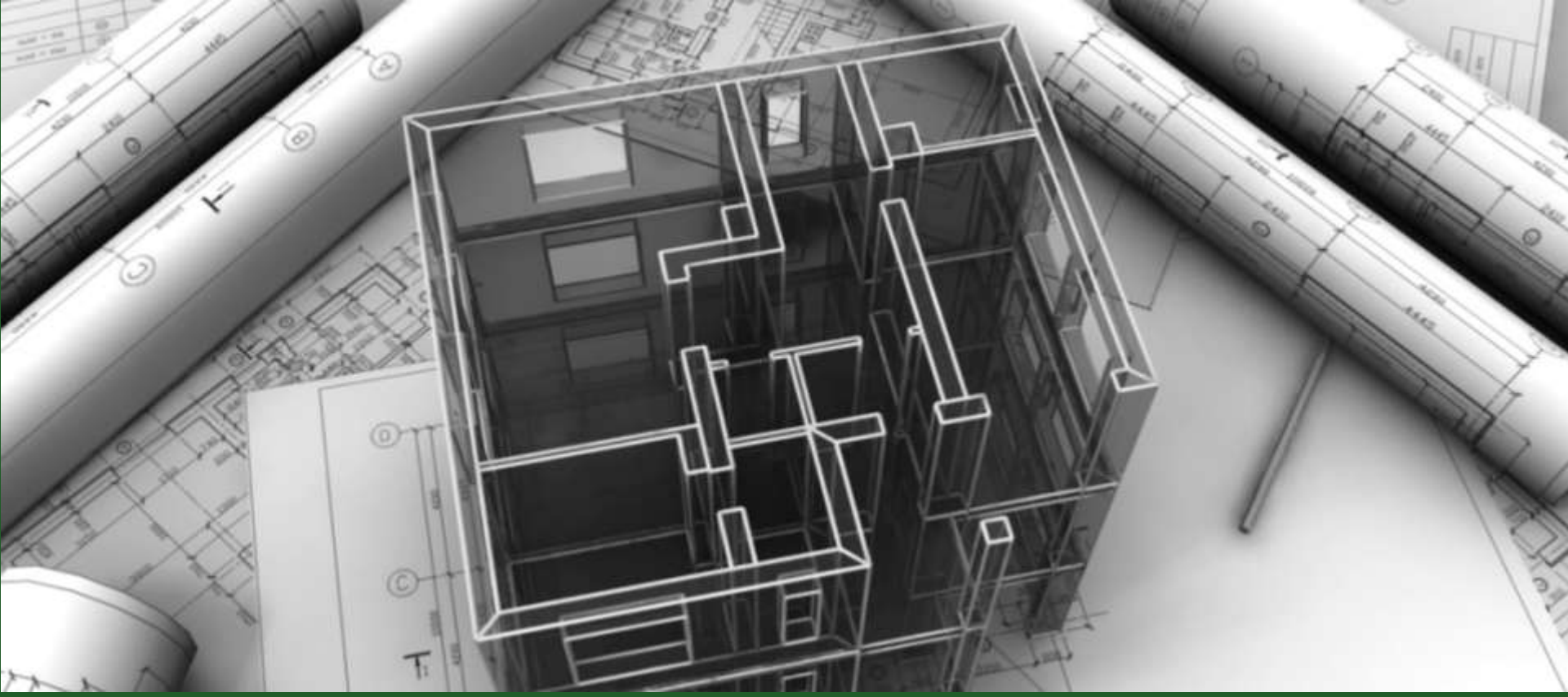
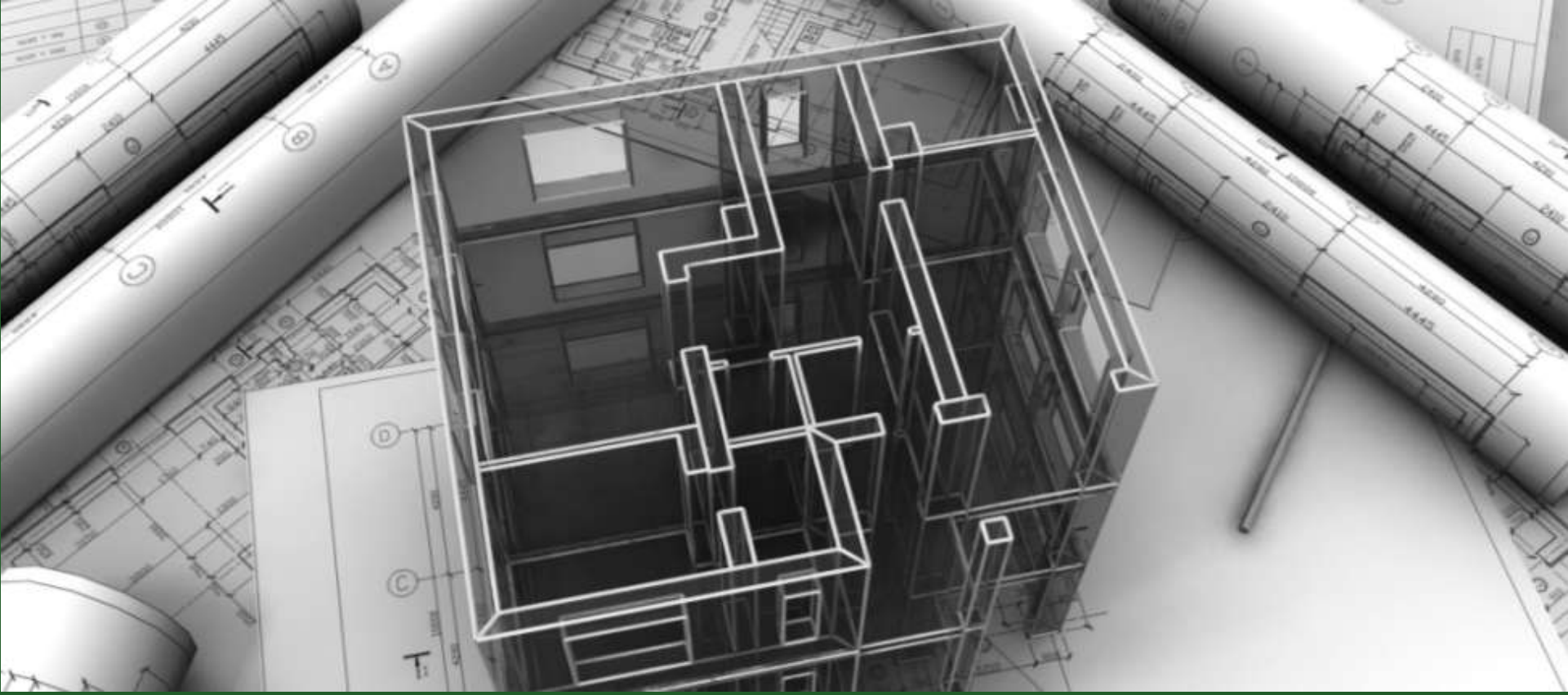


PRECAST IN INFRASTRUCTURE

Maher K. Tadros, Ph.D., P.E., PCI Titan
Emeritus Professor, University of Nebraska
Principal, e.construct, Dubai and USA

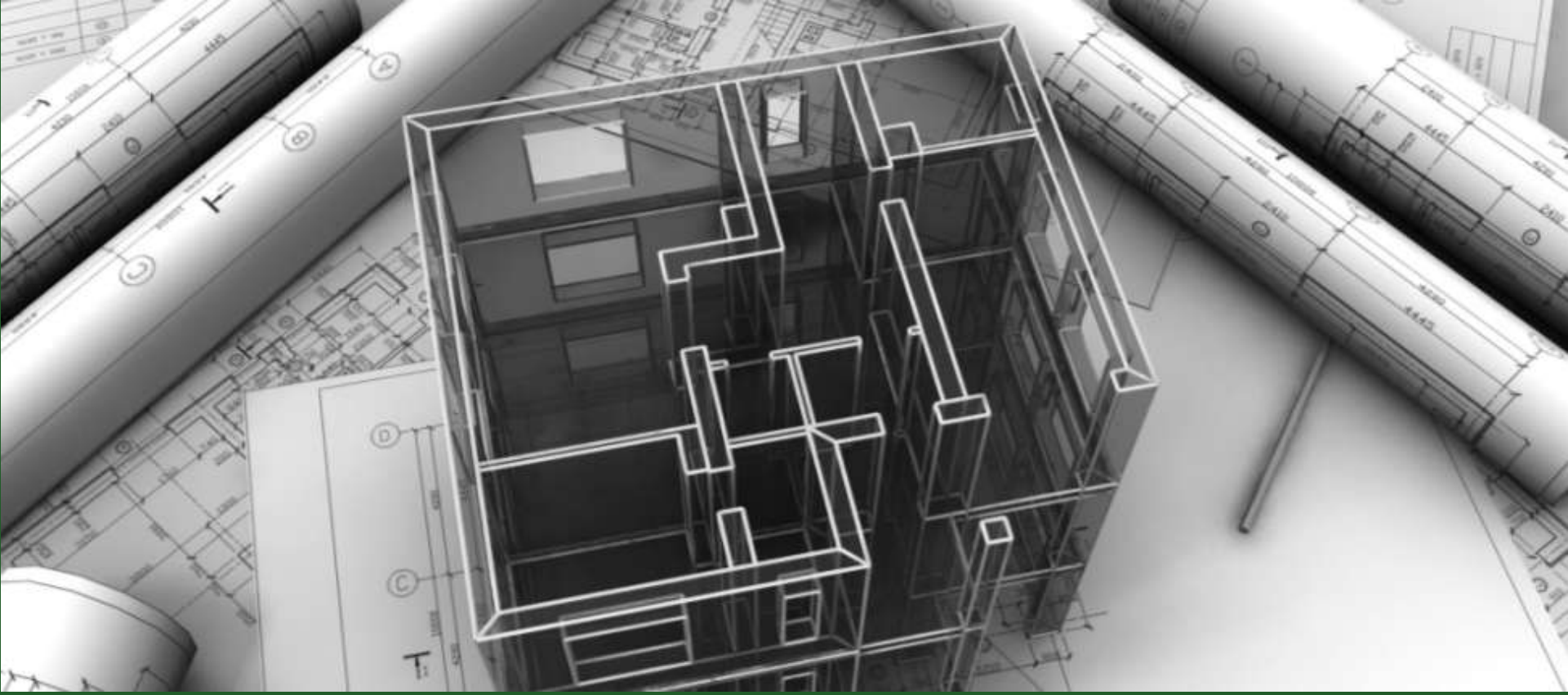
PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012



