

Caltrans Bridge Columns

By

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Why So Many Sizes and Shapes?

Column Design Considerations



Bridge layout, spans, architectural features, right of way and column bent location.

Column Analysis Considerations



Span length determines structure depth and column axial forces, from which column size follows. Column design is highly constrained.

Bridge Design and Analysis



Seismic Design Criteria (SDC) requires columns to be ductile and to dissipate energy during a seismic event by plastic hinging.

Bridge Design and Analysis



Columns are designed in accordance with:

- AASHTO LRFD Bridge Design Specifications (LRFD-BDS)
- Caltrans Amendments to LRFD-BDS
- Caltrans Seismic Design Criteria (SDC)
- Research and Testing

Bridge Design and Analysis

SAP 2000 and CT Bridge

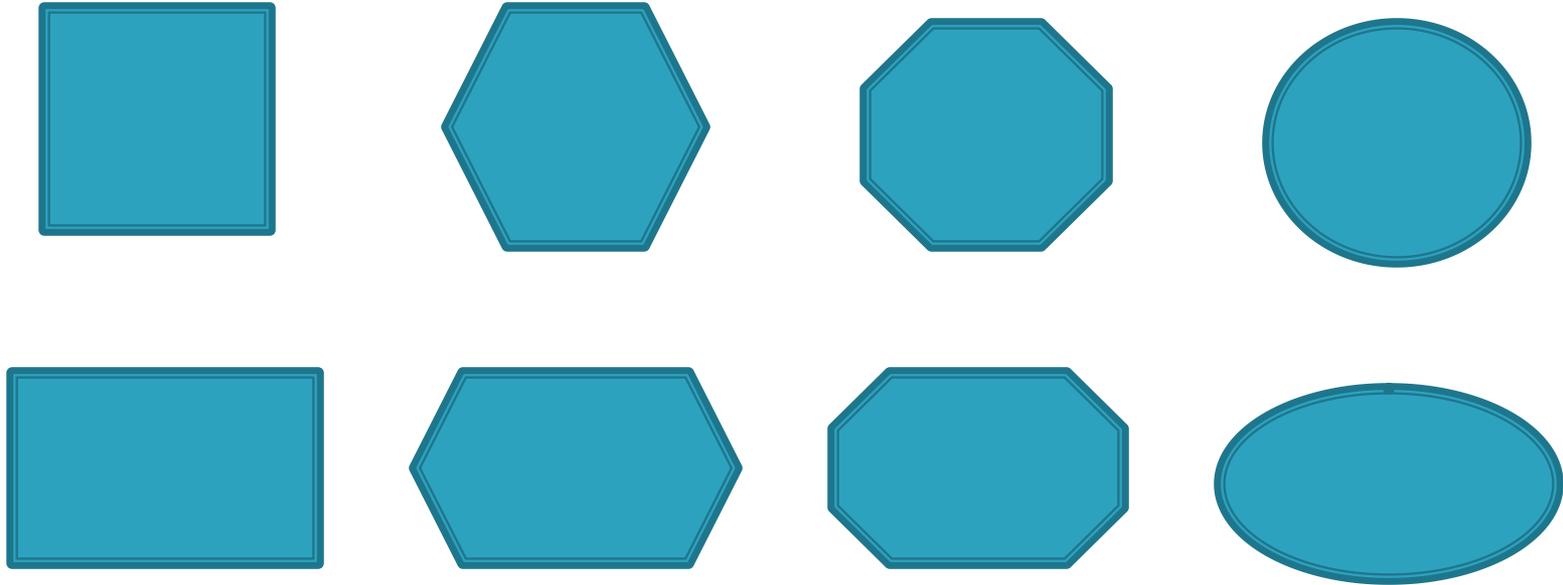
The screenshot displays the SAP2000 v14.2.4 Advanced interface. The main window shows the 'Caltrans Section Properties' dialog, which includes a cross-section diagram of a bridge pier with a circular core and an outer casing. The core is defined by a 'Round' shape with a 'Chamfer' of 62.5, a 'Height' of 500, and a 'Width' of 1000. The casing has a 'Thickness' of 0 and a 'Longit. Factor' of 0. The section is composed of 1 ring with a 'Ring1 Cover' of 41.6667. A table below lists the section components:

