Ten Tips for Structural Engineers and Their Managers

"You know how advice is. You only want it if it agrees with what you wanted to do anyway."
… John Steinbeck

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No Need for Notes!

- ✓ Caldwell, S.R., "Five Tips for Engineering Managers." An invited Article published in the Structural Forum of STRUCTURE Magazine, June 2016
- ✓ Caldwell, S.R., "Five Tips for Young Engineers." An invited Article published in the Structural Forum of STRUCTURE Magazine, July 2016

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Tip #1

Mind the Gap

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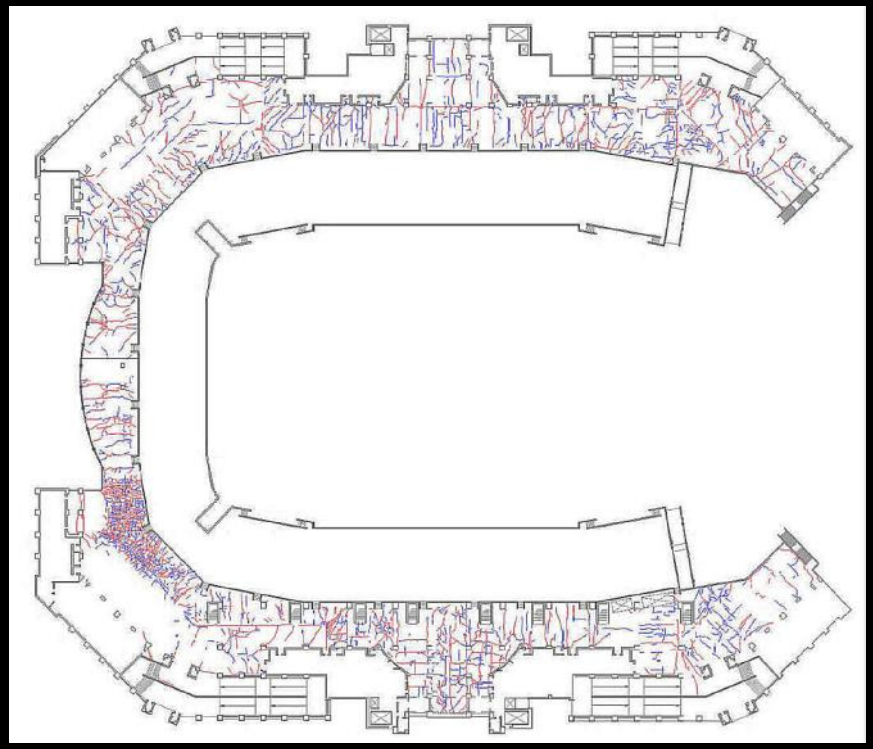

