C. Cost Estimate Methodology

Planning-level cost estimates were prepared for the Potential Improvement Segments using the data in the Field Data Spreadsheet, supplemented by review of conditions in Google Earth and Streetview. As detailed in Appendix B, the first step was to classify each quarter-mile sub-segment's northbound (NB) and southbound (SB) sides into the most applicable improvement type, consistent with the conceptual improvement types illustrated in Chapter 2 of the Study Report. In addition to the presence or absence of planned California Coastal Trail (CCT) in the ROW, existing pavement width and adjacent slopes are the most significant improvement feasibility/cost factors, and they vary widely through the corridor. The data collection classified widths and slopes per ¼ mile sub-segment, and the cost estimate further summarized these into three representative average conditions in each case – assumed center points in a range.

C.1. Conceptual Engineered Cross-Sections

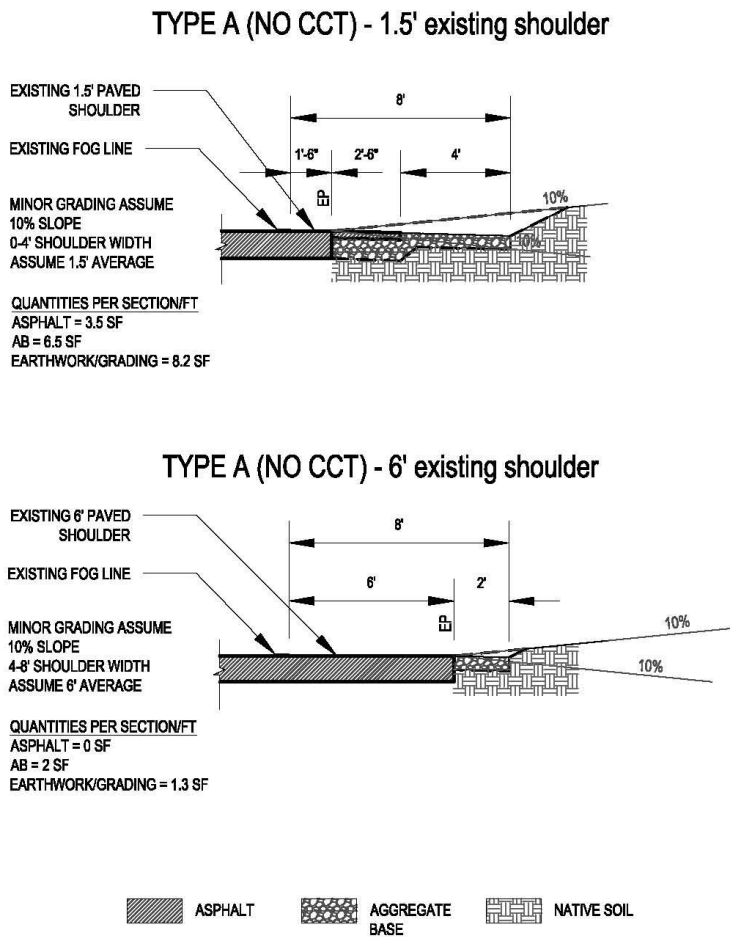
A series of more detailed conceptual engineered cross-sections (see **Figure C-1**) was prepared to provide a basis for estimating quantitiesfor grading, paving, walls, guardrail, and other construction elements. These reflect several variables. The engineered cross-sections are examples and do not reflect all potential variations in design types. They show various representative configurations of cut slopes, which mirror the quantity and cost of the corresponding widening on a fill slope, as illustrated in Type C with CCT. The example engineered cross sections include:

- Three different assumed average levels of adjacent slope:
  - Minor (Type A), with a range of zero to 25% slope, assumed average 10%
  - Moderate (Type B), with a range of 25% to 50% slope, assumed average 40%
  - Severe (Type C), greater than 50% slope, assumed average 100%
- Three different assumed average widths of existing shoulders: 1.5 feet, 6 feet, and 8 feet or more;
- With and without the California Coastal Trail (CCT);
- Two different improvement goals;
  - 8-foot shoulders (4 feet paved and 4 feet unpaved) and 8 feet of adjacent level space for the CCT, where applicable, in locations where slopes are Minor (A) to Moderate (B)[1]
  - 4 foot paved shoulders and 4-foot CCT where adjacent slopes are Severe (C)
- In all segments with CCT a guardrail or other form of crash barrier and a safety fence are included.