Region	Ring	No. of Bundles	Bundle Type	Bundle Bar No.	Bundle Area	Bundle Material
Core1	Ring1	8	Single	#5	199.9996	A615Gr6
Core2	Ring1	2	Single	#5	199.9996	A615Gr6
Core3	Ring1	8	Single	#5	199.9996	A615Gr6
Interlock1	Ring1	1	Single	#5	199.9996	A615Gr6
Interlock2	Ring1	1	Single	#5	199.9996	A615Gr6
Prestress		0	Tendon	N/A	0	N/A
Casing		N/A	Casing	N/A	0	N/A

The 'Concrete Model' dialog is open, showing a stress-strain curve for the concrete material. The curve is labeled with f_{cc} (compressive strength) and ϵ_{cc} (strain at peak stress). The ultimate strain is labeled ϵ_{cu} . The concrete material is '4000Psi' and the confinement material is 'A615Gr60'. The confinement layout is set to 'Tie & Cross Tie' with a 'Longit. Spacing' of 250. The height and width of the confinement are both 416.6667. The confinement material has a 'Bar Size' of #3 and a 'Bar Area' of 70.9676. The concrete material has a 'Bar Size' of #5 and a 'Bar Area' of 199.9996. The concrete material properties are: $\epsilon_0 = 2.219E-03$, $\epsilon_u = 5.000E-03$, $\epsilon_{fact} = 1$, $f_0 = 0.0276$, $f_u = 0.0138$, and $\epsilon_{cu(limit)} = 0.05$. The confinement material properties are: $\epsilon_{su} = 0.09$. A red arrow points from the 'Core Concrete' label in the 'Concrete Model' dialog to the stress-strain curve.

Column lengths, cross section, and reinforcement ratios are modified to adjust the fundamental period of vibrations and stiffness of the structure per the Seismic Design Criteria (SDC).

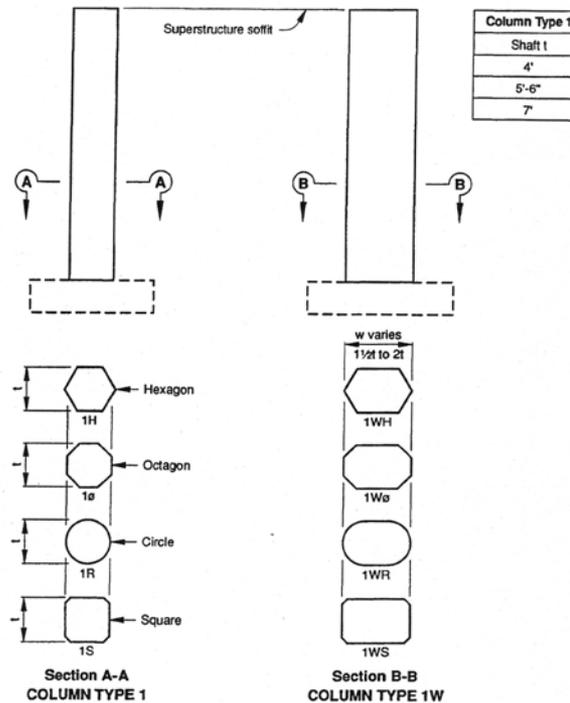
Does Caltrans encourage standard shapes?



- ❑ It is Caltrans Policy to Standardize Columns.
- ❑ Bridge Design Details Manual (BDD) lists 3 column sizes only: 4', 5'-6", 7'.
- ❑ Column sizes should be in 6" increments.

Standard Architectural Columns (Prismatic)

Standard Architectural Columns Prismatic



Standard Architectural Columns (One Way Flare)

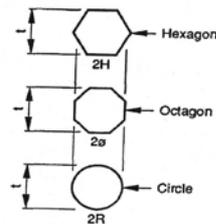
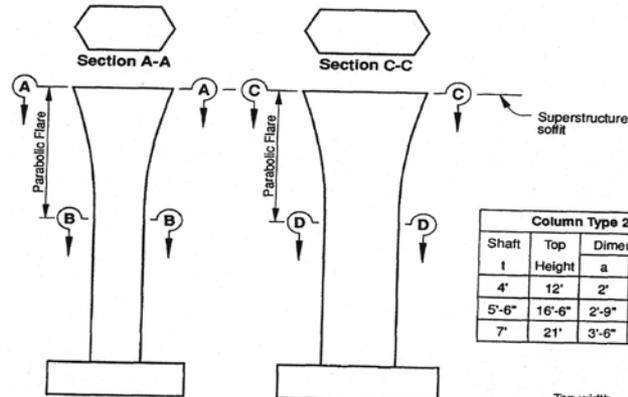
BRIDGE DESIGN DETAILS

APRIL 1990

7-31.1

Standard Architectural Columns One Way Flare

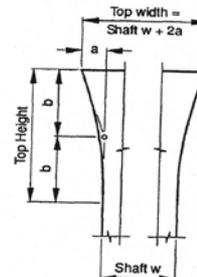
Top section for 2H shown. Others similar except as noted.