ACCELERATED BRIDGE CONSTRUCTION

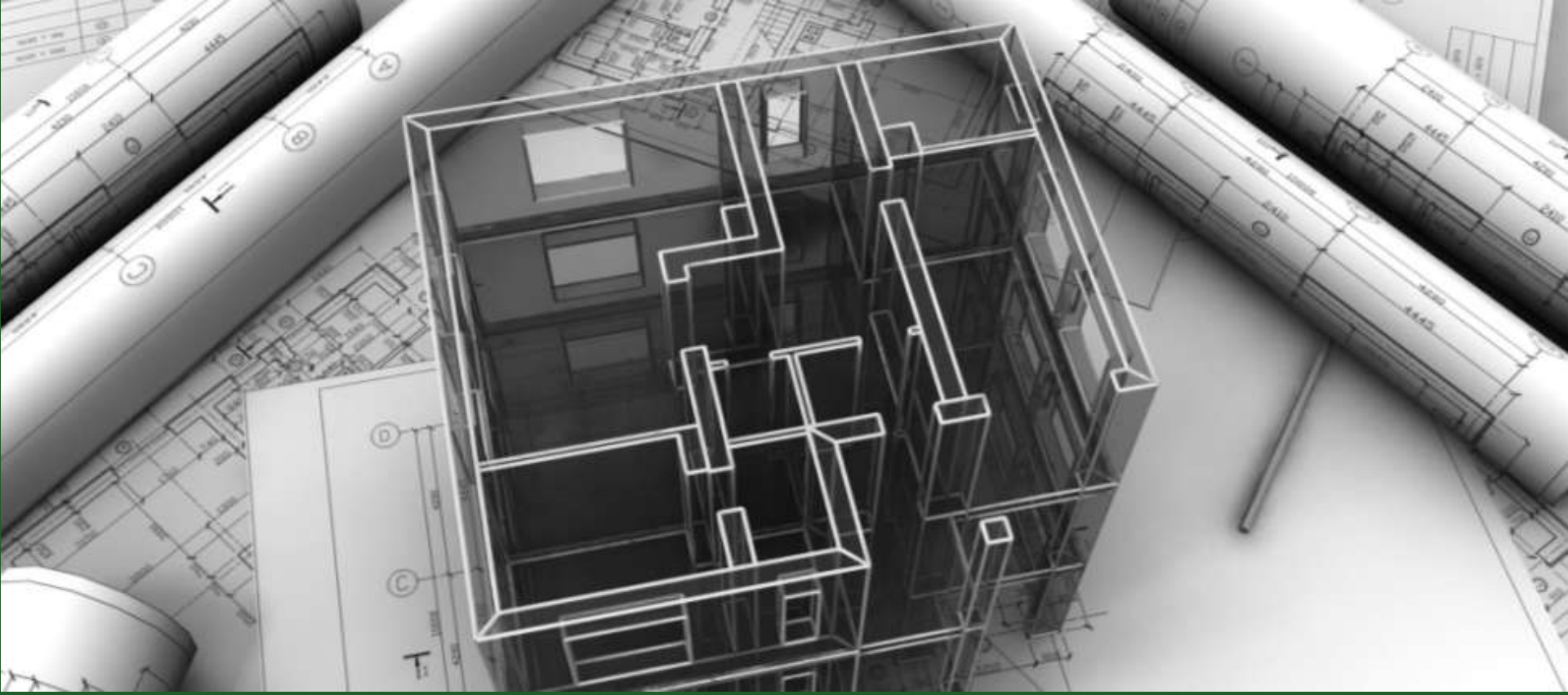
PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

- Prefabricate as many elements as possible
- Minimize use of cast-in-place concrete
- Use rapid setting low shrinkage joint materials
- Rapid construction vs. minimal traffic disruption
- Use creative contractual arrangements



SUPERSTRUCTURE

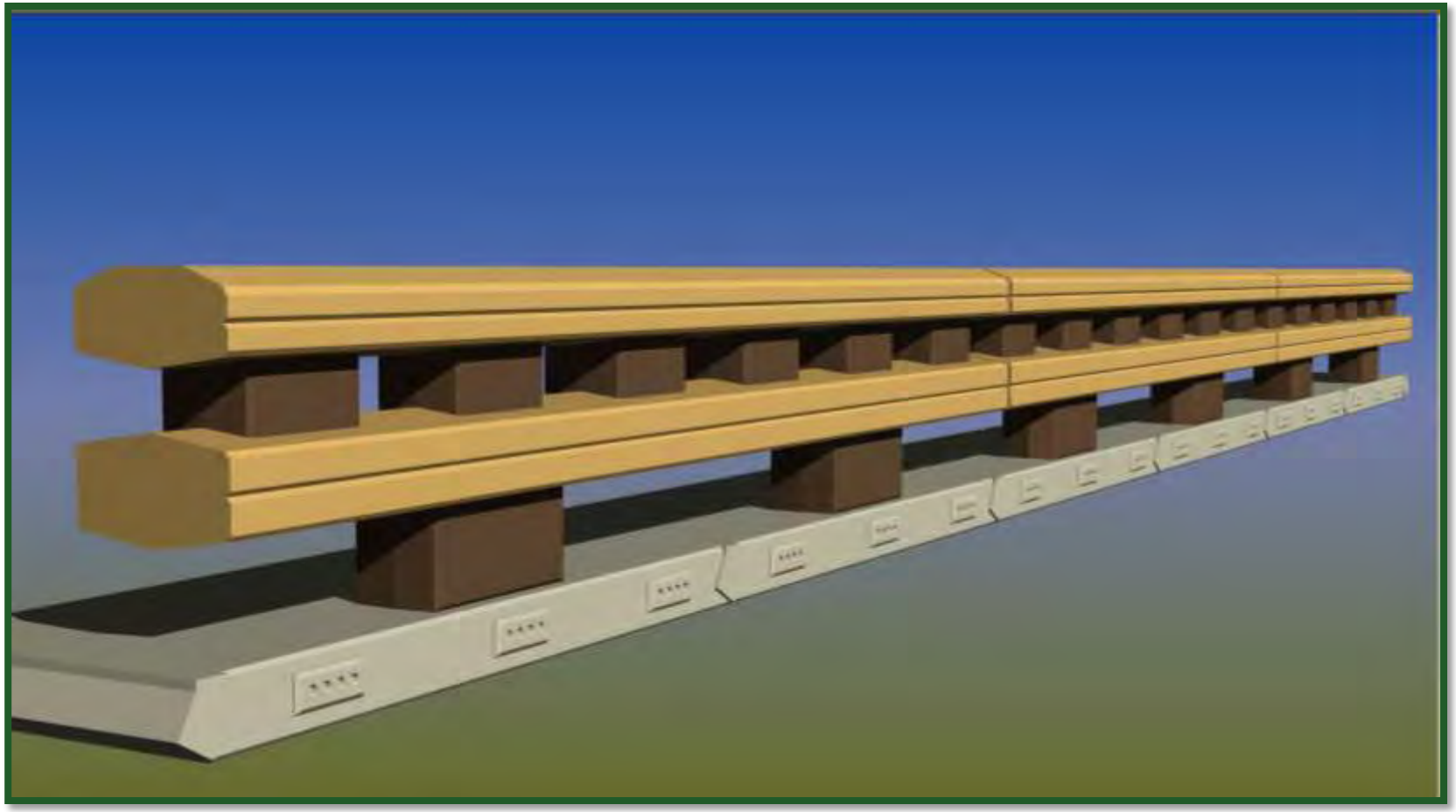
PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012



PRECAST CONCRETE RAILING

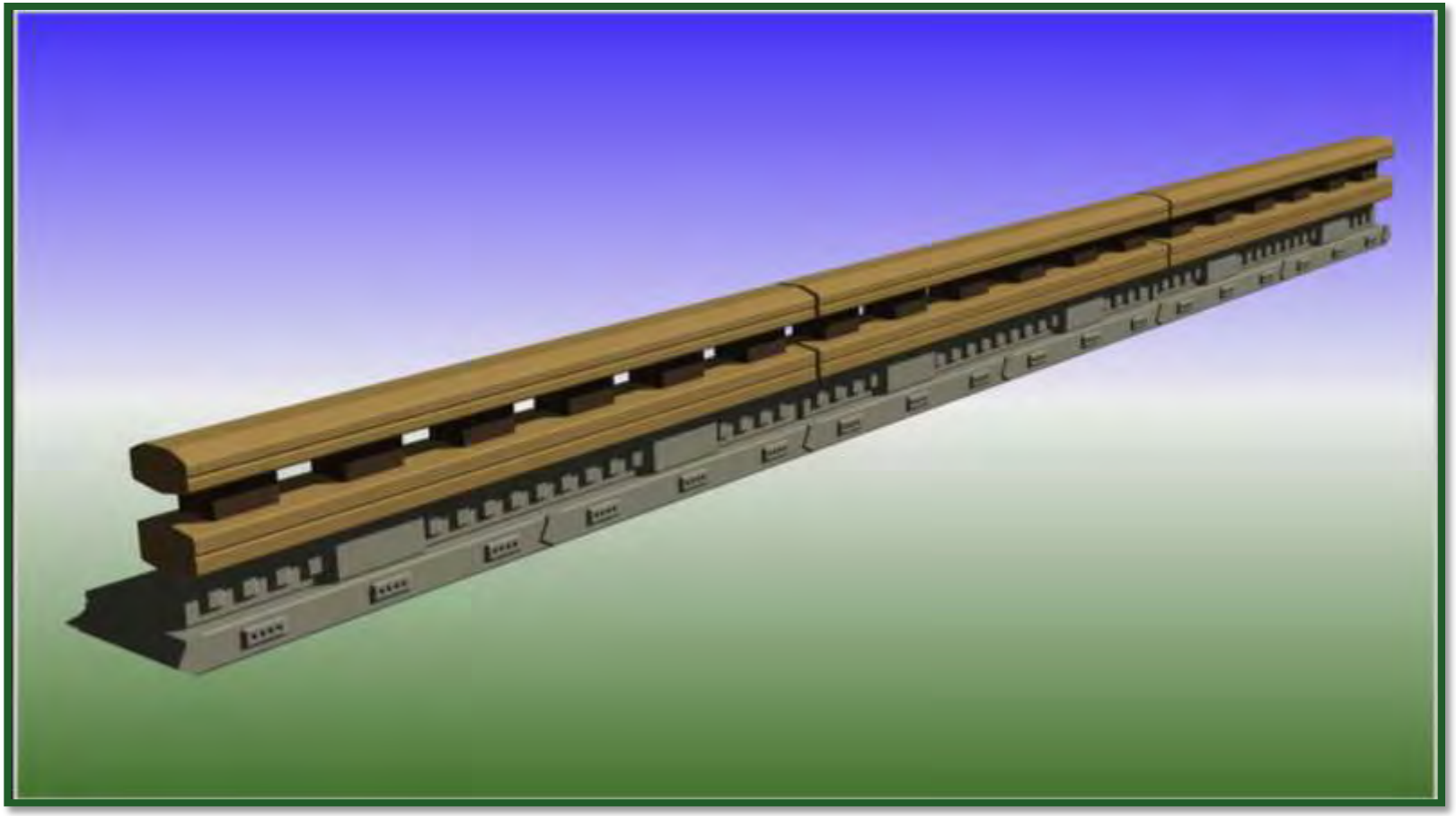
PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

