

# Fresno SR 180 Braided Ramp Design-Build Project

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# Fresno SR 180 Braided Ramp Design-Build Project

- Project Overview
- Construction
- Design
- Aesthetic
- DB Experience

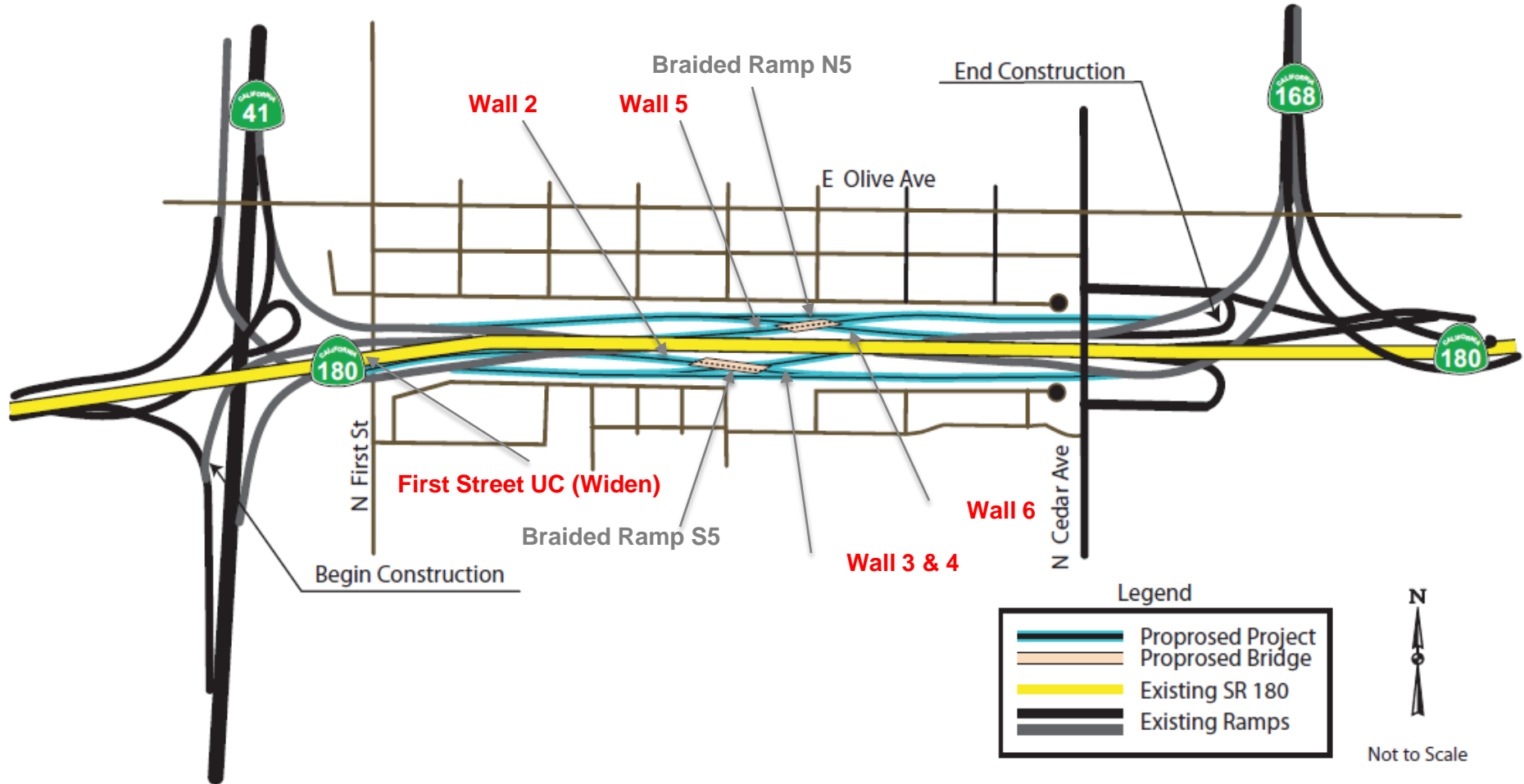
# Project Overview

## Existing Condition



# Project Overview

## Final Condition



# Project Overview

- Two New Bridges
- One Bridge Widening
- MSE Walls
- Sound Walls
- PCC Pavement



# Project Overview



Aerial View- January 2013

# Project Overview



Aerial View- July 2013

# North Bridge Falsework





# North Bridge- Forming Diaphragms



# South Bridge Falsework



# South Bridge- Early Morning Deck Placement



# MSE Walls



# MSE Walls



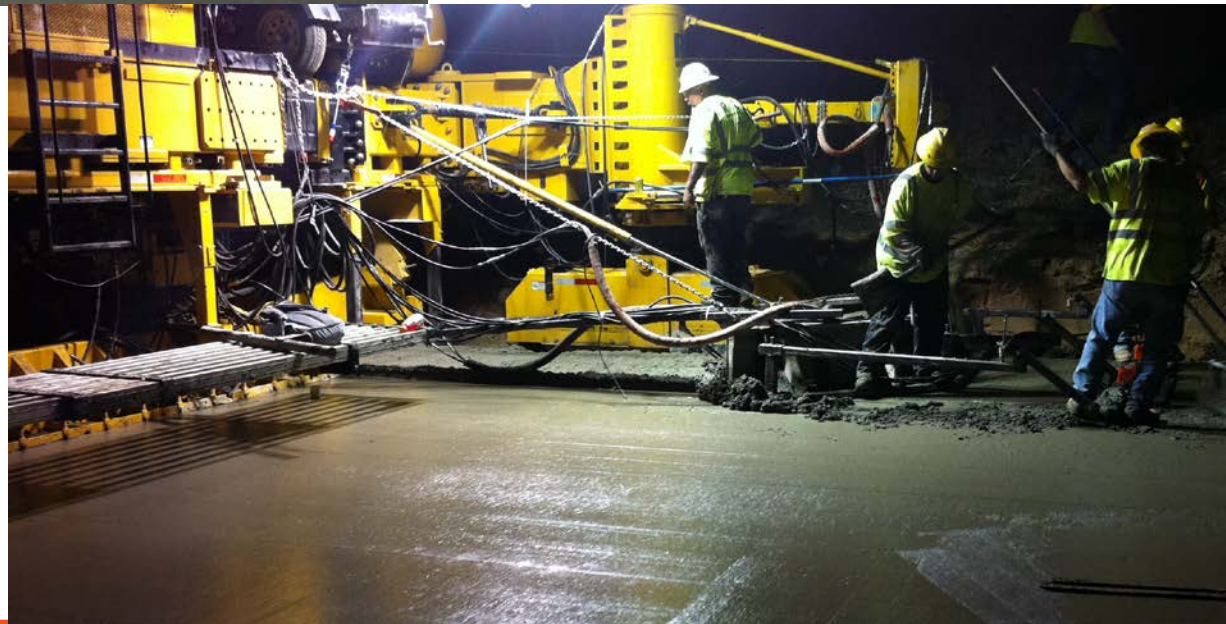
