 2014).

[1]The Oregon Department of Transportation, *Design Guidelines for Public Transportation*, Section 12, 12-6.

TABLE 1: AASHTO Bus Bay Dimensions

	Lengths in Feet					
Thru Speed (MPH)	Entrance Taper	Decel. Lane	Stopping Area	Accel. Lane	Exit Taper	Total
30	5:1 Min	None	50	None	3:1 Max	130 Min
35	170	185	50	250	170	825
40	190	265	50	400	190	1095
45	210	360	50	700	210	1530

Source: *Guide for Geometric Design of Transit Facilities on Highways and Streets, AASHTO, July 2014*

Other design specifications regarding the bus loading area are as follows:

- Curb heights should be no less than 4 inches and no more than 8 inches to minimize passenger falls when boarding or alighting from a bus.
- A minimum horizontal clearance of 2 feet should be provided between the curb and any obstruction (such as a bus stop sign).
- Trees should be trimmed at least 11.5 feet above the roadway pavement for the length of the bus stop.

Passenger Facility Design Parameters

Minimum ADA Requirements for Bus Stops and Passenger Facilities

The ADA and associated regulations require that wheelchair loading pads be a minimum of 5' (parallel to roadway) by 8' (perpendicular to roadway). The grade perpendicular to the roadway cannot be more than 2 percent, while the grade parallel to the roadway should match the roadway grade. The surface shall be "firm, stable and slip resistant".

Bus shelters must provide a clear space within the shelter for wheelchair users, with minimum dimensions of 2.5 feet by 4.0 feet (separate from other passenger seating and circulation areas). The opening to a shelter must be a minimum of 3 feet in width, and the minimum vertical dimension within a bus shelter is 6 feet 8 inches. The wheelchair pad and shelter must be connected with an accessible path.

A key design parameter for bus stops is to ensure that the ADA wheelchair loading areas align with the location of ramps or lifts on the vehicles. In the Yuba-Sutter Transit fleet, the wheelchair loading locations are as follow:

- The commuter buses load wheelchairs in the middle of the bus.

- All other buses 27' and longer load wheelchairs in the front.

- The smaller Dial-A-Ride and Rural Route vehicles load wheelchairs at the rear door.

Given this variation in loading locations, adequate clearance (8' from the face of curb) is needed from the front of the bus to a point 25' from the front of the bus.

Local Standards

While the City of Marysville and Yuba County do not have any standards regarding bus stop design, the City of Yuba City's Standard Details indicates that stops should include a concrete bus shelter pad 6' in depth and 16' in length.

Criteria for Stop Furnishings

There are various methods that can be used to determine when a bench or shelter should be installed at a given location. The most commonly used criteria, the number of passenger boardings, is the criteria recommended to determine which Yuba-Sutter Transit stops warrant installation of a bench or shelter. The following recommended minimum boardings represent a composite of prevailing practices:

- Bench: 5 to 9 boardings per day
- Shelter: 10 or more boardings per day

For shelters or facilities at busier bus stops, it is important to size the enclosed waiting area to comfortably accommodate the peak number of waiting passengers. A typical transit standard is to provide a minimum of 10 square feet per person.

Bus Turning Path Design Specifications

Design Vehicle

The largest vehicle used on Local Routes are the 40-foot-long Gillig buses. They have a width of 8 feet 6 inches (without mirrors) and a height of 11 feet 7 inches. As there are no plans for larger buses (such as articulated buses) on the Local Routes in the future, this vehicle should be used as the design vehicle for the majority of stops along the corridor.

Two stops, however, are also served as part of the commuter service, which uses MCI D4500 buses. These buses have a total length of 45 feet 5 inches, a width of 8 feet six inches (without mirrors) and a height of 11 feet 5 inches. In addition to the current stops (Walton Terminal and Yuba County Government Center), there is the potential that the North Beale Transit Center would be a Commuter Service stop in the future. For these three locations, therefore, this larger vehicle should be used as the design vehicle.

Turning Path Design

In low speed operation, the minimum roadway design requirements is governed by the turning radius and "swept path" when the steering wheel is locked at the maximum extent. For the Local Route design vehicle, the radius of the outside front wheel is 42 feet. However, including the "overhang" of the front bumper and a 3-position front bicycle rack, the total swept path at low speed requires a clearance of 50 feet in radius. The inside radius of the swept path, defined by the track of the rear inside tire, is 25 feet. For the Commuter Service design vehicle, an outside swept path radius of 52 feet is required, with an inside radius of 25 feet.