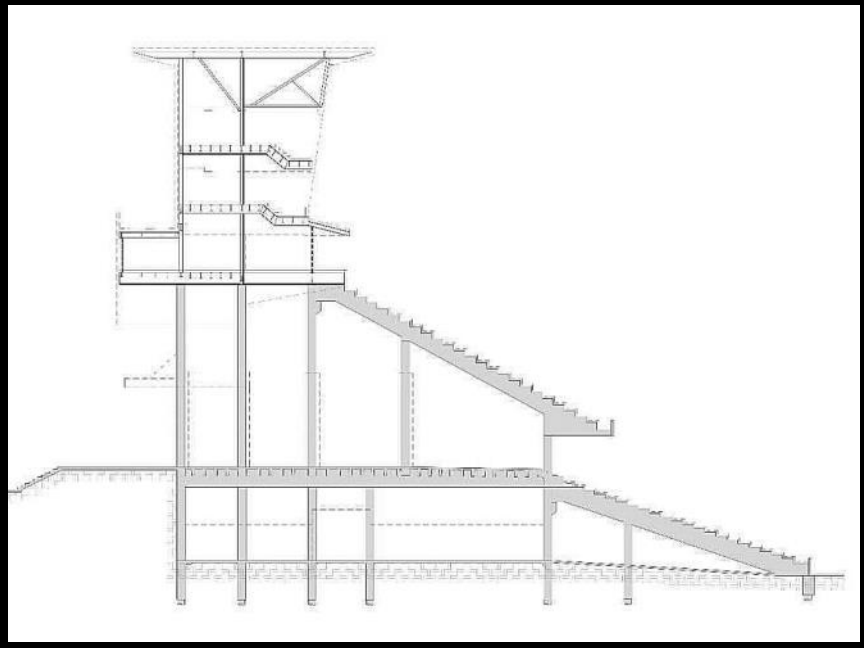

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Tip #2

Ensure Stability

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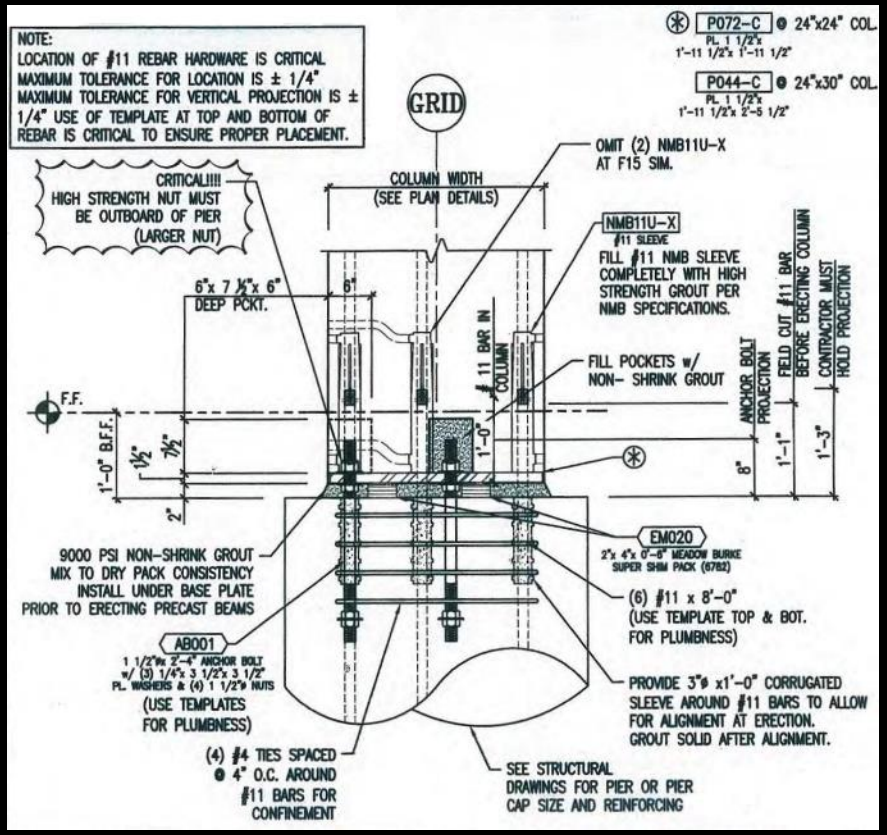
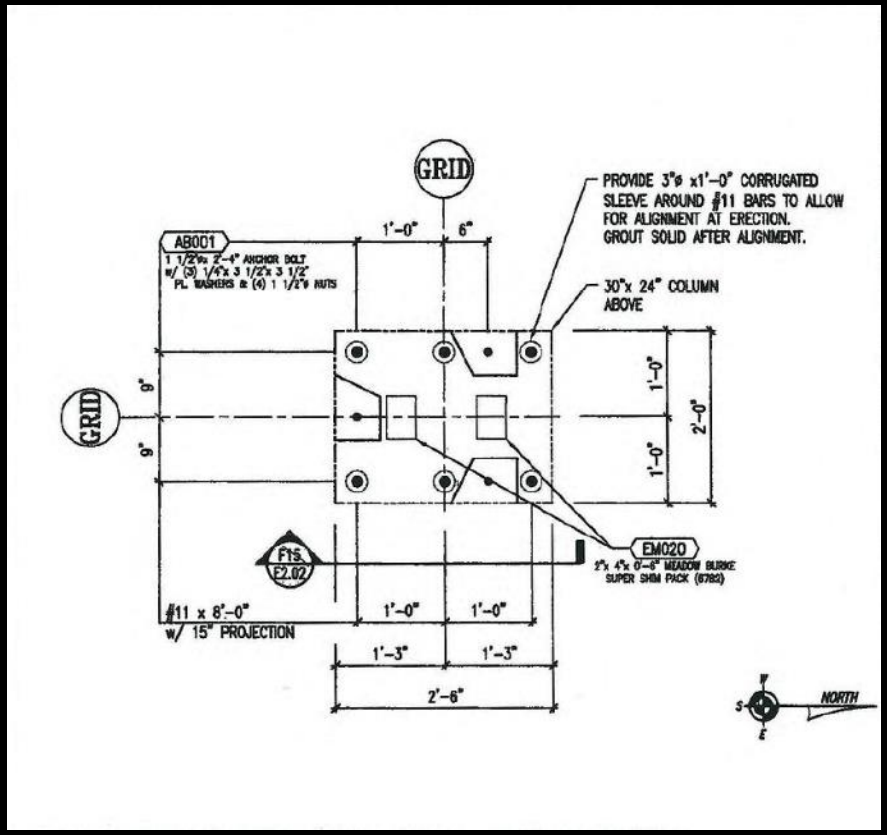
Failure Mode	AISC Code	Required (A)	Provided (B)	Ratio 24" Soil (A/B)	Ratio 36" Soil (*)
Lateral-Torsional	LRFD	251 FK	190 FK	1.32	1.65
Buckling	ASD	51 Psi	33 Psi	1.54	1.96
Flange: Local	LRFD	210 K	76.1 K	2.76	3.45
Bending	ASD	162 K	50.6 K	3.20	4.06
Web: Local	LRFD	210 K	152 K	1.38	1.73
Yielding	ASD	162 K	101 K	1.60	2.03
Web: Local	LRFD	210 K	140 K	1.50	1.88
Crippling	ASD	162 K	93.1 K	1.74	2.21
Web: Local	LRFD	210 K	64.7 K	3.25	4.06
Compression Buckling	ASD	162 K	43.1 K	3.76	4.78