Section B-B
COLUMN TYPE 2

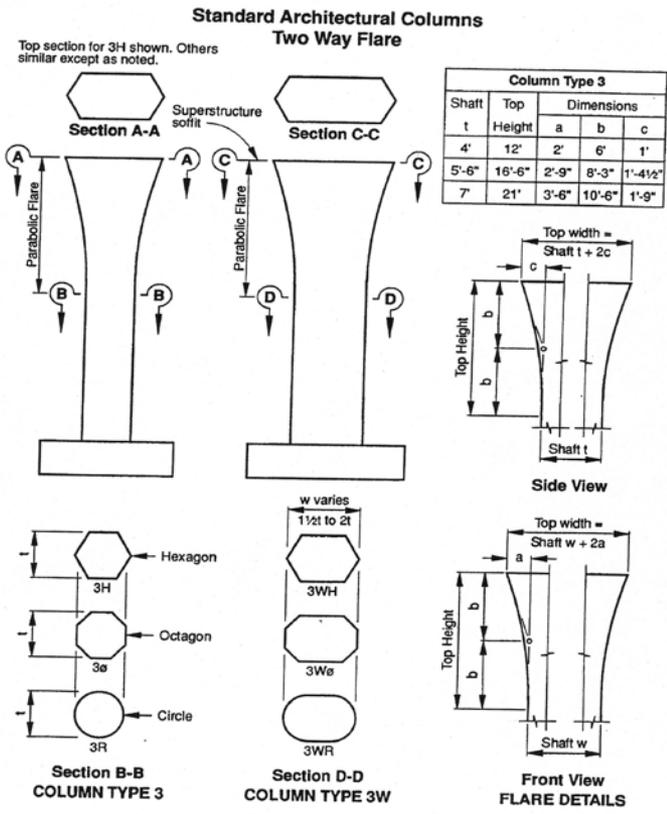


Section D-D
COLUMN TYPE 2W



FLARE DETAILS

Standard Architectural Columns (Two Way Flare)



Column Forms



Steel Column Forms

Column Forms



Steel Column Forms

Column Forms



Steel Column Forms (Flared)

Column Forms



Wood Column Forms

Column Forms



Bridge Columns



Bridge Columns



Gold line Bridge over the EB 210 Freeway (Artist Rendering)



Local stake holder's demand infrastructures projects that enhance the local environment.

Gold line Bridge over the EB 210 Freeway (Steel Column Forms)



Gold line Bridge over the EB 210 Freeway (Completed Project)



Community Signature...(Weaved Basket)

(Standard)



(Stunning)