Precast Concrete Open Railing Model



PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

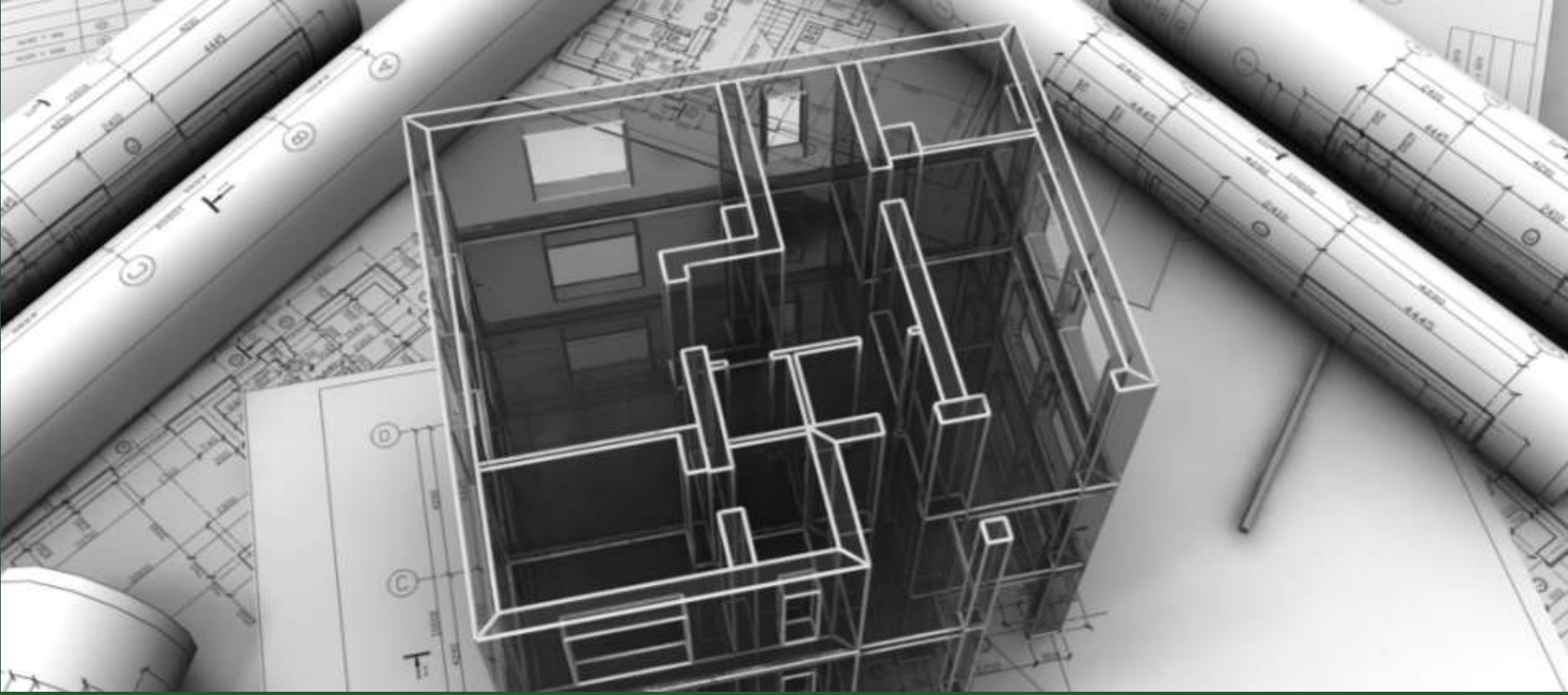
Precast Concrete Closed Railing Model



PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

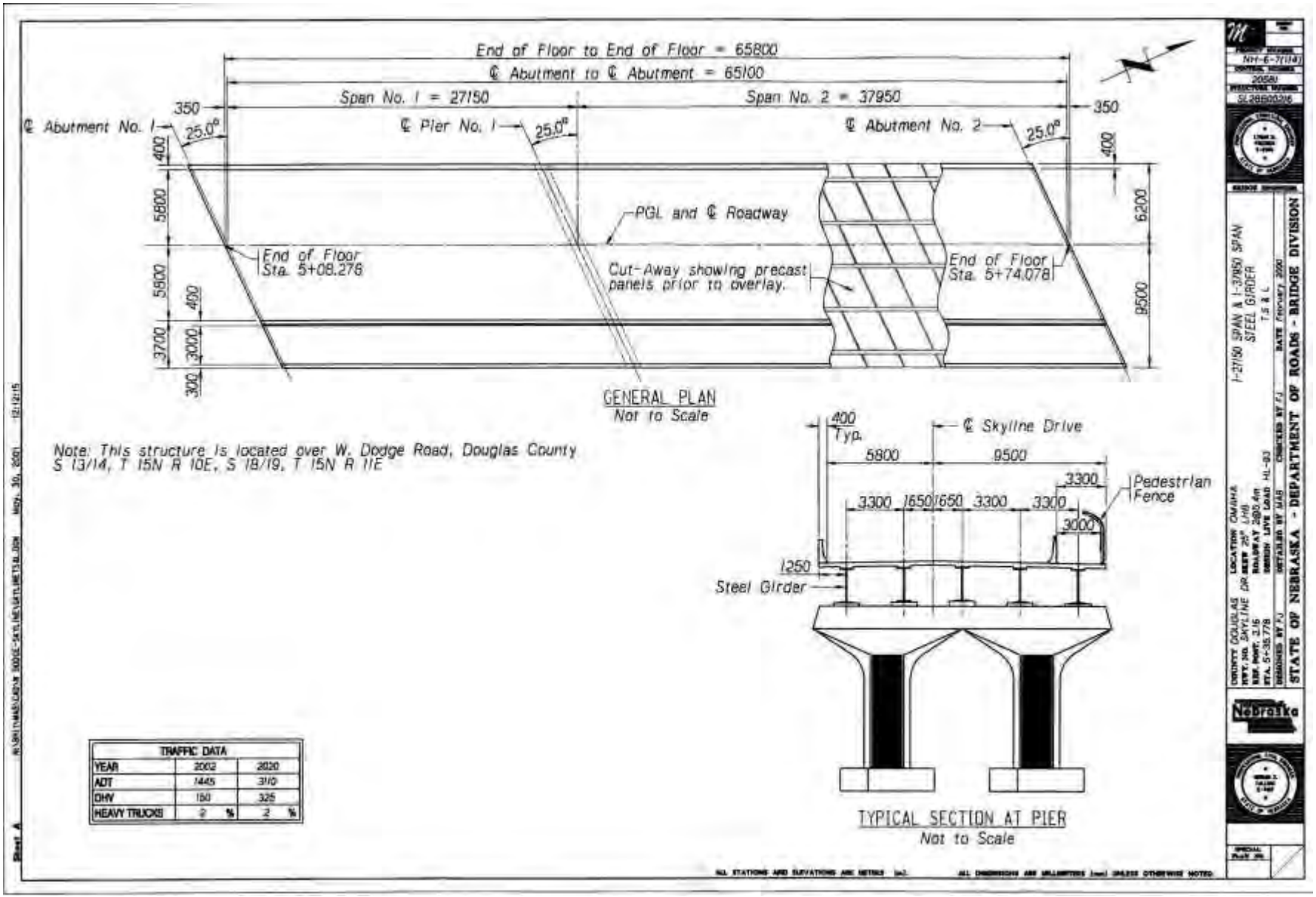
Full Scale Model in Relationship to a Pickup Truck

PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012



PRECAST CONCRETE DECK

PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012



Skyline Bridge Precast Deck System

PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

PANELS STACKED UP IN PRECAST YARD

PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012


15
TONS
15
TONS
15
TONS
15
TONS

Panel Shipping

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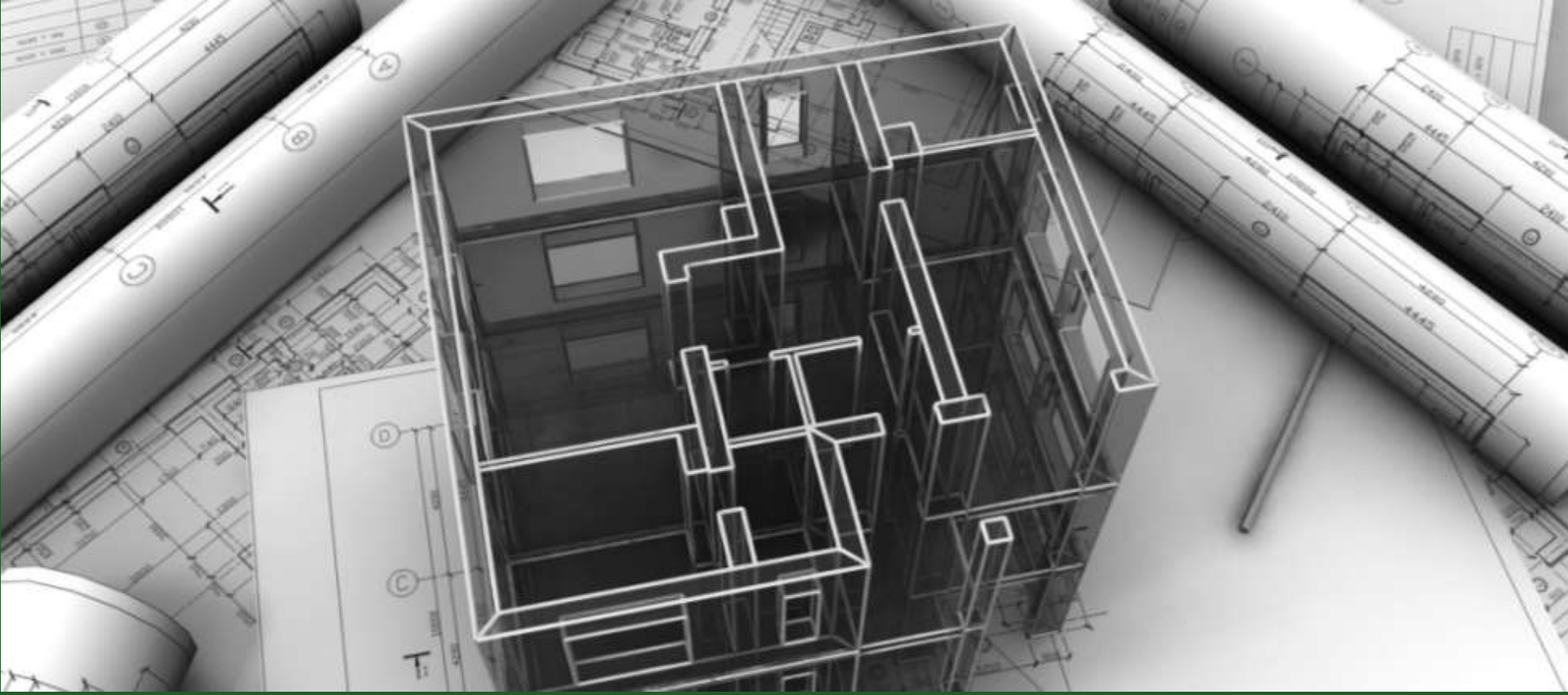
SUSTAINABLE SAVINGS 2012