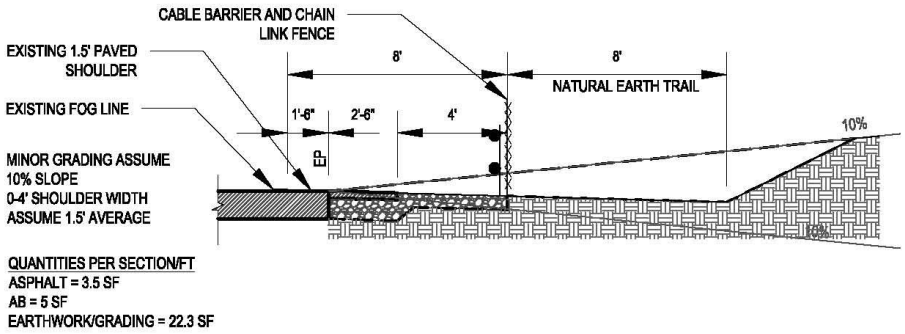
[1] The estimates assume that 8 feet of shoulder is the goal in areas with minor to moderate slopes, as an 8 foot shoulders is the Caltrans Highway Design Manual standard, but assume that only 4 feet of the shoulder will be paved, in response to California Coastal Commission policy. This is a compromise concept that would need to be resolved on a site-specific basis.

The engineered cross-sections and resulting estimates include generalizations about widening relative to slope types. As the design of potential improvement segments is further developed in subsequent stages, depending on the setting, and whether relatively unconstrained segments are sandwiched between segments with severe slopes and other constraints, or vice-versa, the 8 foot widening versions might be designed to be, for example, only 4 feet wide, and the 4 foot type might be designed at 8 feet wide. These potential future adjustments to site-specific improvement concepts are indicated in the dimensioning of the cross-sections, but are not reflected in the cost estimates.

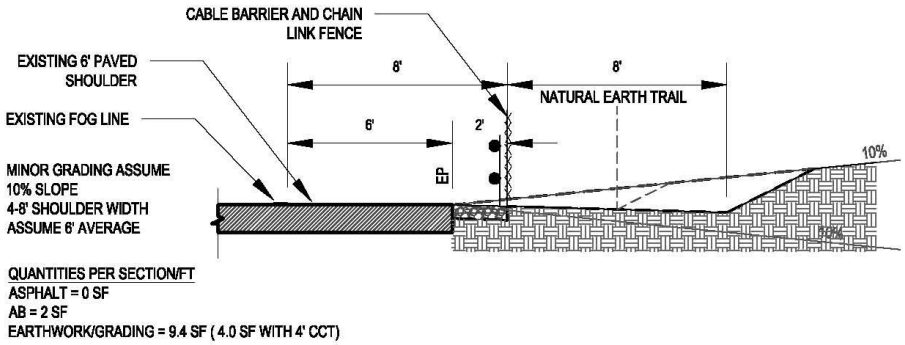
Figure C-1: Improvement Type Engineered Cross-Sections