Outrigger Bents

6th Street Bridge, Los Angeles



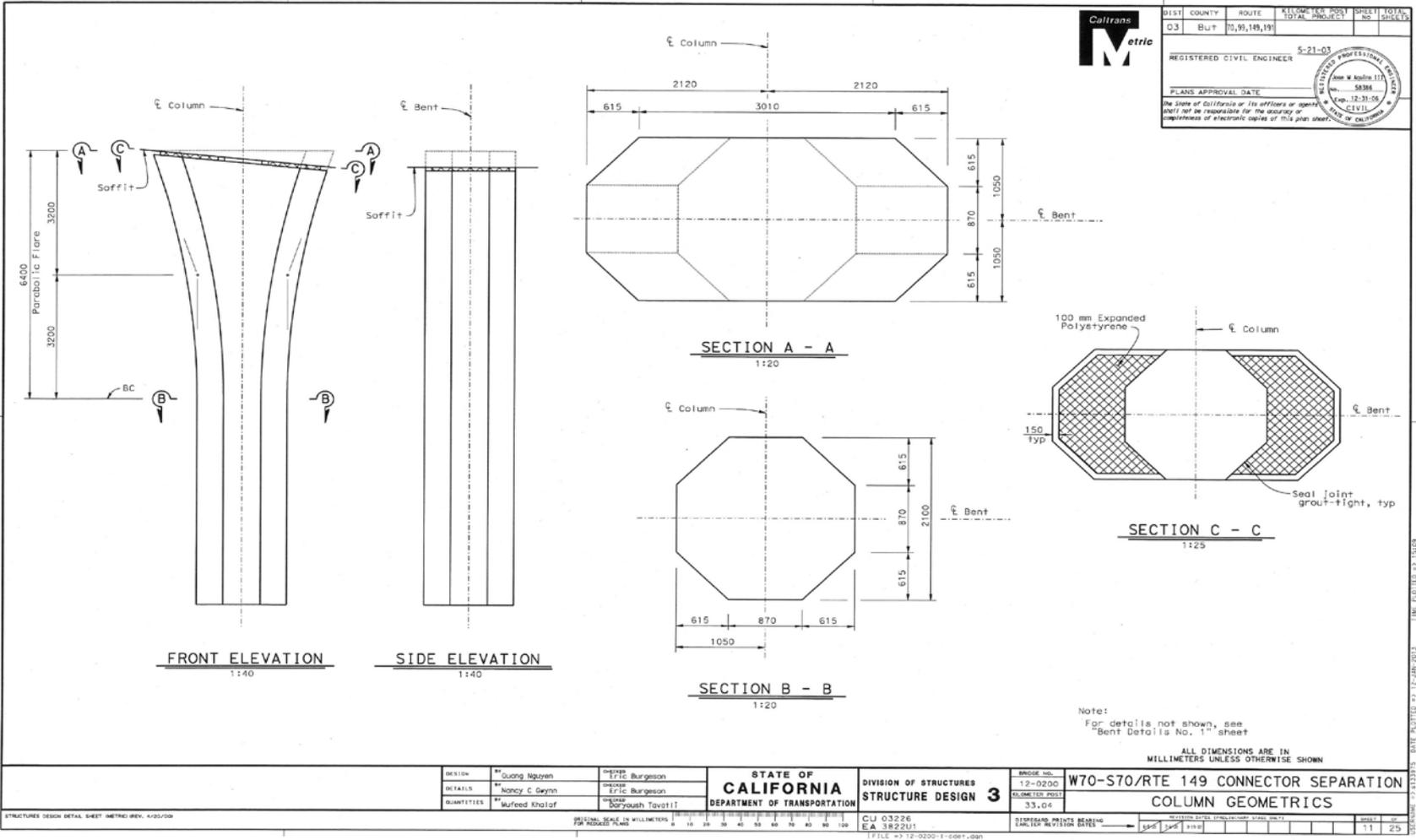
Existing Bridge (Standard?)

6th Street Bridge, Los Angeles



Proposed New Replacement (Stunning?)