P/T Strands Pulled through Channels

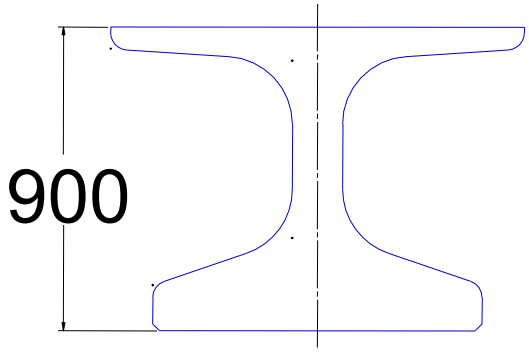
POST-TENSIONING PANEL

Completed Bridge

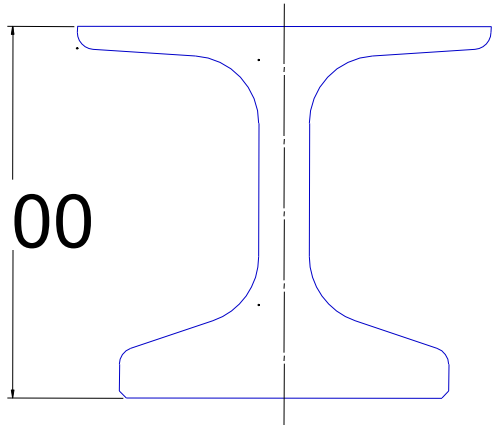


PRECAST CONCRETE GIRDER

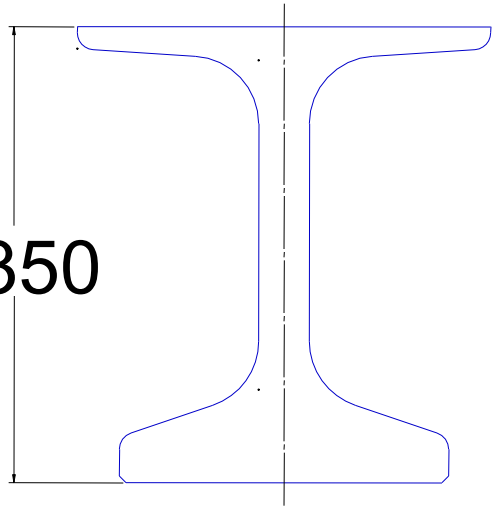
PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012



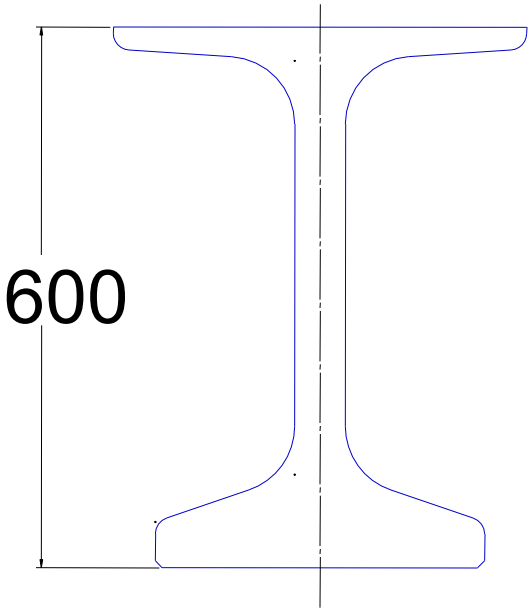
NU900



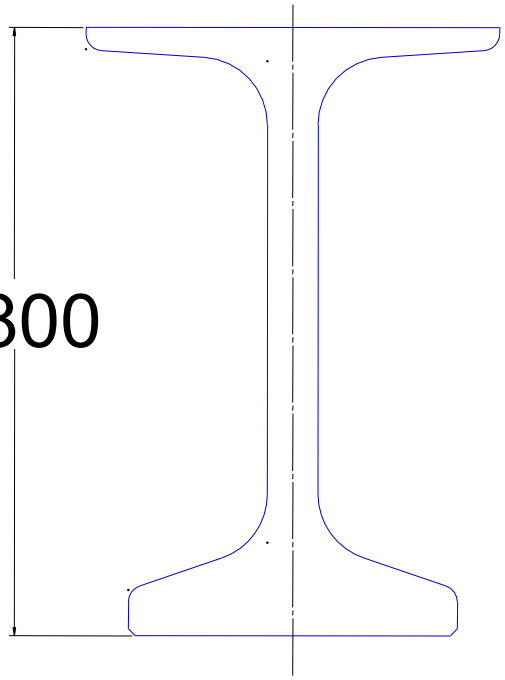
NU1100



NU1350



NU1600



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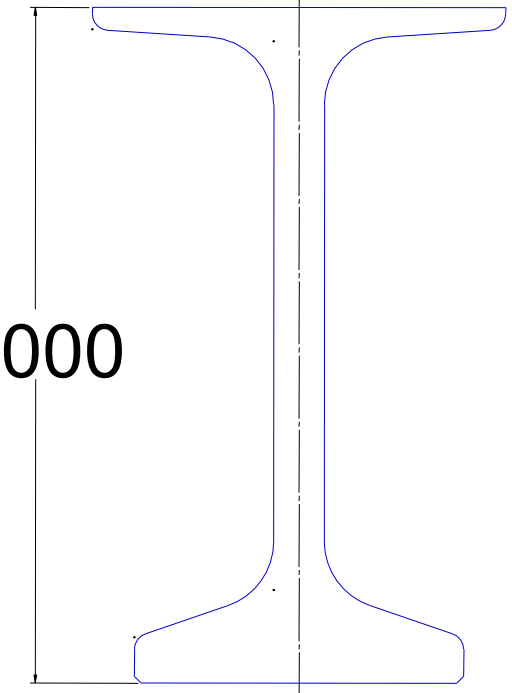
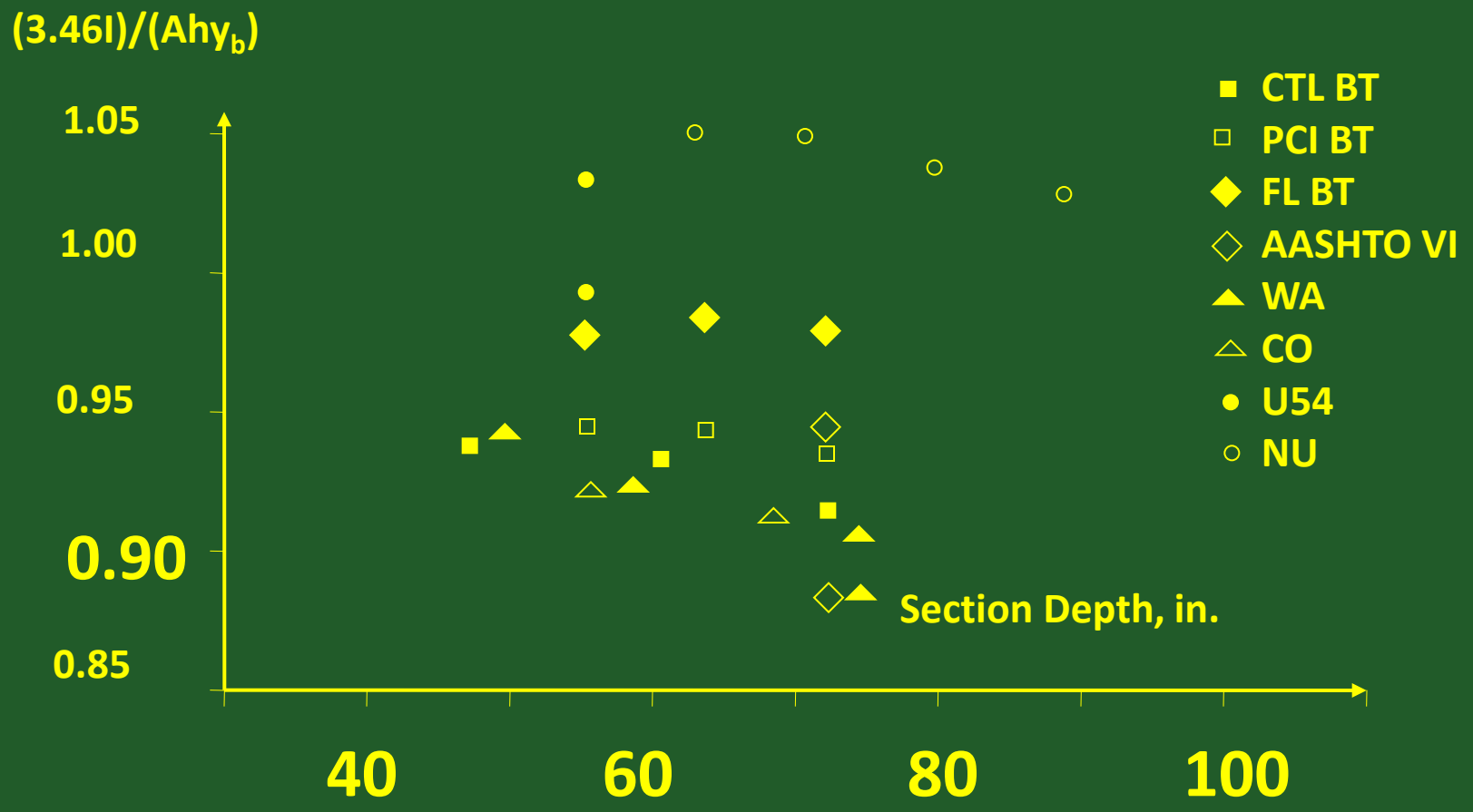