# Soundwall Construction



# Soundwalls



# Paving Crew Operations





# Paving Crew Operations



# Paving Crew Operations



# Batch Plant



# Job Wide Safety Meeting



# Design

## Foundation



# Foundation Flexibility

- Check rigid footing response
- Computer model for spread footings w/soil springs

*North Bridge Bent 2  
Transverse Direction*

$$\Delta Y = 3.415 \text{ in}$$

$$= \Delta f + \Delta y_{col}$$

$$\Delta f = 0.00442 \times 25 \text{ ft}$$

$$= 1.326 \text{ in}$$

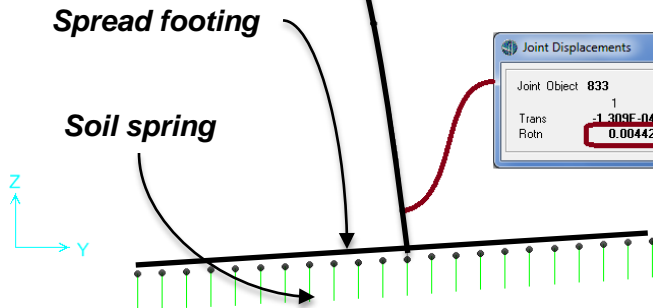
$$\Delta y_{col} = \Delta Y - \Delta f$$

$$= 3.415 \text{ in} - 1.326 \text{ in}$$

$$= 2.09 \text{ in}$$

Joint Object 838		Joint Element 838	
	1	2	3
Trans	-1.309E-04	-3.41503	-0.33542
Rotn	0.01559	0.00000	-2.115E-06