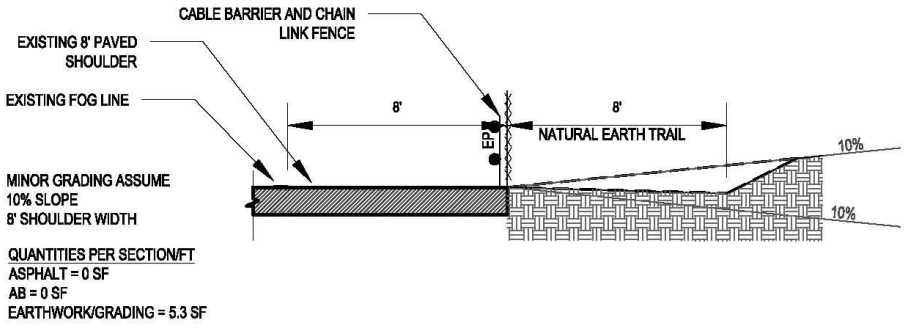
TYPE A with CCT - 1.5' existing shoulder



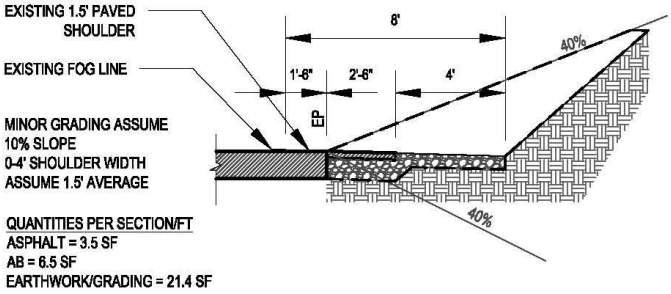
TYPE A with CCT - 6' existing shoulder



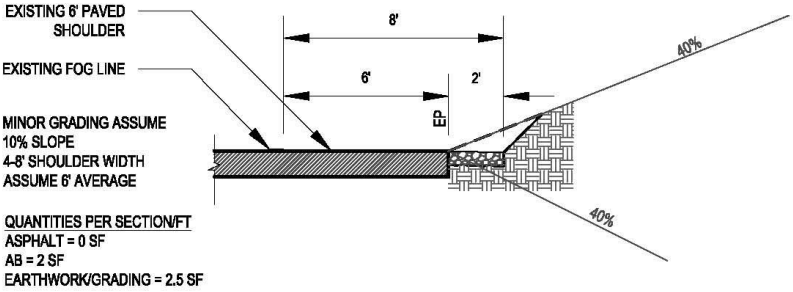
TYPE A with CCT - 8' existing shoulder



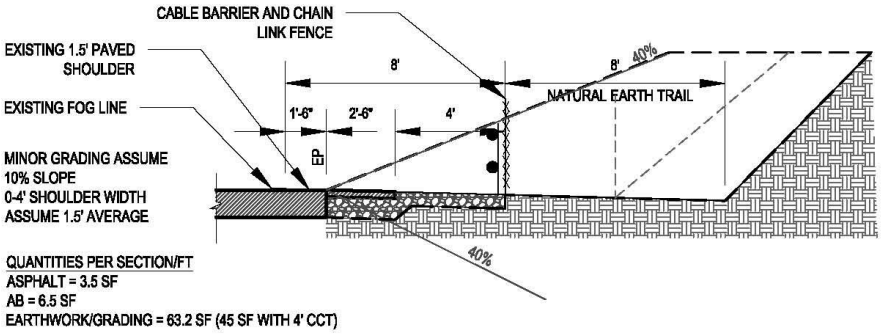
TYPE B (NO CCT) - 1.5' existing shoulder