NU2000

Aswad's Efficiency Ratio with Section Depth

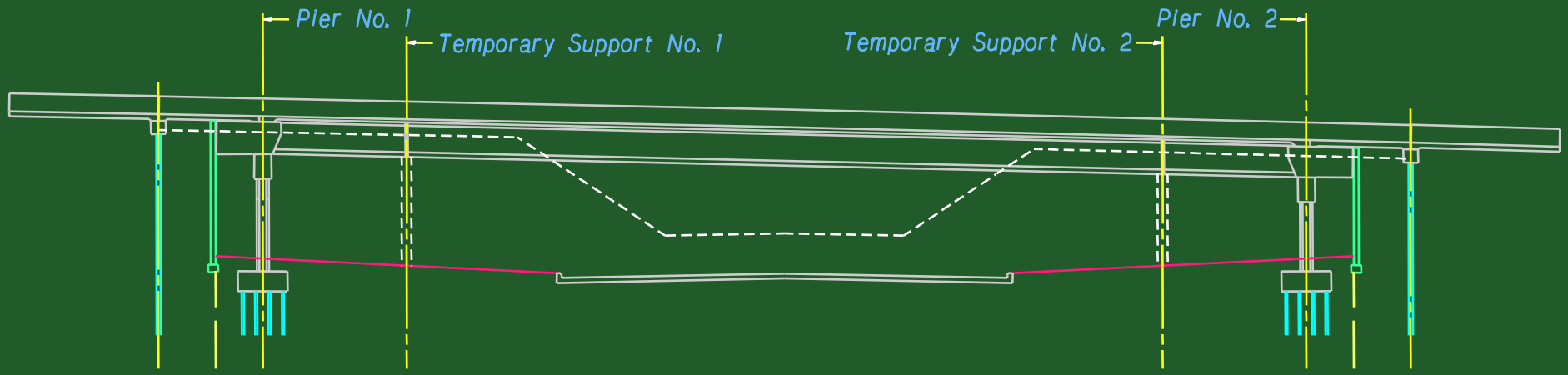


Ref: *Russell, Volz and Bruce,* Fig. 3

PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

Con-Force Structures Limited
Calgary, Alberta

NU Girder 65m (210 ft)
December 2001



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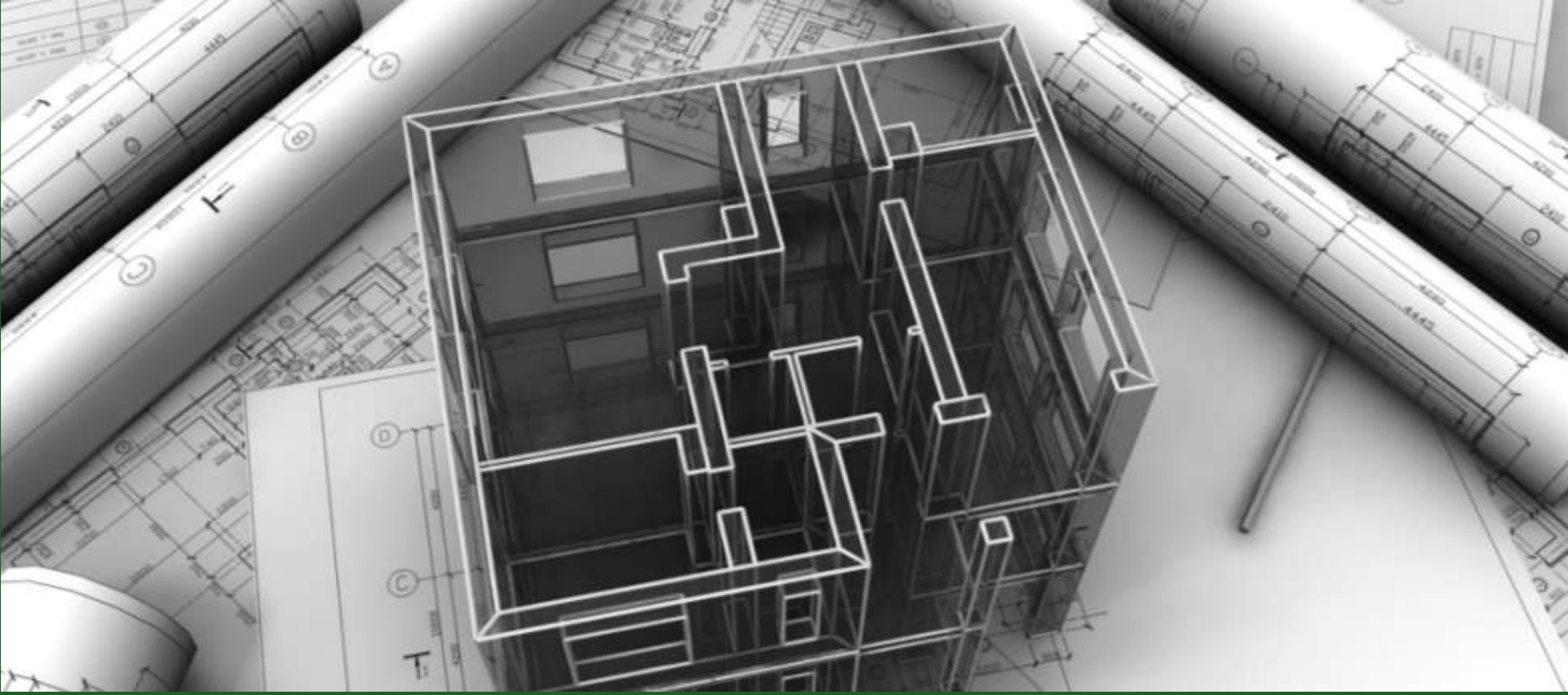
SUSTAINABLE SAVINGS 2012

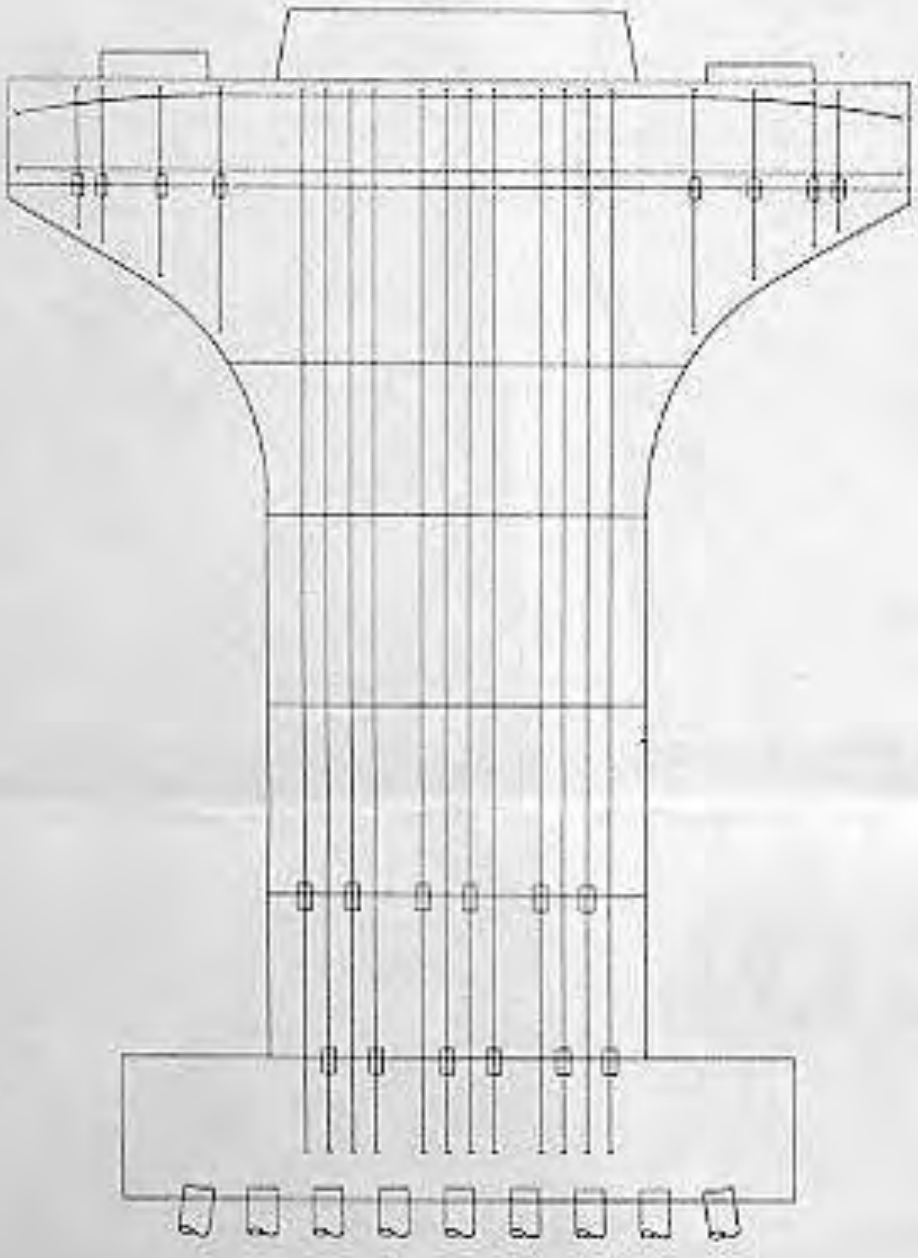

HAWKINS
CONSTRUCTION COMPANY
ROAD
CLOSED

PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012



PRECAST CONCRETE SUBSTRUCTURES

PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012



P.T. bars are 1 3/8 “ Grade 150 ksi, in 3” dia. ducts

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Segments are Match Cast

Hammerhead Segments Ready for Shipping

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Redfish Bay Bridge-Texas, Precast Pier Caps


