Commentary

Element Environment

Assigning the proper element environment is vital for accurate deterioration predictions and future project identification. The environment is simply a 1 to 4 number representing the aggressiveness of the operating practices or local environment of each element. Each element can have only one associated environment but it may be different than the other elements on the same bridge. The definition of each environment is listed below.

Environment	Definition
1 – Benign	Neither environmental factors nor operating practices are likely to significantly change the condition of the element over time or their effects have been mitigated by the presence of highly effective protective systems.
2 – Low	Environmental factors and/or operating practices either do not adversely influence the condition of the element or their effects are substantially lessened by the application of effective protective systems. The most frequently occurring environment in California is environment 2.
3 – Moderate	Any change in the condition of the element is likely to be quite normal as measured against those environmental factors and/or operating practices that are considered typical by the agency.
4 – Severe	Environmental factors and/or operating practices contribute to the rapid decline in the condition of the element. Protective systems are not in place or are ineffective.

The environment designation of an element can change over time; as it would if operating policies were changed to reduce the use of road salt. By definition, the environment designation can not change as the result of maintenance work or deterioration. The most frequently occurring environment in California is environment 2.

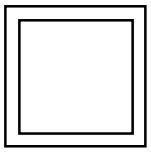
Environment Determination Guidelines

Factors that could increase the severity of the environment rating for various elements include: (Record the predominant environment)

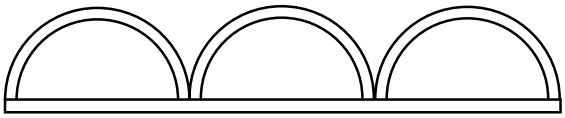
Element	Factor
Timber Elements	High moisture content – All timber elements Pest Infestation – All Timber Members
Steel Elements	Distance From Salt Air – All steel elements
Concrete Elements	Freeze Thaw Cycles – All Concrete Elements Tire Chain Wear – Concrete Bridge Decks Salting of Decks – Concrete Bridge Decks, Rails, and Substructure Elements
Petroleum Based Elements	High Skew – Joints and Bearings Extreme Temperature Ranges – Joints and Bearings Air Pollutants (smog) – Joints and Bearings
Operating Practices	High Traffic or Truck Volumes – Deck, Superstructure, and Joint Elements

Element Determination

- **Culverts.** The quantity for culverts will be the length of the barrel regardless of the number of individual barrels.



Quantity = 1 × Barrel Length



Quantity = 1 × Barrel Length

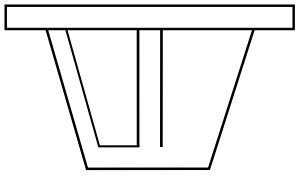
- **Spandrel Arches:** Arches are typically recorded as the number of linear meters on each side of the bridge (2 arches). Spandrel columns should be recorded as the appropriate column element type and individually counted. Deteriorated secondary arch members (either vertical or perpendicular to the arch length) should be recorded as the appropriate width of the member along the horizontal projection of the arch.

- **Accounting for Skew:** The skew of a bridge should be taken into account when recording element quantities for Joints, Abutments, Pier Walls, Culverts, Floor Beams, Tunnels and Bent Caps. Accounting for the skew is as simple as determining the length of the element perpendicular to the roadway and dividing by the cosine of the skew angle.

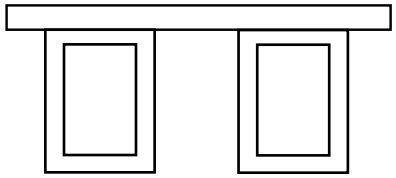
- **Diaphragms and Cross Bracing:** The tributary portion of any deteriorated Cross frame, Diaphragm or Strut should be recorded under the element being braced. A deteriorated cross frame in Condition State 3 on a steel girder bridge would be recorded as 1 meter of girder(the horizontal projection of the cross frame on the girder) in Condition State 3.

Element Determination...

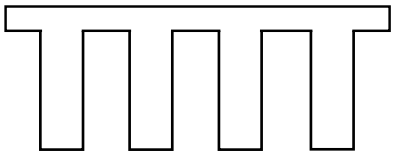
- **Box Girders.** The quantity for box girders is equal to $^{1}|_{2}$ the number of visible girder faces times the length of the bridge.