Recommended Yuba-Sutter Transit Design Parameters

Summarizing the discussion above, the following design parameters are recommended as standard for improvements to Yuba-Sutter Transit stops throughout the transit system. With prior approval from Yuba-Sutter Transit, these standards can be modified based on specific site conditions or to fit within existing right-of-way, as long as minimum ADA and local design standards are met:

- **Bus Pullouts** – At locations where at least 10 feet of paved shoulder width is not available beyond the edge of traveled way[1], pullouts should be provided for stops along two-lane roadways with ADT exceeding 5,000 and along four-lane roadways with ADT exceeding 10,000 (or as needed to address the other factors listed on page 3). Dimensions should be a minimum of 60' in length with 45' tapers on either side and a minimum width of 9' 9.5" between the face of curb and the nearest edge of the traveled way(to be consistent with the Yuba City Standard Details, as shown in Attachment A), with a concrete surface.[2]

- **Bus Loading Area** – At a minimum, all new construction should include a concrete wheelchair pad 5' (parallel to curb) by 8' (perpendicular to curb) located to align with the lift/ramp location of all transit vehicles serving the stop. Slope parallel to the roadway shall match that of the roadway, while cross-slope shall not exceed a maximum of 2 percent. A passenger bench should be provided at locations with 5 or more boardings per day, and a shelter at locations with 10 or more boardings per day. A minimum horizontal clearance of 2 feet should be provided between the curb (if provided) or edge of pavement (if curb not provided) and any obstruction (such as a bus stop sign). Trees should be trimmed at least 12 feet above the roadway pavement for the length of the bus stop.

- **Curb and Sidewalk** – Curb or curb and sidewalk shall be constructed as part of the bus stop improvements along roadways with existing or planned curb/sidewalk. Curb heights should be no less than 4 inches and no more than 8 inches. Sidewalk width shall be determined by the individual jurisdiction.

[1] Traveled way includes vehicular and bike lanes, and is typically the inside edge of the gutter pan on an urban roadway and the outside edge of the pavement marking fog line on a rural roadway without a bike lane.

[2] Except along state highways, where Caltrans standards should be applied.

- **Shelter Pad** -- If a shelter is warranted, a shelter pad at least 16' (parallel to the travel lane) by 6' (perpendicular to the travel lane) should be provided, in order to accommodate the standard shelter shown in Attachment B. In most cases, the combination of the pad and sidewalk in front of the shelter/bench will be sufficient for the required 5' by 8' ADA loading area. If not, the pad will need to be extended in depth or length to accommodate the 5' by 8' ADA loading area in front or at the end of the shelter. A minimum distance of 5' between the front edge of the shelter/bench and the front edge of the curb should be provided. Shelter should be placed on the pad so that trash receptacles mounted on the end wall are accessible. If separate, an accessible path of travel (with a minimum width of 36 inches and adequate slope and surface) shall be provided connecting the wheelchair pad and shelter pad.

- **Bench Pad** -- If a bench is warranted, a pad at least 8' (parallel to the travel lane) by 3' (perpendicular to the travel lane) should be provided, in order to accommodate the standard bus bench shown in Attachment C. In most cases, the combination of the pad and sidewalk in front of the bench will be sufficient for the required 5' by 8' ADA loading area. If not, the pad will need to be extended in depth or length to accommodate the 5' by 8' ADA loading area in front or at the end of the bench.

- **Design Vehicle** – A 40' transit bus should be used as the design vehicle for all stops along the Local Routes, except that a 45'5" commuter transit bus should be the design vehicle for stops currently served by the commuter routes, and for the North Beale Road location.

Local or Caltrans standards should be applied with regards to the design of sidewalks and bicycle facilities.

Resources and References

American Planning Association. *Bicycle Facility Planning,* Planning Advisory Service, Report Number 459, APA Research Department, Chicago, Illinois, 1995.

Americans with Disabilities (ADA) Access Board, *Revised Draft Guidelines for Accessible Public Right-of-Way*, November 23, 2005.

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City of Yuba City, *2009 Standard Details*. http://www.yubacity.net/city_hall/departments/public_works/engineering/technical_documents/standard_details/

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Orange County Transportation Authority, *Bus Stop Safety and Design Guidelines*, Orange, California, 2004.