Lake Ray Hubbard
Bridge, Texas
FEB 18 2002

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SUSTAINABLE SAVINGS 2012

Opposite loading to in-place loads
Short 75 ton weight

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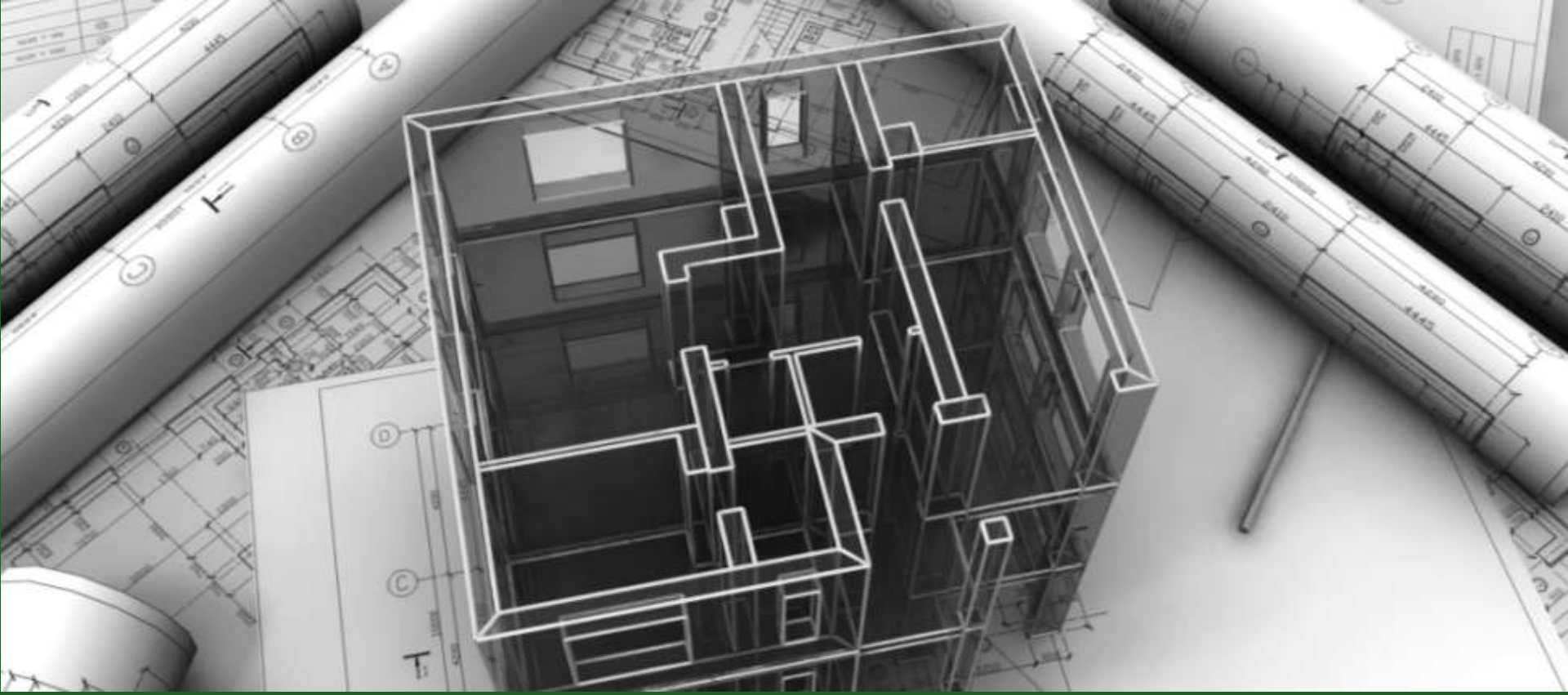
SUSTAINABLE SAVINGS 2012

Louetta Road Overpass, Texas



EXAMPLES OF RAPIDLY CONSTRUCTED BRIDGES

PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

Baldorioty Bridges, San Juan

- **Design & Build Four Urban Grade Separations**
  - **2 – 300 m long x 10 m wide**
  - **2 – 210 m long x 10 m wide**
- **Maintain Continuous Traffic**
- **Complete each Bridge in Less than**

72 Days

~~72 Days~~ **HOURS!**

- **$100,000 Penalty, per day, beyond 72 hours**

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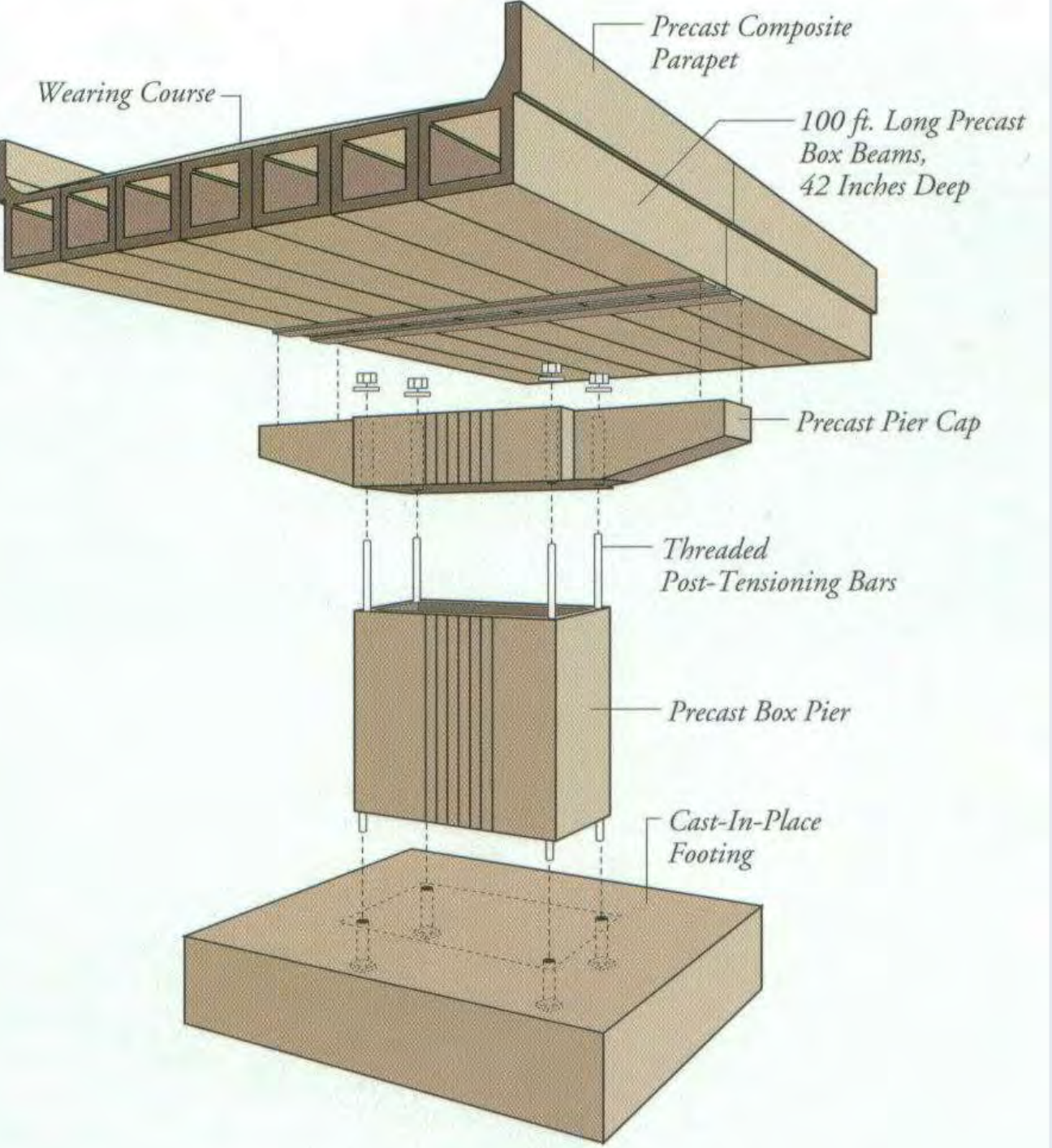
SUSTAINABLE SAVINGS 2012