Caltrans Bridge General Plan Sheet



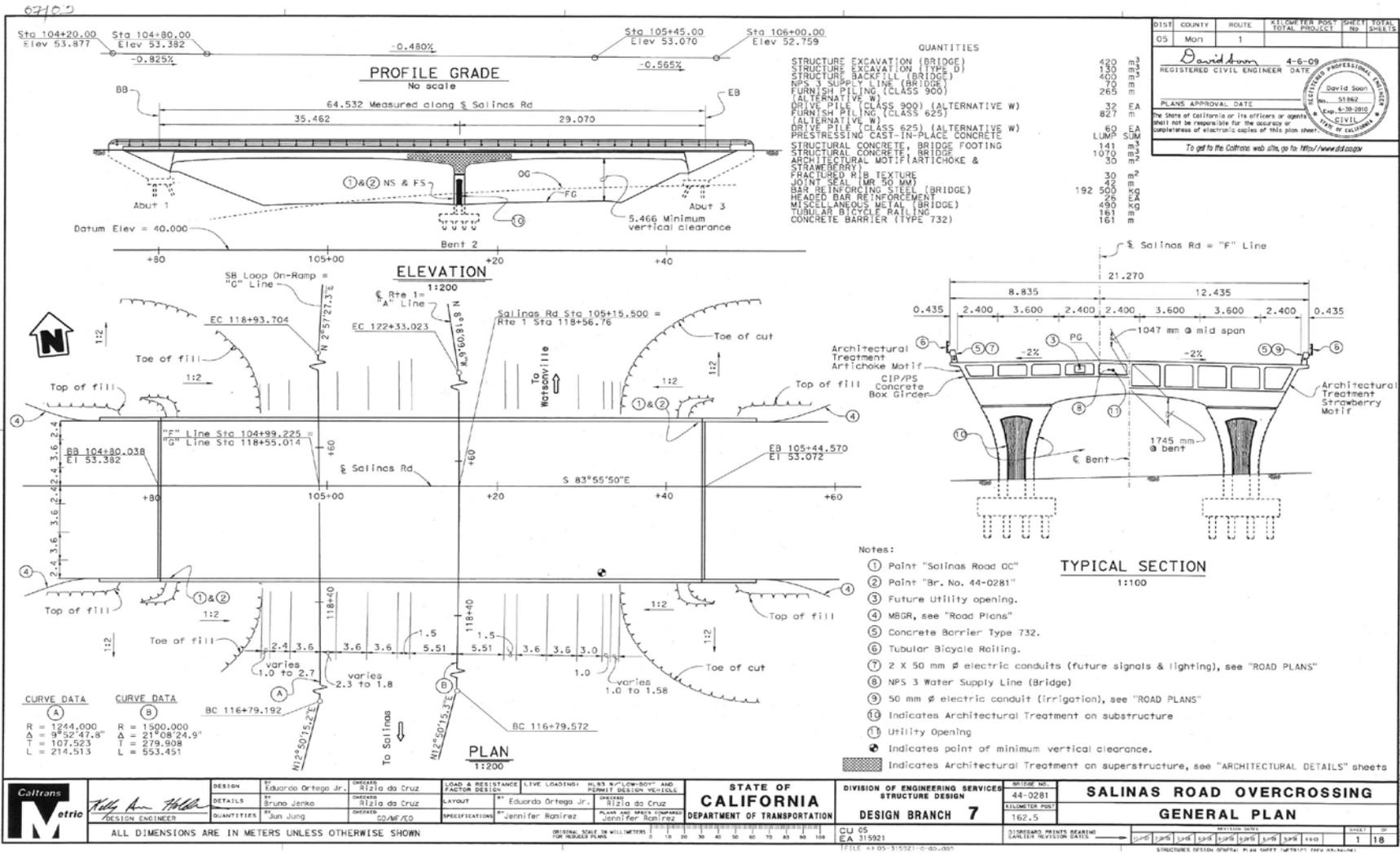
Caltrans Standard Bridge Column Flare

James R. Roberts Bridge



Flared Top Columns

Caltrans Bridge General Plan Sheet



Architectural Treatment

Flared Column



Architectural Treatment

Architectural Treatment (Columns)



Architectural Treatment (Columns)



Architectural Treatment (Columns)



ESTRELLA RIVER BRIDGE

PREPARED BY: DES, BRIDGE ARCHITECTURE AND AESTHETICS

Donner Pass Road OC; HWY 80



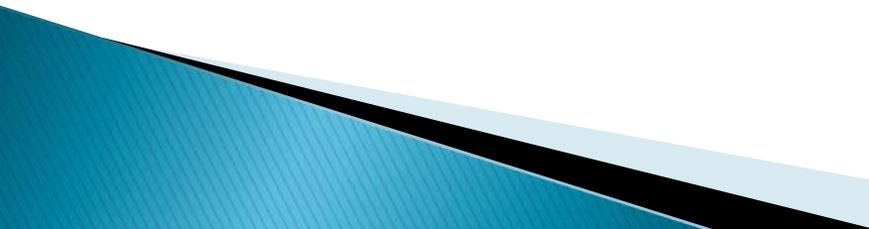
Bridge Columns (Non-Standard)

San Mateo Creek Bridge



Aesthetics Local Agency Involvement

Why So Many Column Sizes and Shapes?

- ❑ Caltrans' designers do have standard column sizes and shapes.
 - ❑ Seismic Design Criteria, AASHTO-LRFD, and Bridge Site Considerations dictate minor column modifications.
 - ❑ Local Agencies provide funding for most bridge structures and choose the design engineer for their projects (mostly a private Consultant not Caltrans).
 - ❑ Locals want "Signature Projects" to make their communities unique and their requests can not be ignored.
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How does Caltrans Select Bridge Column Shape, Size, Look, Form, Materials?