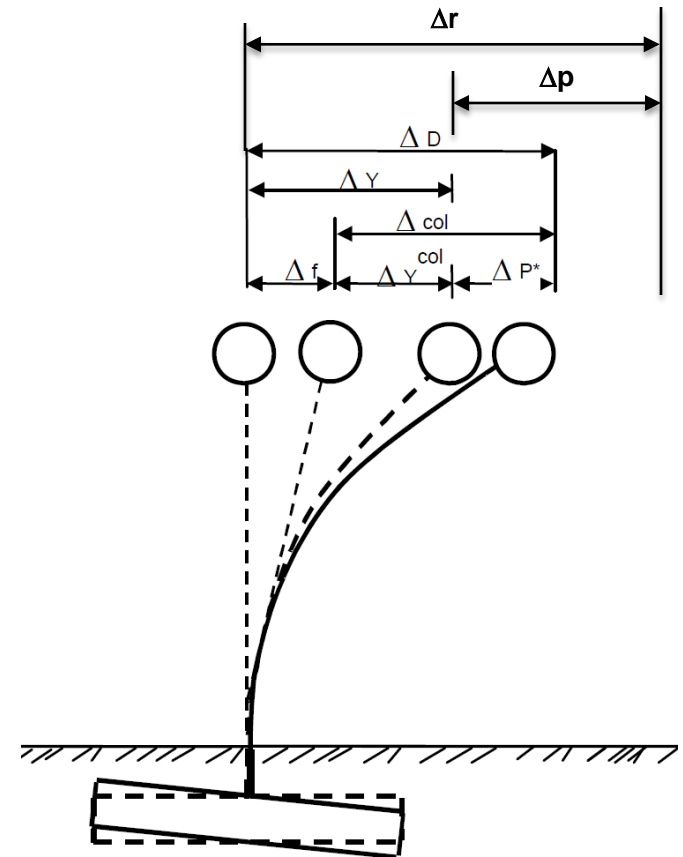
Joint Object 833		Joint Element 833	
	1	2	3
Trans	-1.309E-04	-0.11229	-0.29475
Rotn	0.00442	0.00000	-2.115E-06