Concept

Precast girders

Precast pier & cap

CIP footing

Quaker City, Ohio

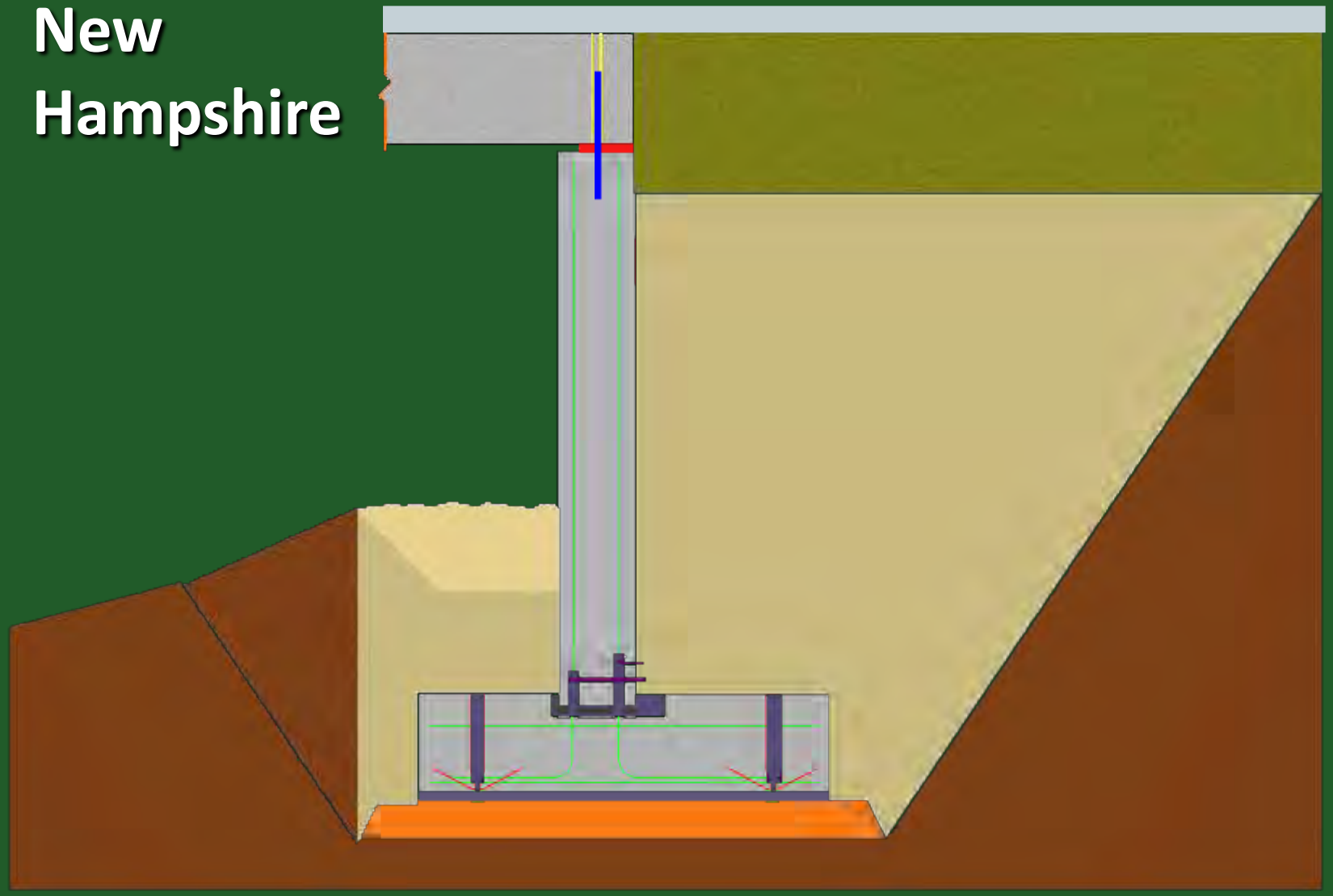
Quaker City, Ohio

PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

Quaker City, Ohio

Rapid Bridge Construction In New Hampshire

New Hampshire

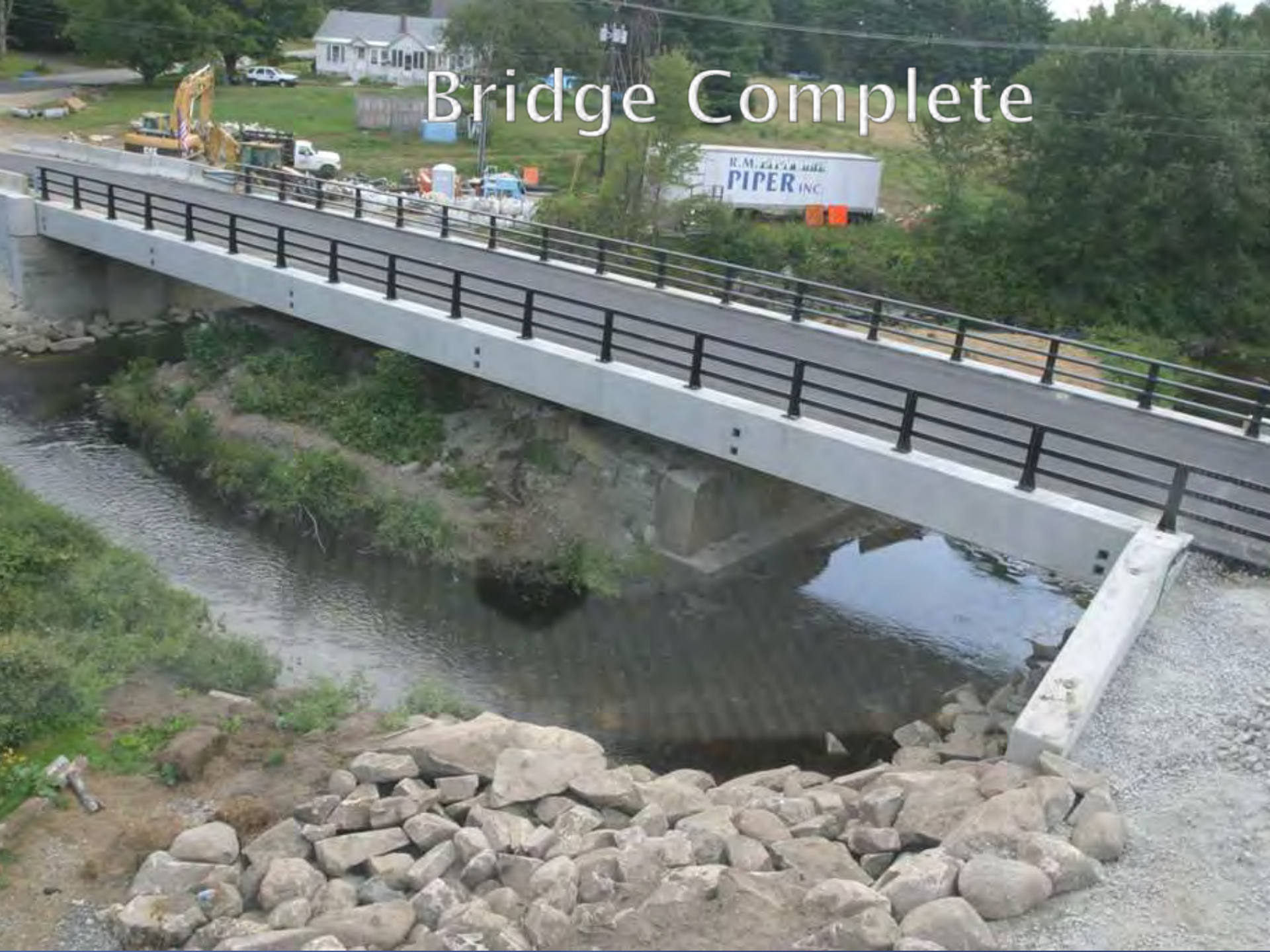


PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

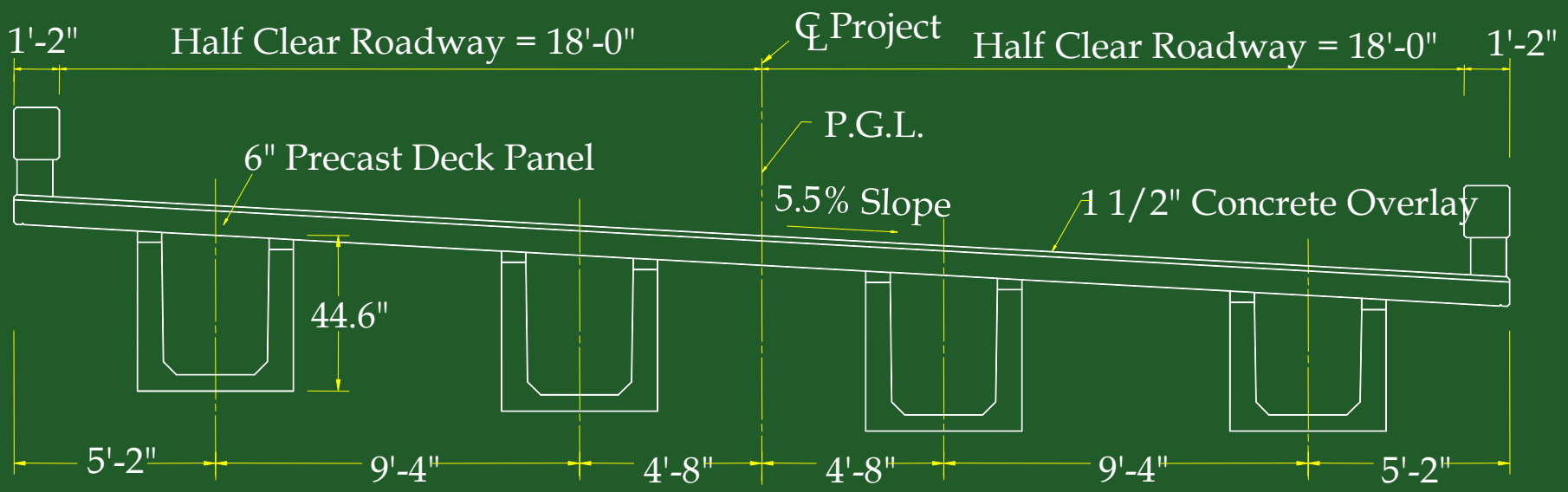

AUG 19 2004


AUG 20 2004


Days 5 & 6

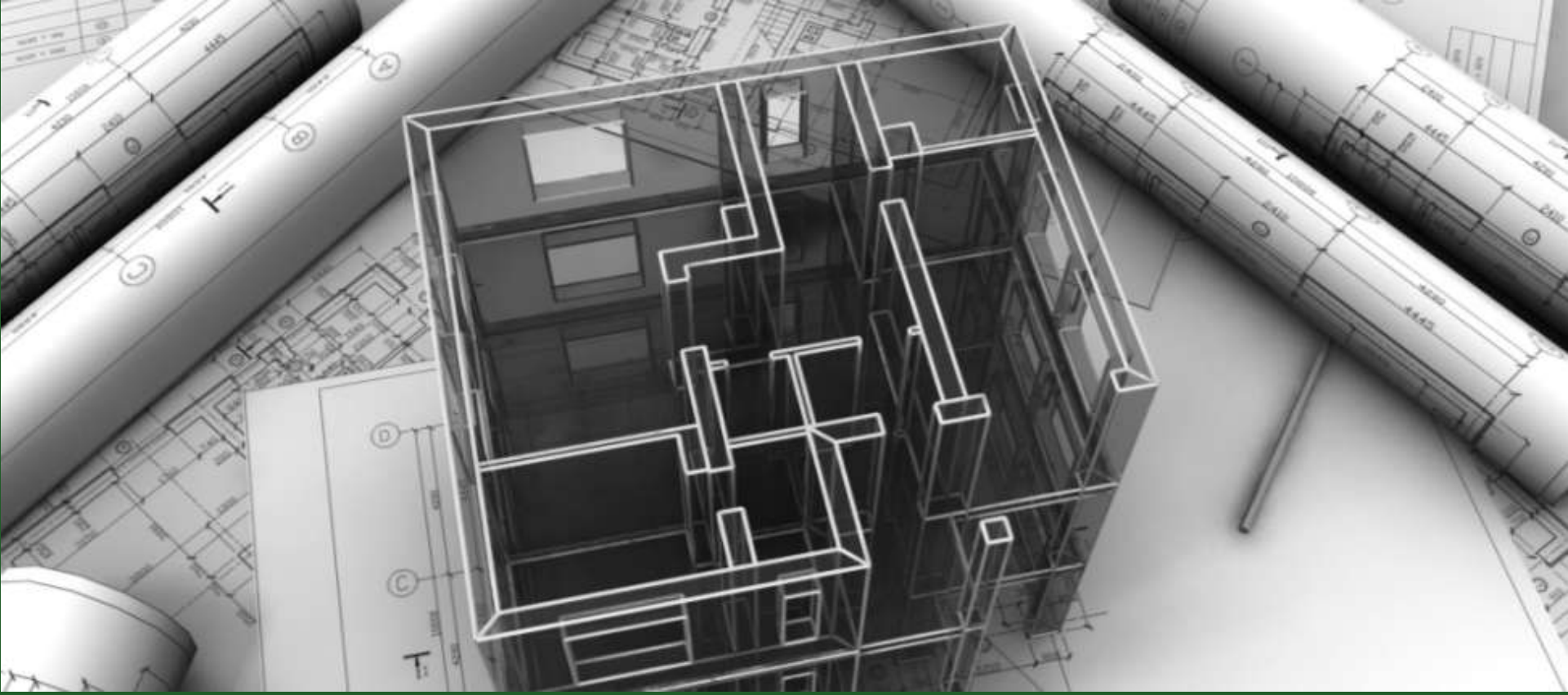

Bridge Complete
PIPER INC

Value Engineering –Final Design



Bridge Cross Section

Precast Curved U-Girder
4 Girder Lines @ 9’-4”
Precast Deck Panel w/ 1 ½” Concrete Overlay