Regional Transportation Commission of Washoe County. *Planning for Transit: A Guide for Community and Site Planning,* Reno, Nevada, 1992.

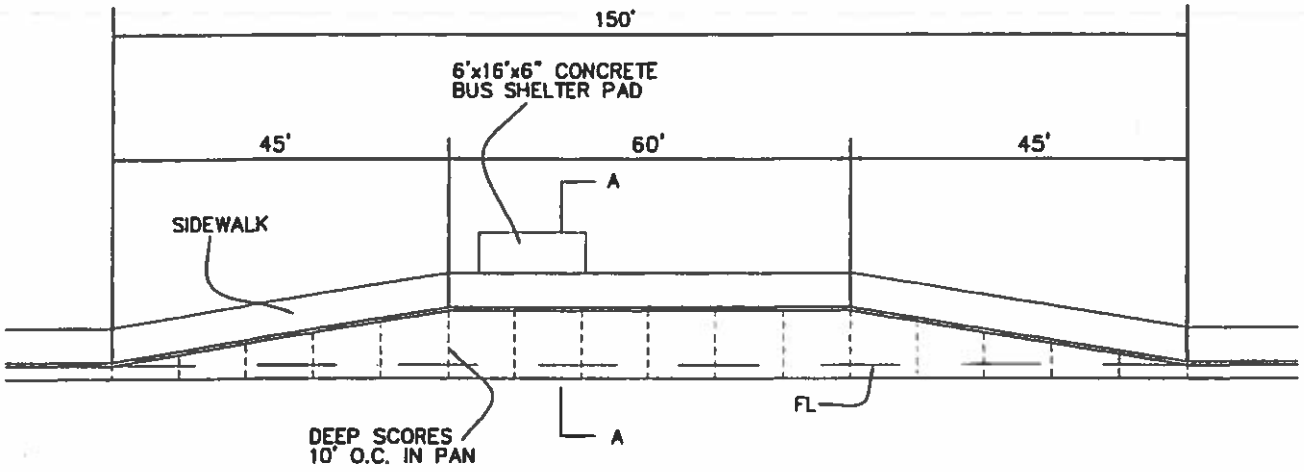
Transportation Research Board, *Bus Transit Service in Land Development Planning*, Transit Cooperative Research Program, TCRP Synthesis 67, Washington, D.C., 2006.

Transportation Research Board. *Guidelines for the Location and Design of Bus Stops,* Transit Cooperative Research Program, Report 19, National Academy Press, Washington D.C., 1996.

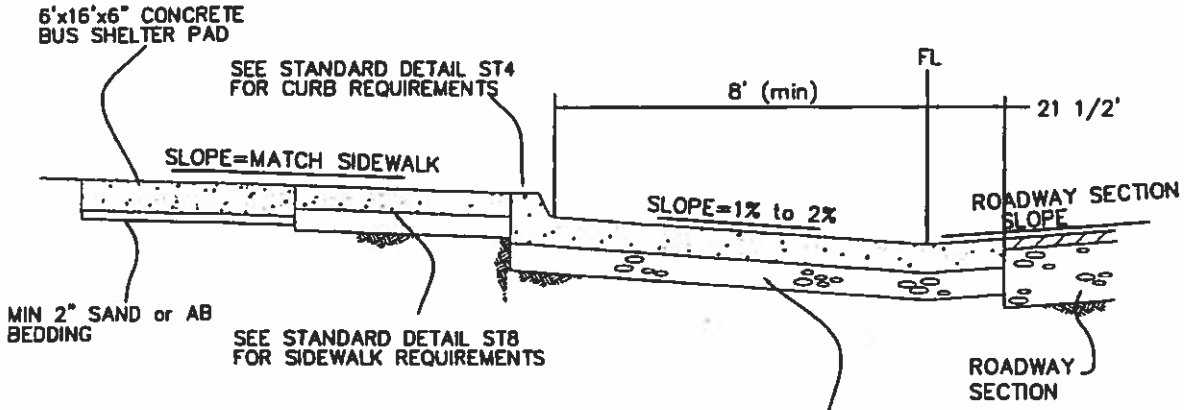
United States Access Board, *Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way*, https://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way/proposed-rights-of-way-guidelines

Yuba County, *Standard Plans.* http://www.co.yuba.ca.us/Departments/Community%20Development/Public%20Works/pubStd_Dwgs.aspx