NOTE:
LOCATION OF #11 REBAR HARDWARE IS CRITICAL
MAXIMUM TOLERANCE FOR LOCATION IS ± 1/4"
MAXIMUM TOLERANCE FOR VERTICAL PROJECTION IS ± 1/4" USE OF TEMPLATE AT TOP AND BOTTOM OF REBAR IS CRITICAL TO ENSURE PROPER PLACEMENT.
P072-C @ 24"x24" COL.
PL. 1 1/2"x 1'-11 1/2"x 1'-11 1/2"
P044-C @ 24"x30" COL.
PL. 1 1/2"x 1'-11 1/2"x 2'-5 1/2"
GRID
CRITICAL!!!! HIGH STRENGTH NUT MUST BE OUTBOARD OF PIER (LARGER NUT)
COLUMN WIDTH (SEE PLAN DETAILS)
OMIT (2) NMB11U-X AT F15 SIM.
NMB11U-X #11 SLEEVE
FILL #11 NMB SLEEVE COMPLETELY WITH HIGH STRENGTH GROUT PER NMB SPECIFICATIONS.
6"x 7 1/2"x 6" DEEP PCKT.
6"
#11 BAR IN COLUMN
FILL POCKETS w/ NON- SHRINK GROUT
F.F.
1'-0" B.F.F.
1 1/2"
1 1/2"
2"
1'-0"
ANCHOR BOLT PROJECTION
FIELD CUT #11 BAR BEFORE ERECTING COLUMN
CONTRACTOR MUST HOLD PROJECTION
8"
1'-1"
1'-3"
EM020
2"x 4"x 0'-6" MEADOW BURKE SUPER SHIM PACK (6782)
9000 PSI NON-SHRINK GROUT MIX TO DRY PACK CONSISTENCY INSTALL UNDER BASE PLATE PRIOR TO ERECTING PRECAST BEAMS
(6) #11 x 8'-0" (USE TEMPLATE TOP & BOT. FOR PLUMBNESS)
AB001
1 1/2"ø 2'-4" ANCHOR BOLT w/ (3) 1/4"x 3 1/2"x 3 1/2" PL. WASHERS & (4) 1 1/2"ø NUTS
(USE TEMPLATES FOR PLUMBNESS)
PROVIDE 3"ø x1'-0" CORRUGATED SLEEVE AROUND #11 BARS TO ALLOW FOR ALIGNMENT AT ERECTION. GROUT SOLID AFTER ALIGNMENT.
(4) #4 TIES SPACED @ 4" O.C. AROUND #11 BARS FOR CONFINEMENT
SEE STRUCTURAL DRAWINGS FOR PIER OR PIER CAP SIZE AND REINFORCING


GRID
1'-0"
6"
AB001
1 1/2"ø 2'-4" ANCHOR BOLT w/ (3) 1/4"x 3 1/2"x 3 1/2" PL. WASHERS & (4) 1 1/2"ø NUTS
PROVIDE 3"ø x1'-0" CORRUGATED SLEEVE AROUND #11 BARS TO ALLOW FOR ALIGNMENT AT ERECTION. GROUT SOLID AFTER ALIGNMENT.
30"x 24" COLUMN ABOVE
GRID
9"
9"
1'-0"
1'-0"
2'-0"
F15
E2.02
EM020
2"x 4"x 0'-6" MEADOW BURKE SUPER SHIM PACK (6782)
#11 x 8'-0" w/ 15" PROJECTION
1'-0"
1'-0"
1'-3"
1'-3"
2'-6"
NORTH