# Foundation Flexibility

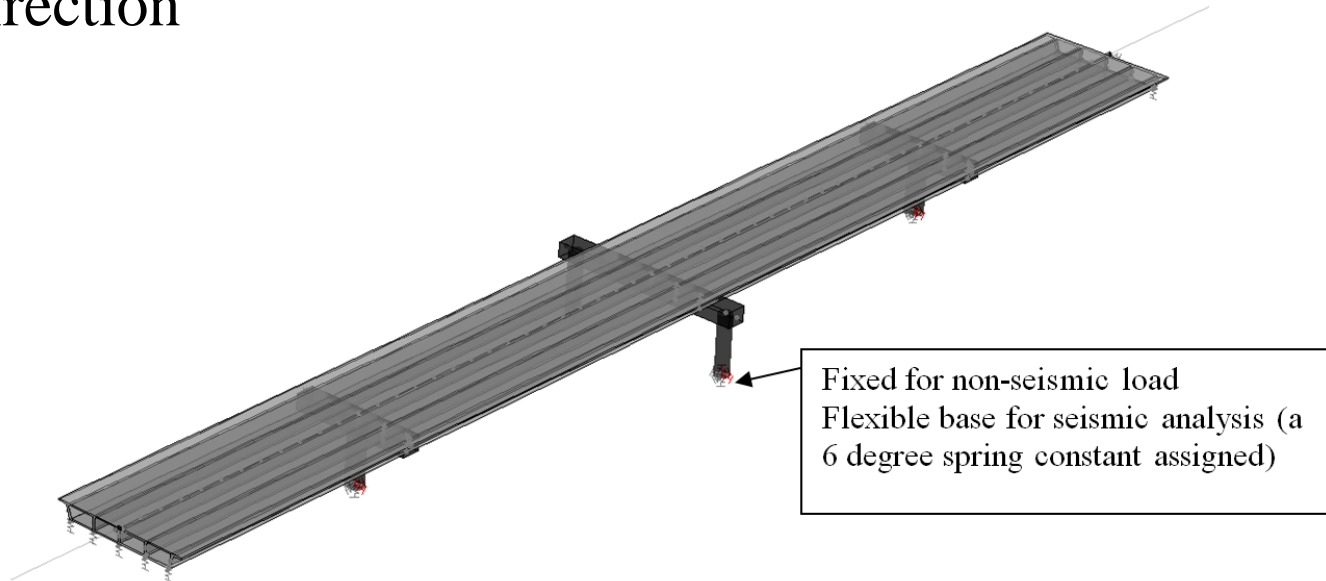
- P- $\Delta$  Effect

	S5 Bent 2	N5 Bent 2
$\Delta f$ (ftg flexibility, in)	1.7	1.3
$\Delta y^{col}$ (yield displ., in)	2.1	2.1
$\Delta y$ (yield displ., in)	3.9	3.4
$\Delta p$ (plastic displ., in)	6.9	6.3
$\Delta r$ (lateral offset, in)	10.8	9.7
P (axial load, k)	3500	1900
$P \times \Delta r$ (k-ft)	3150	1536
$0.2 \times M_p$ (k-ft)	5695	1735



# Seismic Design - Dynamic Analysis

- Effective sections for ductile members
- Flexible foundation at the bases of columns
- Soil resistance at the abutments neglected in longitudinal direction

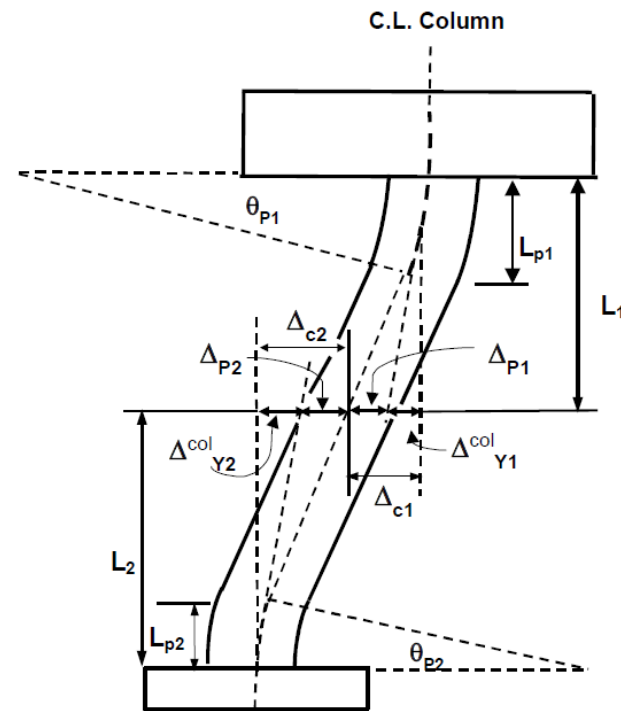
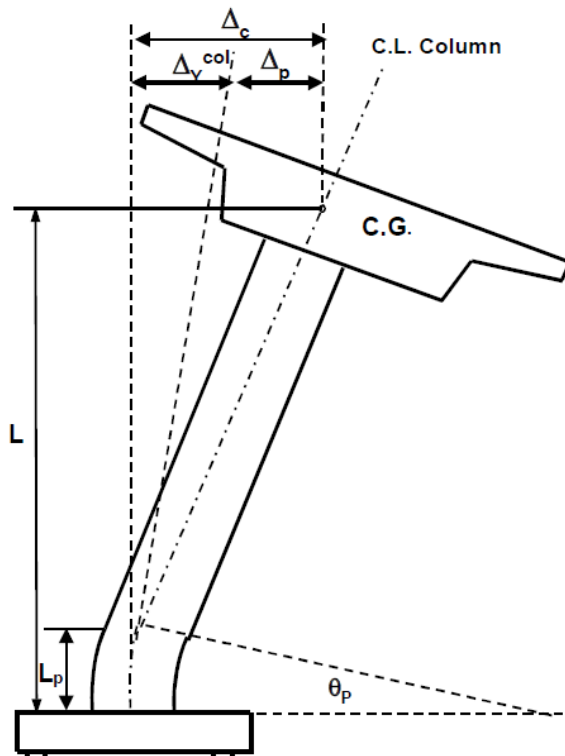


