CALIFORNIA DEPARTMENT OF TRANSPORTATION PLENARY SESSION

Presented by:

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California DOT Opening Remarks

- **The "Big Picture" at California DOT:**
  - Department Organization.
  - Strategic Planning and Innovation.
  - Budget and funding for transportation needs.
- **Project Delivery:**
  - Project delivery in Caltrans.
    - Increase in funding
    - Shelf projects
  - Future Department project delivery will focus on congestion relief:
    - "Go California" legislation.
    - Accelerate design and construction schedules.
    - Continue development of relationships with partners in the delivery of transportation projects.

Innovative California Precast Applications

- **San Mateo–Hayward Bridge (Widen)**: The widening of the existing 4.9 mile long trestle portion of this vital San Francisco Bay crossing was designed with 90 % of the structure consisting of precast concrete fabricated structural elements. In summary, this widening consists of a thin cast-in-place deck poured on **precast** deck panels, supported by **precast** bulb-tee girders, that rest on **precast** bent cap shells, that are integral with **precast** octagonal piles.
  - Listed below is a summary of the precast components used in the San Mateo – Hayward Bridge Widening Project:

- 42 *in* diameter by 118 *ft* long precast concrete cylinder piles (total 826).
- Precast concrete bent cap shells (total 278).
- 42 *in* deep by 86 *ft* long precast, prestressed bulb-tee girders (total 2168).
- 3.25 *in* thick precast, prestressed concrete deck panels, (19,000 units, 893,500 *sq ft* total).

– Construction proceeded quite rapidly on this project. The width of the widening is 58.6 *ft*, and the contractor was able to build 3 – 90 ft long spans per week. This works out to the area of bridge deck equivalent to a football field constructed each week. This is considered one of the most successful precast projects ever constructed in California.

– This project will be presented in detail in the **Imagineering in California: San Francisco Bay Toll Bridge Projects** session. The presentation is titled: *San Mateo-Hayward Bridge Widening Project – Precast Intensive Design and Construction*, Ali Asnaashari, California DOT, Sacramento, Calif. and R. Jon Grafton, Pomeroy Corporation, Petaluma, Calif.

- **San Francisco–Oakland Bay Bridge (Skyway Project):** The new San Francisco-Oakland Bay bridge consists of two structure types: the self-anchored suspension portion spans over the main shipping channel, and the precast segmental (Skyway) portion that comprises a majority of the bridge.

– Precast segments are cast in a temporary yard in Stockton, and shipped on barges to the job site in Oakland.

– The Skyway consists of 452 individual precast segments, resulting in a total length of nearly 1.3 miles

– The cost of the Skyway is $1,042,000,000, and work is progressing on schedule.

– To date, over 360 of the 452 segments have been cast, with an average production rate of 3 – 4 segments per week.

- To date, all of the Skyway piers are complete, and approximately 220 units have been erected and post-tensioned into place.
- This project will be presented in detail in the **Imagineering in California: San Francisco Bay Toll Bridge Projects** session. The presentation is titled: *San Francisco – Oakland Bay Bridge Skyway Project – Precast Segmental Fabrication and Construction*, David Neumann, California DOT, Sacramento, Calif.
- When completed, the new bridge is expected to look similar to the artist's rendering shown on the right side of the page.

- **Richmond–San Rafael Bridge Project:** The purpose of this project is to replace a deteriorated trestle section of the Richmond-San Rafael Bridge. Items that made this replacement unique include:
  - The use of a single precast double-tee section with an overall width of 43'-8".
  - The overall length of the replacement is 1.25 miles.
  - Each girder is made up of three match-cast precast segments. These segments are assembled on a barge prior to shipping them from the plant to the job site.
  - The center 40 *ft* segment is pretensioned, and the girder end segments have linear haunches.
  - All three segments are post-tensioned together on the barge in order complete the 100 *ft* long simple span girder.
  - Once in place, four simple span girders are post-tensioned together for continuity to create 400 *ft* long frames
  - This project will be presented in detail in the **Imagineering in California: San Francisco Bay Toll Bridge Projects** session. The presentation is titled: *Richmond-San Rafael Bridge Project – Spliced Girder Case Study*, Tim Holien, Pomeroy Corporation, Petaluma Calif. and Craig Chatelain, DMJM + Harris, Sacramento, Calif.