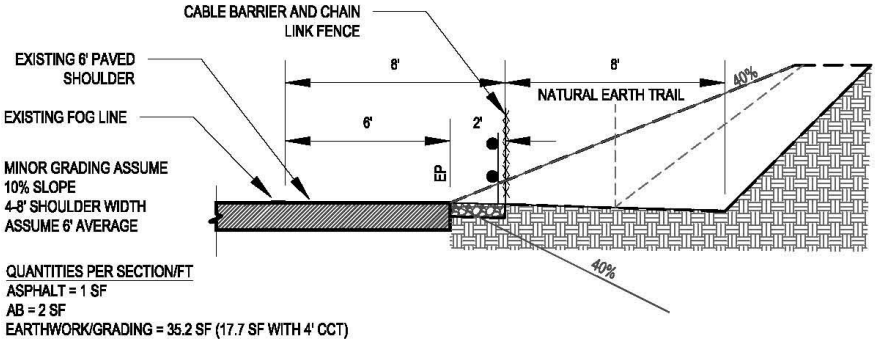
TYPE B (NO CCT) - 6' existing shoulder



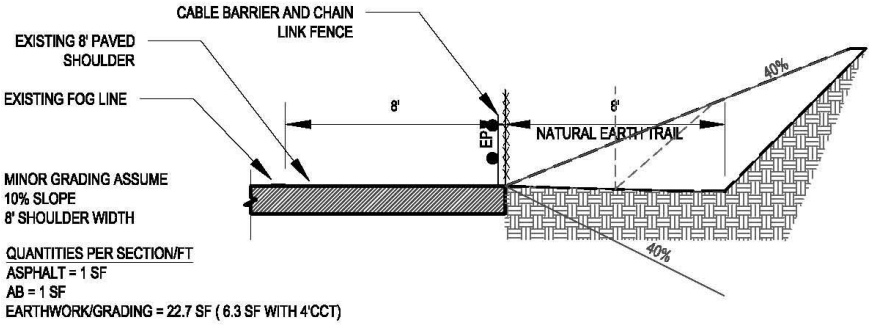
TYPE B with CCT - 1.5' existing shoulder