Quantity = 1/2(2) = 1 Girder × Length

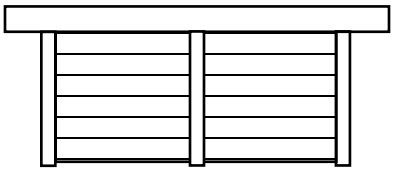


Quantity = 1/2(4) = 2 Girder × Length



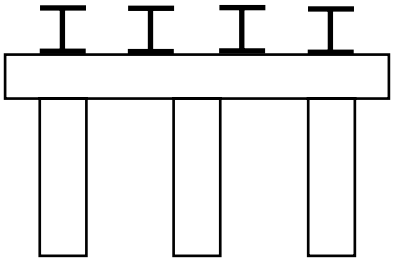
Quantity = 1/2(8) = 4 Girder × Length

- **Timber Abutments.** These type of abutments typically will get 3 different elements, a timber cap, timber column, and timber abutment. The timber abutment in these cases will consist only of the back wall of the abutment.



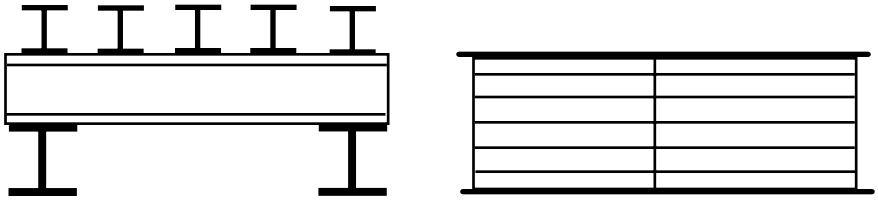
Quantity: Timber Piles = 3, Timber Cap = 1 × width, Timber Abutment = 1 × width

- **Pile Bent.** Pile bents will typically have two elements, a non integral cap and columns. Any diagonal column bracing structurally required can be considered in rating the condition of the columns.



Quantity: Columns = 3, Cap 1 × Width

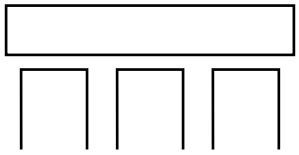
- **Stringers/Floor Beams/Girders.** Stringers are the small elements which run longitudinally to the deck and carry the load from the deck to the floor beams. Floor beams are transverse to the deck and carry the stringer load out to the truss or girders. Girders are the main longitudinal superstructure members which carry the loads to the substructures. See diagram below:



Quantity: Girders = 2 × Length, Floor Beam = 3 × Width, Stringers = 5 × Length

Timber longitudinal members shall always be recorded as Stringers

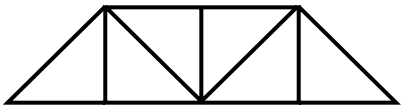
- **Concrete Channels.** These elements are precast channels with normal reinforcement (not pre-stressed). Record these elements as a reinforced concrete girder, and also include the deck as a separate element.



Quantity = 1/2(8) = 4 × Length

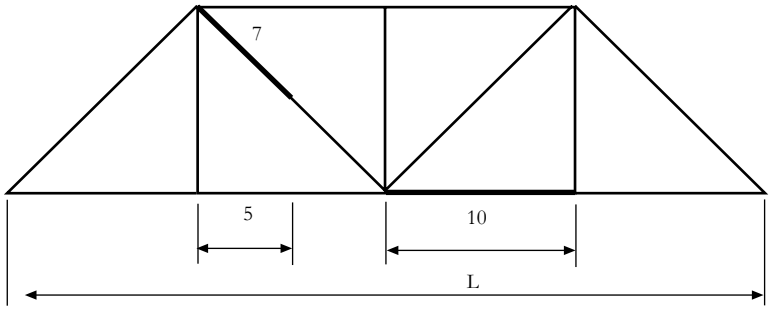
Element Determination...

- **Trusses.** Trusses are recorded as the number of linear meters on each truss line of the bridge. Diagonals, verticals or cross bracing are not counted as additional quantities.



Quantity = 1 × Length (for each truss line on the bridge)

Deteriorated Portions of a Truss: All measurements of the truss components are along the horizontal projection of the element. For deteriorated vertical and portal members record the appropriated horizontally projected width of the member to the nearest meter (typically 1 meter). Deteriorated portions of diagonal members should also be recorded as the horizontally projected quantity to the nearest meter. In the example below, the total deficient length to record is 15 meters.



Rail Length Limits: Record the rail length that is present for the bridge itself. For a typical bridge this would mean recording all rail lengths on the bridge deck/slab, any wingwalls, and isolated approach rails. If the approach rails or median rail are continuous(not isolated) only record the lengths to the ends of the structure including wingwalls.

Record the lengths of vehicle Barrier Rails only. Do not record chain link fences or other pedestrian only rails.