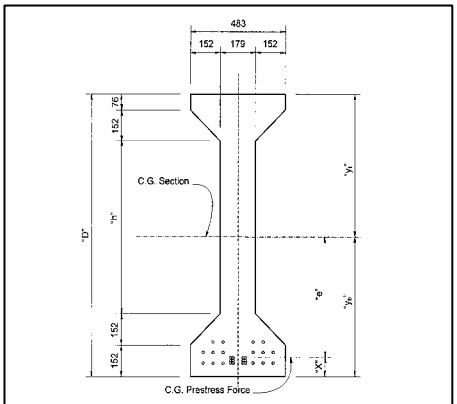
- **San Mateo – Hayward Bridge (Retrofit):** Piers supporting the main spans of this bridge lacked the necessary lateral capacity to withstand bay area earthquake. The solution involved retrofitting the existing piers with two precast "dog-bones" post-tensioned together, and pin-connected to 4 large diameter piles designed to limit seismic displacement.
  - Project involved the seismic retrofit of 20 piers, resulting in 40 precast units.
  - Epoxy coated bar reinforcing steel was required throughout. Rebar cages were fabricated in the plant, and lifted onto barges for forming and pouring of concrete.
  - The rebar cage itself weighed 55 tons.
  - A completed "dog-bone" is 9 *ft* tall, 100 *ft* long, with a 24 *ft* maximum width. Casting was done on the barge, because the overall weight of one unit is 550 tons. The finished units were barged to the job site from Petaluma.
  - The units are placed directly above their final position, a wet splice is poured, then the units are post-tensioned, and released to rest on the pinned connections at the 4 pile locations.
  - This project won a PCI Award, and is considered one of the most innovative bridge applications of precast concrete in California.

California Standard Precast Girder Applications

Back in the late 1950's and early 1960's, during a period that this country's Interstate transportation system was under development, prestressed concrete became a practical solution in the design and construction of bridges. Most of the country adopted the precast/prestressed concrete girder bridge as a preferred structure type, and these bridges have served the State DOT's well for almost 50 years.

During this same time frame, California took a slightly different path that the rest of the nation. For a variety of different reasons, California adopted the cast-in-place, post-tensioned box girder as its structure of choice. However, precast-pretensioned girder bridges have always had a place in California. In fact, recent statistics show an increasing percentage of bridges in California are being designed with precast girders, and with accelerated project delivery as a main focus within the Department, that trend is expected to continue well into the future.

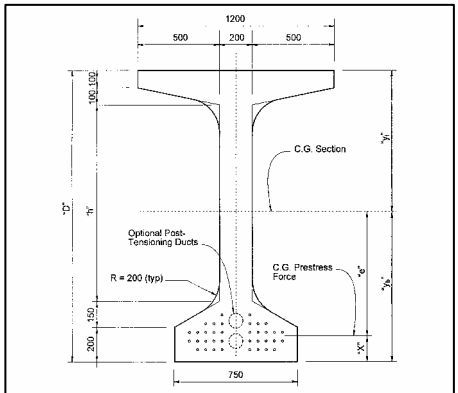
- **California "I" Girder:** Developed as a standard girder shape in the late 1950's, this structure type has several advantages:
  - Used routinely for span lengths up to about 100 *feet*.
  - Results in the elimination of ground-supported falsework, which allows for the following:
    - Enhanced safety to the traveling public.
    - Reduced fill cone heights.
    - Reduction in working days, resulting in less impact to traffic flow.
  - Ideal for widenings because of limited long-term deflections once deck is poured (minimal impact to existing structure).
  - Excellent quality control of girder fabrication.
  - Many California fabricators are able to produce this girder, making this structure type competitive with cast-in-place structures in the 100 *foot* span range.



SECTION PROPERTIES

"D" (mm)	"h" (mm)	Area (mm^2)	I (mm^4)	y_b (mm)	y_t (mm)	S_b (mm^3)	S_t (mm^3)	r (mm)	Mass (N/m)	Wt. (Kg/m)
914	382	279 200	28 200 E6	435	479	60.3 E6	54.7 E6	308	6580	671
1067	535	308 500	39 800 E6	508	559	78.3 E6	71.1 E6	360	7223	736
1219	687	333 700	56 800 E6	580	639	97.9 E6	89.0 E6	413	7866	802
1372	840	361 000	77 800 E6	654	718	118.9 E6	108.4 E6	464	8509	867
1524	992	388 300	102 900 E6	729	796	141.4 E6	129.3 E6	515	9152	933
1676	1144	415 600	132 600 E6	802	874	165.3 E6	151.6 E6	565	9795	998

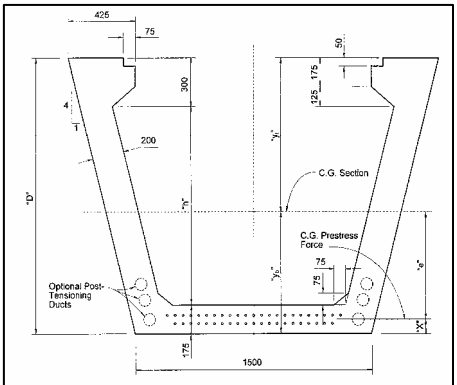
- **California "Bulb-tee" Girder:** Introduced as an alternative to the cast-in-place box girder about 8 years ago, this girder can be designed to span 180 *ft* or more. In addition to the benefits of the California "I" girder, the "Bulb tee" has the following characteristics:
  - When pre-tensioned, this girder is used routinely for span lengths up to 125 *ft*, and depending on the haul route, as long as 140 *ft*.
  - When girder segments are spliced together with post-tensioning, spans as high as 180 *feet* or more can be achieved.
  - The girder section modulus makes it possible to design a debonded strand pattern to control tensile stresses at the top fiber of the girder end region.
  - Specific applications of the California "Bulb-tee" girder will be presented in the **Imagineering in California: Precast Bridge Applications** session. The two presentations are titled:
    - *Sacramento River Bridge Replacement Project – Spliced Girder design and Construction*, Mark Darnall, California DOT, Sacramento, Calif.
    - *California Long-Span Bulb-Tee Girder Construction*, Mike Hein, Con-Fab California Corporation, Lathrop, Calif.