Attachment A



PLAN



SECTION A-A

NOTES:
1. ADD 50' TO TURNOUT FOR EACH ADDITIONAL PASS THROUGH BUS

BUS TURNOUT

DATE	REVISIONS	BY

CITY OF YUBA CITY

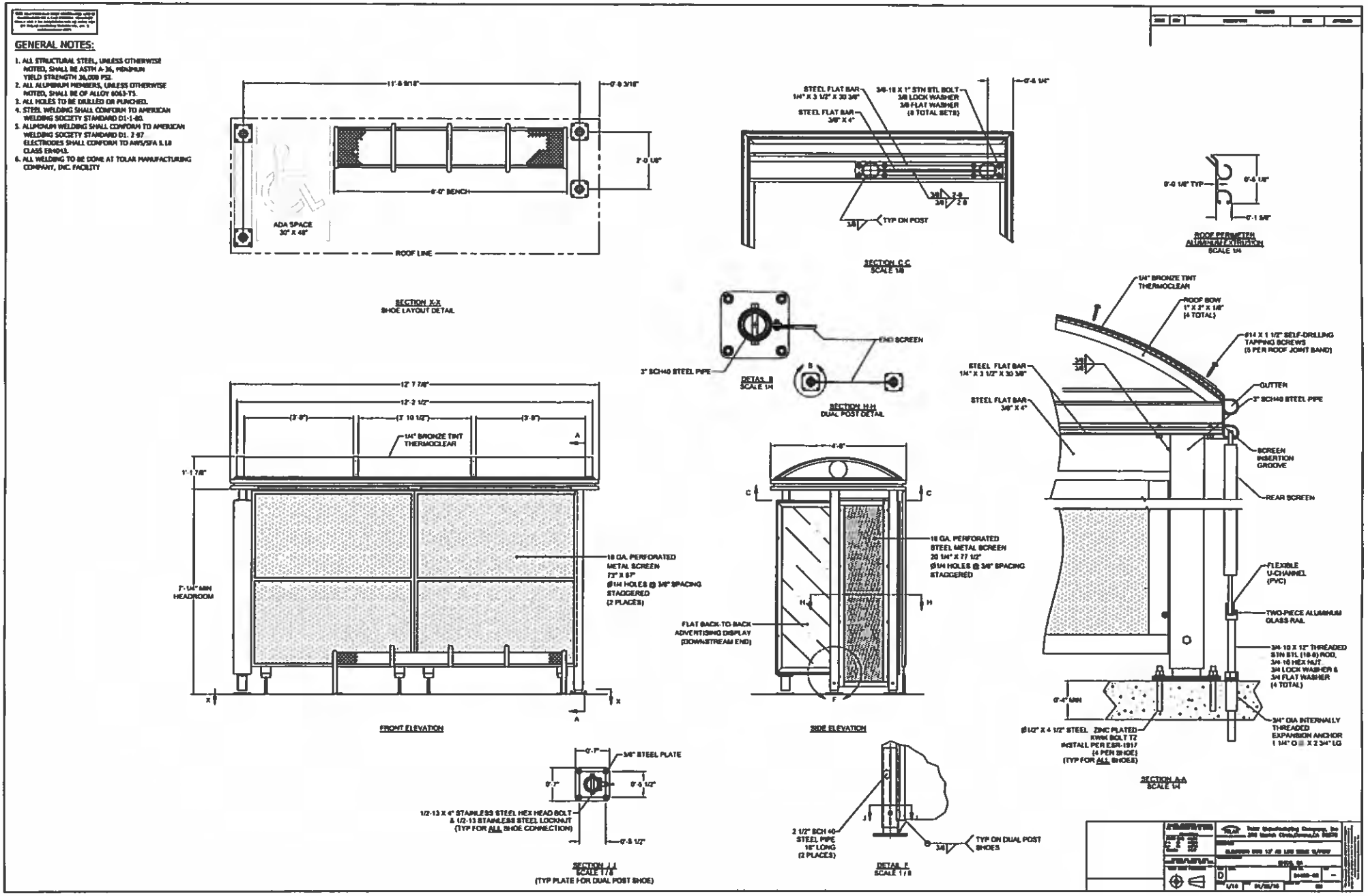
STANDARD DETAIL

ST12

APPROVED 7/21/09 DATE

Yuba-Sutter Transit Standard Bus Shelter

Attachment B



Yuba-Sutter Transit Standard Bus Bench

Attachment C