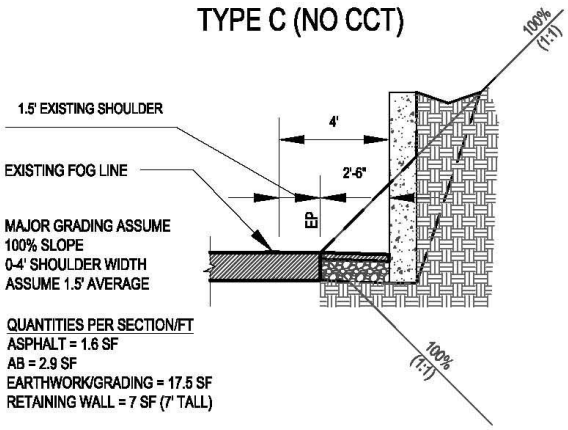


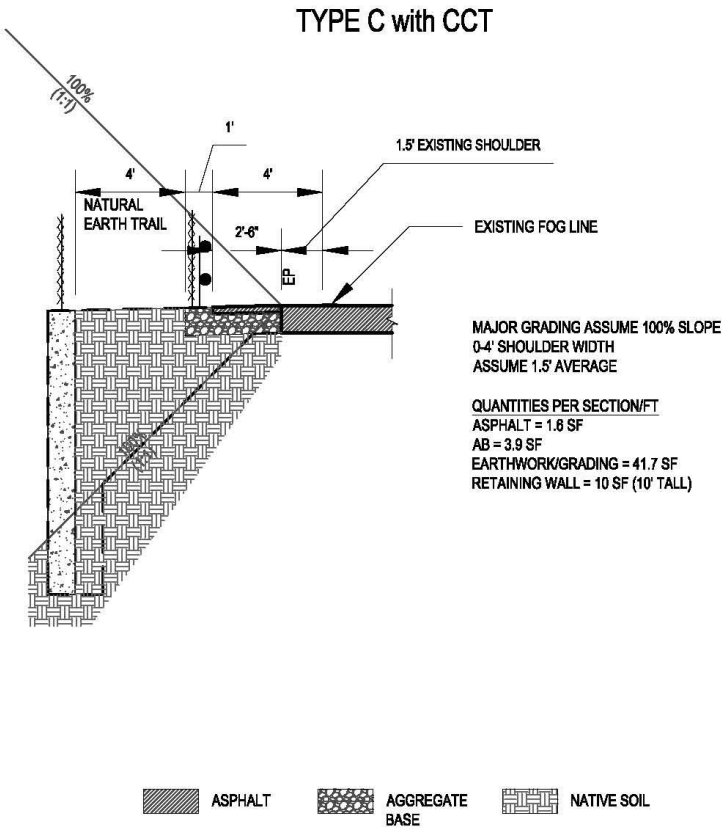
TYPE B with CCT - 6' existing shoulder



TYPE B with CCT - 8' existing shoulder




TYPE C (NO CCT)
100% (1:1)
1.5' EXISTING SHOULDER
4'
EXISTING FOG LINE
2'-6"
EP
MAJOR GRADING ASSUME
100% SLOPE
0-4' SHOULDER WIDTH
ASSUME 1.5' AVERAGE
QUANTITIES PER SECTION/FT
ASPHALT = 1.6 SF
AB = 2.9 SF
EARTHWORK/GRADING = 17.5 SF
RETAINING WALL = 7 SF (7' TALL)
100% (1:1)


TYPE C with CCT
100% (1:1)
1'
1.5' EXISTING SHOULDER
4'
4'
NATURAL
EARTH TRAIL
2'-6"
EP
EXISTING FOG LINE
MAJOR GRADING ASSUME 100% SLOPE
0-4' SHOULDER WIDTH
ASSUME 1.5' AVERAGE
QUANTITIES PER SECTION/FT
ASPHALT = 1.6 SF
AB = 3.9 SF
EARTHWORK/GRADING = 41.7 SF
RETAINING WALL = 10 SF (10' TALL)
ASPHALT
AGGREGATE BASE
NATIVE SOIL

C.2. Review of Site-Specific Improvement Types

The initial definition of conceptual improvement design (shoulder widening and space for the CCT) was driven by terrain as identified in the field conditions inventory:

- Areas with Type A and B slopes (< 50% or 2:1) were programmed for widening as necessary to provide 4 foot paved shoulders for bikes, plus 4 foot unpaved shoulder for buffer and vehicle safety, plus and 8 foot space for the CCT where applicable.
- Areas with Type C slopes (> 50% or 2:1) were programmed for widening as necessary to provide 4 foot paved shoulders for bikes without the additional 4' unpaved shoulder, and 4 foot space CCT where applicable.

The field inventory was by necessity quite generalized on the basis of averaged cumulative conditions within each quarter mile subsegment. During cost estimate preparation these results were reviewed against field conditions using Google Streetview to check the resulting improvement design types against conditions.

In some cases adjustments were made in the slope type and pavement width classifications, and notes were added regarding factors that should be considered in refining the conceptual improvements and costs at the next stage. These changes and notes are reflected in the Potential Improvement Segment tables and total cost estimates in Section 3 of the Study report, and are contained in the cost estimate spreadsheets provided as one of the Study products.

C.3. Utility Poles

Utility poles that are obstructing widening for the PCBR and/or CCT could be a significant cost factor. The field data indicates quarter mile segments where two or more utility poles are obstructing the widening area. A methodology for a "placeholder" cost for utility pole relocation was developed based on discussions with Caltrans staff.2 The cost for utility pole location depends on whether the poles carry electrical service, or only communications. Also, any pole in Caltrans ROW that is covered by an encroachment permit with Caltrans will have to be moved by the utility provider at their cost. Poles that are in the ROW and have "prior rights" (grandfathered in) will have to be relocated at the project's cost. The data doesn't include these factors, so for estimating purposes it is assumed that 10% of the poles will have to be paid for by the project at $10,000 per pole (an assumed average cost between power and communications poles). An average spacing of 100 feet between utility poles was assumed, or 13.2 utility poles per quarter mile. Thus for each quarter mile where obstructing utility poles are indicated, an allowance of $13,200 was provided for utility pole relocation.