3D Extrude View



# Seismic Design - Push Over Analysis

- Calculation per SDC 3.1.3
- Rigid foundation assumption



# Seismic Design – Displacement D/C Ratios

	Longitudinal Direction			Transverse Direction		
	$\Delta d$ (in)	$\Delta c$ (in)	$\Delta d / \Delta c$	$\Delta d$ (in)	$\Delta c$ (in)	$\Delta d / \Delta c$
<b>Braided Ramp S5</b>						
Bent 2	1.5	7.1	0.2	1.1	8.3	0.1
Bent 3	1.4	8.9	0.2	1.3	8.9	0.1
Bent 4	1.5	7.1	0.2	1.1	8.3	0.1

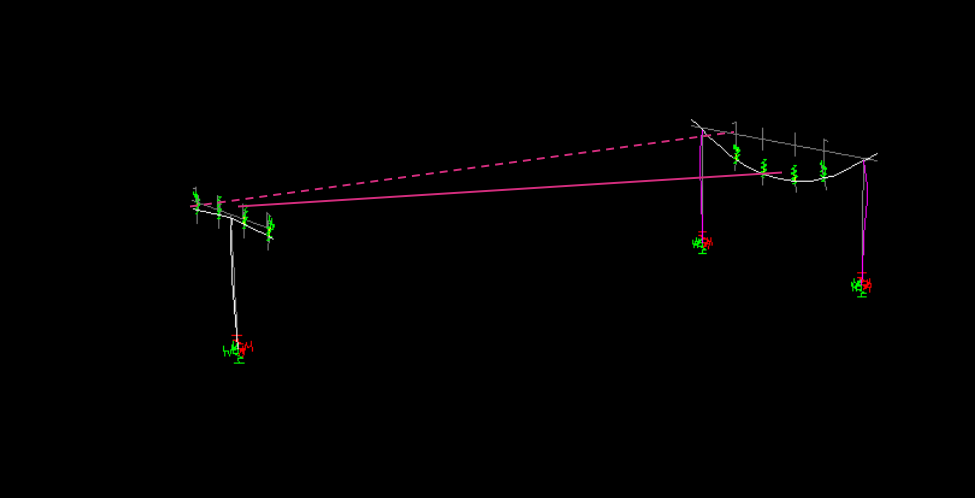
# Seismic Design - Ductility Demands

	Longitudinal Direction			Transverse Direction		
	$\Delta d$ (in)	$\Delta y(i)$ (in)	$\mu d$	$\Delta d$ (in)	$\Delta y(i)$ (in)	$\mu d$
<b>Braided Ramp S5</b>						
Bent 2	1.5	2.0	0.8	1.1	1.4	0.8
Bent 3	1.4	1.9	0.7	1.3	1.9	0.7
Bent 4	1.5	2.0	0.8	1.1	1.4	0.8

# Seismic Design - Ductility Capacities

	Longitudinal Direction			Transverse Direction		
	$\Delta c$ (in)	$\Delta y^{col}$ (in)	$\mu c$	$\Delta c$ (in)	$\Delta y^{col}$ (in)	$\mu c$
<b>Braided Ramp S5</b>						
Bent 2	7.1	2.0	3.6	8.3	1.4	5.9
Bent 3	8.9	1.9	4.7	8.9	1.9	4.7
Bent 4	7.1	2.0	3.6	8.3	1.4	5.9