SECTION PROPERTIES

"D" (mm)	"h" (mm)	Area (mm^2)	I (mm^4)	y_b (mm)	y_t (mm)	S_b (mm^3)	S_t (mm^3)	r (mm)	Mass (N/m)	Wt. (Kg/m)
1400	850	598 500	155 400 E6	721	679	215.5 E6	228.8 E6	510	14 060	1433
1550	1000	626 500	201 200 E6	795	755	253.0 E6	266.5 E6	567	14 770	1505
1700	1150	655 700	254 200 E6	870	830	292.1 E6	306.2 E6	622	15 480	1577
1850	1300	686 100	314 500 E6	945	905	333.0 E6	347.5 E6	677	16 180	1650
2000	1450	716 300	382 600 E6	1019	981	375.4 E6	390.0 E6	731	16 890	1722
2150	1600	746 500	458 800 E6	1094	1056	419.4 E6	434.5 E6	784	17 600	1794

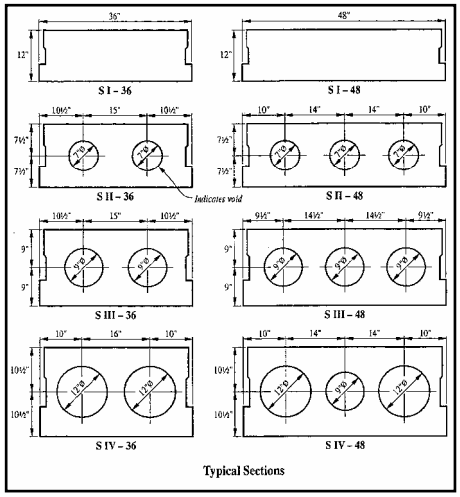
- **California "Bath-tub" Girder:** Introduced in California at the same time as the "bulb-tee", the California "Bath-tub" girder isn't nearly as popular as it's relative. Some of the drawbacks are: cost, fabrication difficulty, cross-slope issues, form availability and hauling weight. However, use of the California "bath-tub" girder has the following benefits:
  - Has a cast-in-place box girder appearance, which is useful in maintaining an aesthetic corridor theme.
  - Like the "bulb-tee", when girder segments are spliced together with post-tensioning, spans as high as 180 *feet* or more can be achieved.
  - Girder segments can be cast well ahead of when they are needed at the bridge site. Girder segments can be erected quite rapidly, with minimal traffic impact.



SECTION PROPERTIES

"D" (mm)	"h" (mm)	Area (mm²)	I (mm⁴)	y_b (mm)	y_t (mm)	S_b (mm³)	S_t (mm³)	r (mm)	Mass (N/m)	Wt (Kg/m)
1400	925	864 000	191 500 E6	612	788	313.0 E6	243.1 E6	471	20 370	2076
1550	1075	925 900	251 500 E6	693	857	368.2 E6	290.0 E6	521	21 820	2225
1700	1225	987 700	321 800 E6	755	945	428.2 E6	340.5 E6	571	23 280	2374
1850	1375	1 049 600	403 200 E6	827	1023	487.5 E6	394.1 E6	620	24 740	2522
2000	1525	1 111 400	496 400 E6	899	1101	552.2 E6	450.9 E6	668	26 200	2671
2150	1675	1 173 300	602 100 E6	972	1178	619.4 E6	511.1 E6	716	27 660	2819

- **California Voided Slab:** Pre-engineered for span lengths up to 48 *feet*, these slab units are commonly used in California under the following conditions:
  - Depth-to-span ratios of 0.03 make this girder a good choice for small spans, with limited temporary or permanent clearance requirements.
  - In remote areas of the state Modoc, Siskyiou counties for example, where ready mix concrete is difficult to obtain.
  - Used on small creek crossings where rapid construction is required.
  - Again, as with all precast elements, voided slabs are fabricated with excellent quality control and assurance.



Typical Sections

- **Other Less Common Girder Shapes:**
  - Precast trapeziodal girder (spliced and simply supported).
  - Precast double-tee girder.
  - Precast rectangular girders.