C.4. Culverts

Culverts may present a challenge to shoulder widening or the development of the Coastal Trail. If the existing culvert does not provide adequate distance from the edge of the roadway to accommodate the envisioned widening, it will have to be extended, and depending on its' condition, potentially replaced. The available data did not detail the location of all culverts, their type, length, or condition, so these factors must be extrapolated. A listing of culverts was provided for certain limited segments of the study area. The estimate assumes that this frequency of culverts is relatively consistent for all segments culverts; or approximately 8-9 culverts per mile, or 2 per quarter mile. About 25% of culverts in the available data needed replacement or

[2] Brett Benson, Caltrans District 1 ROW Department, phone conversation

major repair, and about 60% were rated "Do nothing." To provide a "placeholder" cost for culverts, it is assumed that two culverts per quarter mile would need to be extended, and one of these would need to be replaced. The cost for culvert extension depends on the extent of widening.

Culvert extension or replacement cost can vary significantly based on culvert size and type, and site conditions. The cost estimate includes an assumed average cost of $200 per lineal foot of culvert extension or replacement, and a $2000 allowance per culvert for the inlet or outlet. These costs were based on review of a long-term bid history for culvert replacement.[3] Using these unit costs, costs per quarter mile for culverts were extrapolated as follows:

- For Type A and B slopes with CCT the total widening/extension could be 16 feet or more. For budgeting purposes 20 feet at $200 per foot was assumed, plus $2000 for inlet or outlet, or $6000.
- For Type C slopes without CCT widening could be up to 4 feet. For budgeting purposes 5 feet of extension at $200 per foot was assumed, plus $2000 for inlet or outlet, or $3000.
- For Type C slopes with CCT widening could be up to 8 feet. For budgeting purposes 10 feet of extension at $200 per foot was assumed, plus $2000 for inlet or outlet, or $4000.
- Half the culverts are assumed to need replacement, with an allowance of an additional 40 feet of culvert at $200 per foot, or $8000 total, which was added per quarter mile to all potential improvement segments on top of the extension cost.

C.5. Right-of-Way Acquisition

The study corridor is comprised of a combination of both prescriptive and fee ownership right-of-way (ROW). Prescriptive ROW pertains to areas of the highway where the ROW is ill-defined and ownership is not documented. Fee ownership ROW pertains to areas where the ROW is defined and ownership is documented. The identification of fee versus prescriptive ROW is limited by available data. Based on the current limitations of available data, the field inventory identified segments of ROW where acquisition may be required.

Caltrans ROW Department staff[4] suggested an allowance of $2500 per parcel for ROW acquisition. The logic is that large parcels (20 acre and above) would be less expensive than smaller parcels which may be residential or commercial and may have more extensive improvements in the area to be acquired, and therefore large and small parcels would cost roughly the same. A related consideration raised by Caltrans is the fact that some zoning codes require setbacks from the ROW/parcel line. Moving the ROW may thus change the setback and limit the use and value of the property. Because it would be difficult to correlate parcels to the quarter mile inventory segments, the cost escalation factor was approximated by doubling the allowance per quarter mile for ROW acquisition in urbanized areas.

Finally, extent and cost of ROW acquisition is likely to be higher in areas with prescriptive ROW compared to areas with fee ROW because any disturbance or construction outside of the existing limits may require acquisition of additional ROW.

[3] FLH Bid History Cost Estimates for Culvert Repair and Replacement Tasks

[4] Brett Benson, Caltrans District 1 ROW Department, phone conversation

ROW acquisition is likely to vary for different segments improvement types, and assumptions were made to try to account for this:

1. CCT segments (typically SB or west side) in Type A or B slopes – 16 feet of widening); $1250 per quarter mile segment in fee ROW areas; $2500 per quarter mile segment in prescriptive ROW areas
2. Non-CCT segments with Type A or B slopes and CCT segments (typically SB or west side) in Type C slopes – 8 feet of widening: no requirement/cost in fee ROW areas; $1250 per quarter mile segment in prescriptive ROW areas
3. Non-CCT segments with Type C slopes (4 feet of widening, but likely to include slope/construction easements: no requirement/cost in fee ROW areas; $1250 per quarter mile segment in prescriptive ROW areas

Again, cost of ROW in urbanized areas ("Urban Features" in the field inventory), was doubled.