# Design – Unity Geometry



# Fresno SR 180 Braided Ramp Design-Build Project

## Design

### Column Confinement – Spiral vs. Hoop

Spirals – The most effective & economic

AASHTO Seismic Guide  
Specification C8.6.3

WSDOT BDM

Hoops - Improved constructability and better Seismic Performance

AASHTO Bridge Design  
Specifications C5.10.11.4.1C

Caltrans' MTD

# Aesthetic Appearance of Existing Structures

- CIP concrete structures
- Integral bent caps
- Flared columns
- Fracture FIN texture



# Aesthetic Appearance of Braided Ramps

- CIP concrete structures
- Integral bent caps
- Columns:
  - Straight columns
  - Flared columns w/ flare gap
- Abutment
  - Match Existing Structure
- MSE Wall
  - Fracture FIN Architectural Treatment



# Aesthetic Appearance

**Te insert Box Bridge Elevation View Showing integral bent cap box girder.**

# Aesthetic Appearance



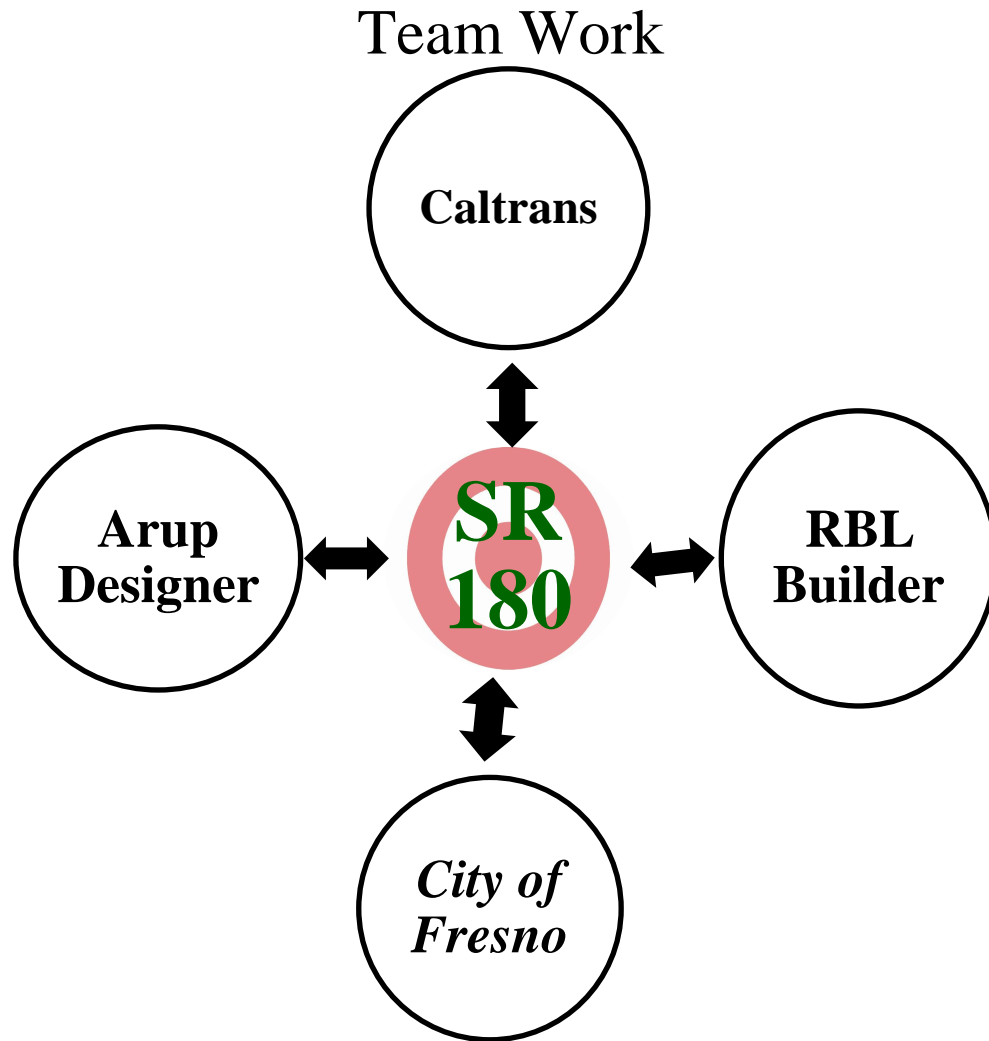
# Aesthetic Appearance



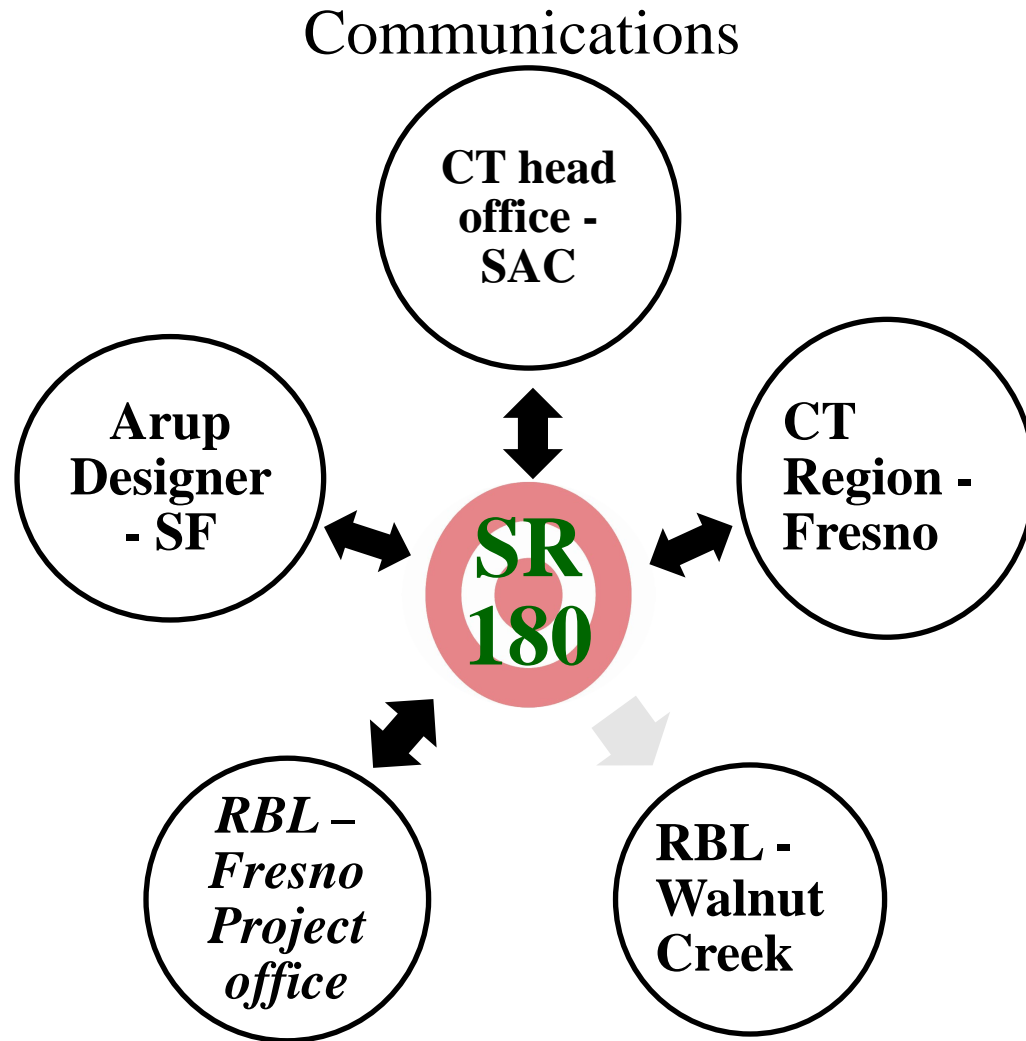
ured FIN finish



# DB Experience



# DB Experience



# DB Experience

QC/QA

# Fresno SR 180 Braided Ramp Design-Build Project

Question ?