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Tip #3

Design, Then Compute

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Tip #4

Be a Sponge

Tip #5

Own Your Work

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Tip #6

Swim Upstream

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Tip #7

Stay in Your Lane

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Tip #8

Embrace Construction

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Tip #9

Cherish Your People

Tip #10

Make a Profit

Summary

ENGINEERS

- ✓ Mind the Gap
- ✓ Ensure Stability
- ✓ Design, Then Compute
- ✓ Be a Sponge
- ✓ Own Your Work

MANAGERS

- ✓ Swim Upstream
- ✓ Stay in Your Lane
- ✓ Embrace Construction
- ✓ Cherish Your People
- ✓ Make a Profit

Finally, as Requested …

a brief discussion of

Scope Creep

**A profit-eroding malady afflicting nearly all SEs,
caused by performing Special and Extra Services,
without receiving adequate additional compensation.**

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No Need for Notes!

- ✓ Caldwell, S.R., "Scope Creep." An invited Article published in the Structural Forum of STRUCTURE Magazine, January 2019

Special Services - 1

- ✓ Skylight framing, window and curtain walls, cladding, and doors
- ✓ Window washing systems
- ✓ Nonloadbearing interior partitions and ceilings
- ✓ Anchorages, pads, brackets, and platforms for MEP equipment
- ✓ Guide systems for elevators, escalators, and conveyors
- ✓ Handrails and guardrails
- ✓ Stage equipment, catwalks, and acoustical fixtures
- ✓ Sculptures, screens, and decorative work
- ✓ Retaining walls not attached to buildings
- ✓ Fountains, culverts, tunnels, and other site work
- ✓ Antennas, flagpoles, lighting, and signage

Special Services - 2

- ✓ Investigation or field verification of existing conditions
- ✓ Coordination of special wind studies and wind tunnel tests
- ✓ Coordination of special seismic studies and shake table tests
- ✓ Preparation of additional documents for phased construction
- ✓ Preparation of additional documents for fast-track construction
- ✓ Preparation of estimated material quantities
- ✓ Preparation of estimated construction costs
- ✓ Preparation of shop drawings and erection drawings
- ✓ Design for special energy and sustainability requirements
- ✓ Design for special fire resistance requirements
- ✓ Design or review of excavation retention or trench bracing
- ✓ Design or review of construction shoring
- ✓ Design of future expansion and tenant improvements
- ✓ Preparation of certifications and permit applications

Extra Services

- ✓ Evolving revisions to the size or scope of a project
- ✓ Changes proposed by the owner, architect, or consultants
- ✓ Changes or substitutions proposed by the contractor
- ✓ Changes due to undiscovered or unanticipated conditions
- ✓ Changes due to newly adopted codes or other regulations
- ✓ Changes due to a value engineering exercise
- ✓ Changes due to a construction cost overrun
- ✓ Revisions that are inconsistent with prior instructions
- ✓ Services necessitated by deficiencies in the contractor's work
- ✓ Services necessitated by delays in the contractor's work
- ✓ Additional representation required at the construction site
- ✓ Services as an expert witness in a project-related dispute

Two Reasons for Scope Creep

First, structural engineers' scopes of work are not always clearly defined in written professional services agreements for all projects. Many engineers continue to accept assignments based on verbal agreements, or they work under the terms of their proposals that were never formally accepted in writing. Other engineers routinely accept agreements that were drafted entirely by their clients, often without their review or input. When the scope of work is not clearly defined before work commences, an engineer is in a poor position to request additional compensation later on.

Second, many structural engineers are reluctant to request additional compensation when they are asked to provide special or extra services. They fear that such requests might adversely affect their relationships with their clients and impair their opportunities for future projects. Sadly, these fears are not entirely unfounded. However, additional compensation is almost never offered except in direct response to a clearly stated request from an engineer.

The Solution is Discipline

Structural engineers must have the discipline to secure a signed professional services agreement that clearly defines their scope of work and compensation before starting every new project.

Then, structural engineers must have the discipline to secure an agreement for appropriate additional compensation before providing any special or extra services.

Discipline can be difficult to maintain on every project, but it is essential to profitability.

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Thank You !

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