C.6. Other Project Cost Factors

The estimate for each Potential Improvement Segment includes allowances for related construction and "soft" costs as follows:

Clearing and Grubbing	5%
Erosion Control - SWPPP	4%
Mobilization	5%
Traffic Control	5%
SUB-TOTAL:	
Contingencies	20%
Design and Surveying	15%
Environmental	5% - 20% (see below)
Review and Construction Engineering	20%
ROW / ROW Engineering	See Below
TOTAL	

C.7. Environmental Costs

Environmental study, permitting, and mitigation costs can be a major factor for potential PCBR and CCT improvements. These can even be "deal-breakers" for some projects. It was not feasible to accurately estimate these costs at the very early stage and broad scale of this Study, or to identify specific "deal-breakers". However the Study included a relatively detailed high-level assessment of known constraints, and provided a "score" for environmental constraints for each quarter-mile sub-segment, as discussed in Appendix A. These scores were classified into four different cost levels from 5% to 20% per quarter mile and aggregated to represent the environmental process costs in the Potential Improvement Segment summaries.

Similarly, cultural resources information (limited to a "yes" or "no" for known resources per quarter mile segment) was correlated with improvement type/disturbance extent to produce four levels of project cost for this issue, from 5% to 20%

C.8. Unit Costs

Estimates were prepared corresponding to the above engineered cross-sections to reflect the most representative condition/improvement scenario for each quarter-mile sub-segment. Additional cost items were added for each sub-segment to reflect the presence of features such as narrow bridges, culverts, trees, utilities, and urban improvements that would tend to increase the cost.

Improvements for each of these scenarios were quantified to produce a total cost per mile for that type, and multiplied by the number of miles of that type present in the study area.

Table C-1 presents the master cost item list for the various conditions/improvements scenarios represented in the cross-sections in **Figure C-1**, and the other factors that were applied in the cost estimate tables. The quarter-mile sub-segment costs for each Potential Improvement Segment were added together to get the total construction cost.

Table C-1.Master Cost Item List

Construction Item	Unit	Unit Price	
Tree Removal	LF	$7.10	Assume 25 Trees/mile@$1500
Reinforced Concrete Retaining Wall - per face square foot (FSF)	FSF	$150.00	Per face square foot (FSF) - assumed to include 2' concrete lined ditch behind wall
Bridge Replacement/Reconstruction	LF	$2,000.00	$1,000 ea. for NB and SB sides; not estimated for bridges with PSR
Earthwork/Grading for Improvements (based on cross-section area)	CF	$1.00	Assumes widening into cut bank, or backfill of a down-slope wall; CCT surface assumed to be native earth
Sawcut and remove 1' AC Edge	LF	$1.00	Assumed for pavement widening for tie-in
Aggregate Base - 8" depth	SF	$1.50	For all shoulder widening - assumed extra 1' for pavement tie-in; based on $60/CY
Asphalt Paving - 3" depth	SF	$4.00	Assumed to create max. 4' shoulders; beyond 4' assumed to be base rock - assumed extra 1' for pavement tie-in
Roadway/Path Striping & Signage W/O CCT	LF	$4.00	Fog line, bike route signage, etc
Roadway/Path Striping & Signage With CCT	LF	$6.00	Fog line, trail CL striping, pavement markings, bike path signage, etc
Guardrail on Type C Slopes W/O CCT - SB Side		$30.00	Includes removal of existing guardrail, new guardrail
Fence/Barrier between CCT and Roadway	LF	$50.00	Includes removal of existing guardrail, new guardrail, and fence or railing for bike safety
Fence/Railing between CCT and Wall or Steep Slope	LF	$20.00	Fence or railing for safety - Type B or C slopes
Culvert Extension/Replacement	LF	$200	Placeholder to cover various types
Inlet or Outlet for Culvert Extension/Replacement	EA	$2000	Placeholder to cover various types
Utility Pole Relocation	EA	$10,000	Placeholder for communications and/or electric

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