Ravenna Viaduct: Concrete Filled Steel Tube Arch

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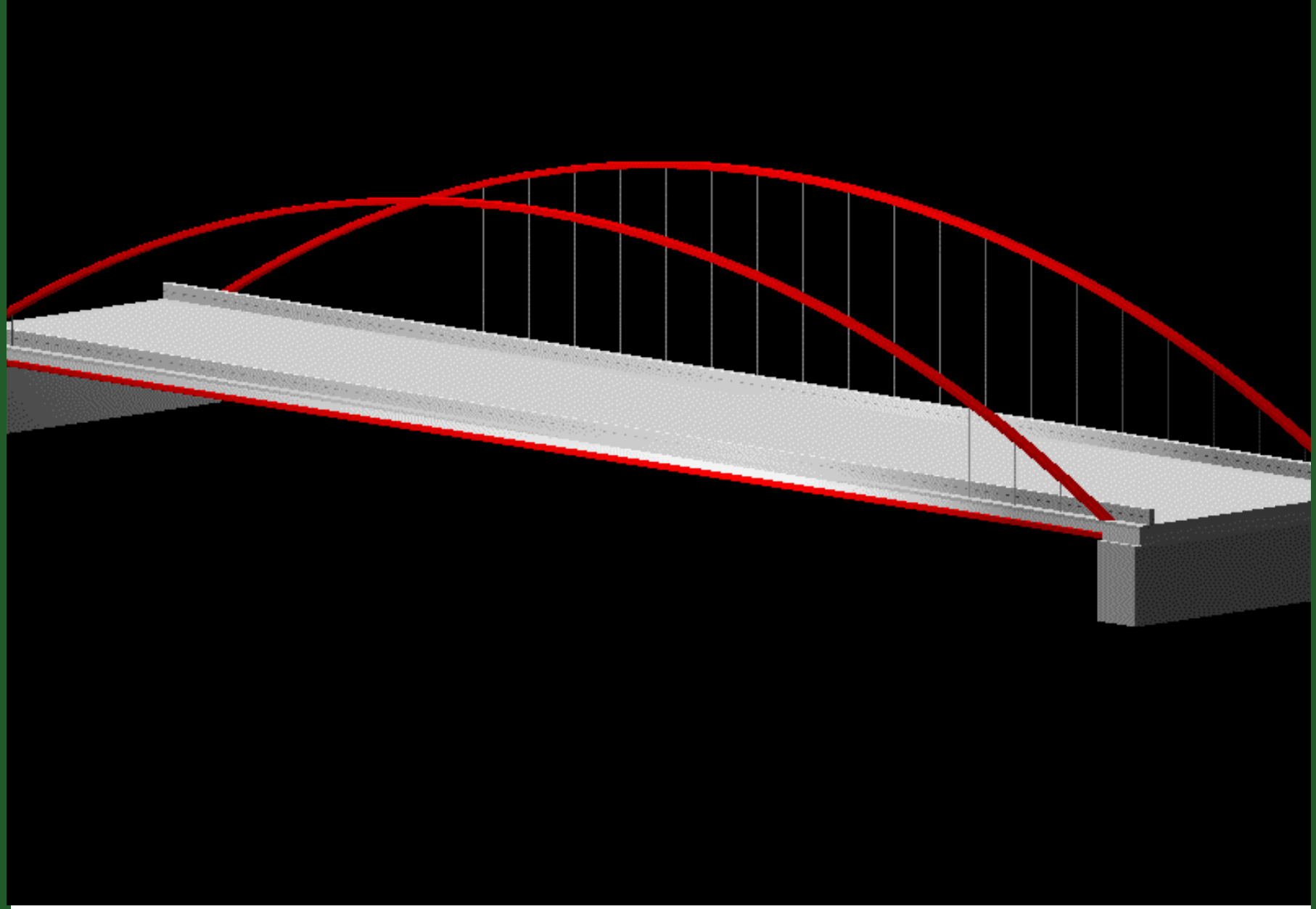
SUSTAINABLE SAVINGS 2012

Bridge Components



PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

Hollow tube: P_{ult} = 39.8 kips, Deflection = 10.7 IN.

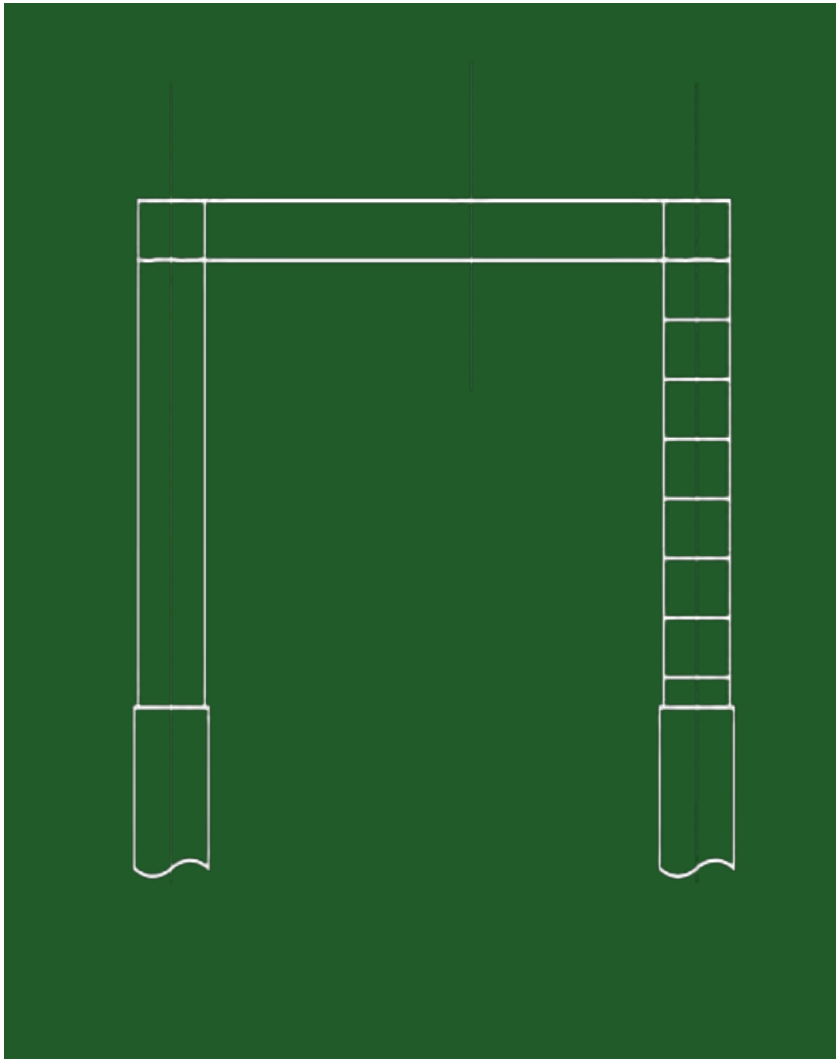
Filled tube: P_{ult} = 55.3 kips Deflection = 16.5 IN.

BOTTOM CHORD FLEXTURAL STRENGTH TESTING

Ultimate load 462 kips (predicted 460 kips);
Ultimate deflection = 4.52” (predicted 4.50”)


NEBRASKA

Abutment and Foundation



6' x 8' Columns

8' x 65' diameter Drilled Shaft

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SUSTAINABLE SAVINGS 2012

VAN SEUMEREN GROUP

MAMMOET

PRECAST FOR ALL

SUSTAINABLE SAVINGS 2012

PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

Actual Pick

LIFTING THE NEW PCU INTO PLACE

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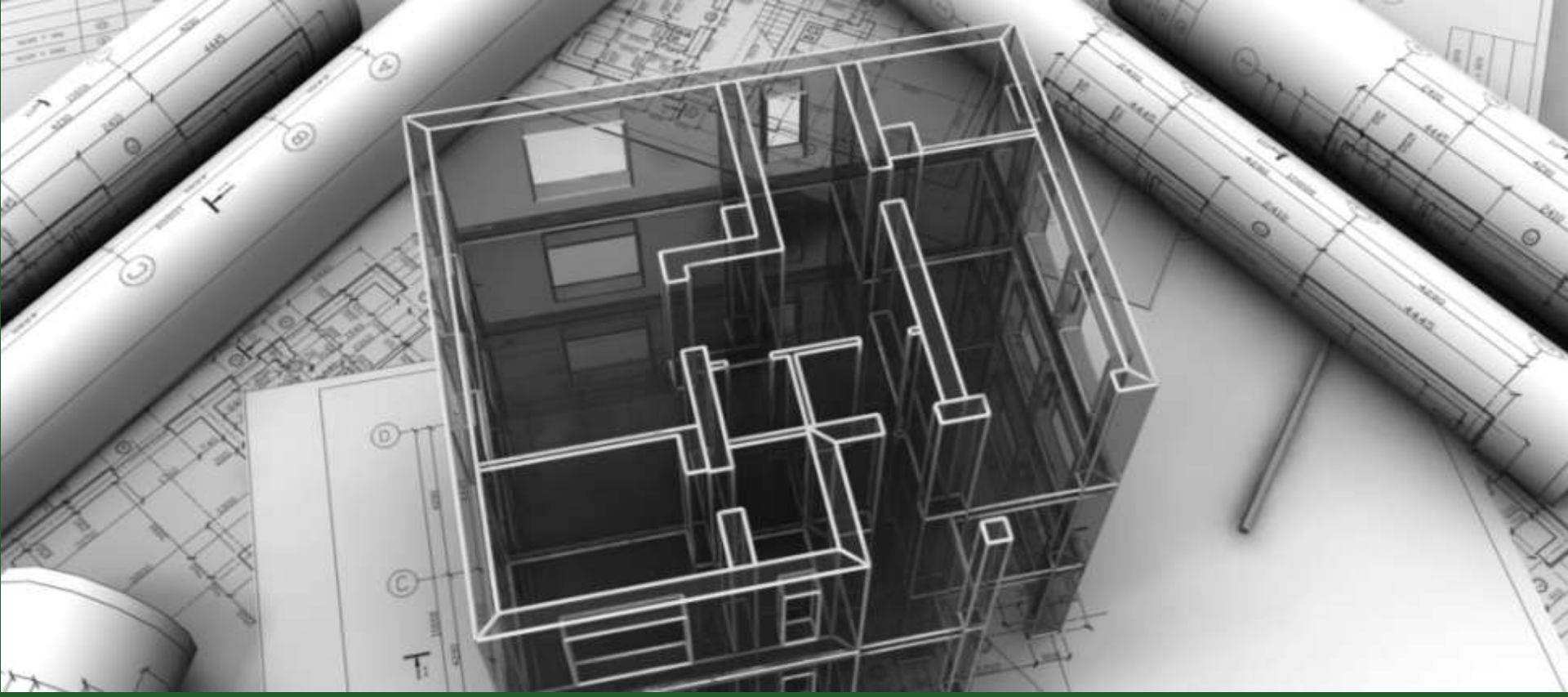
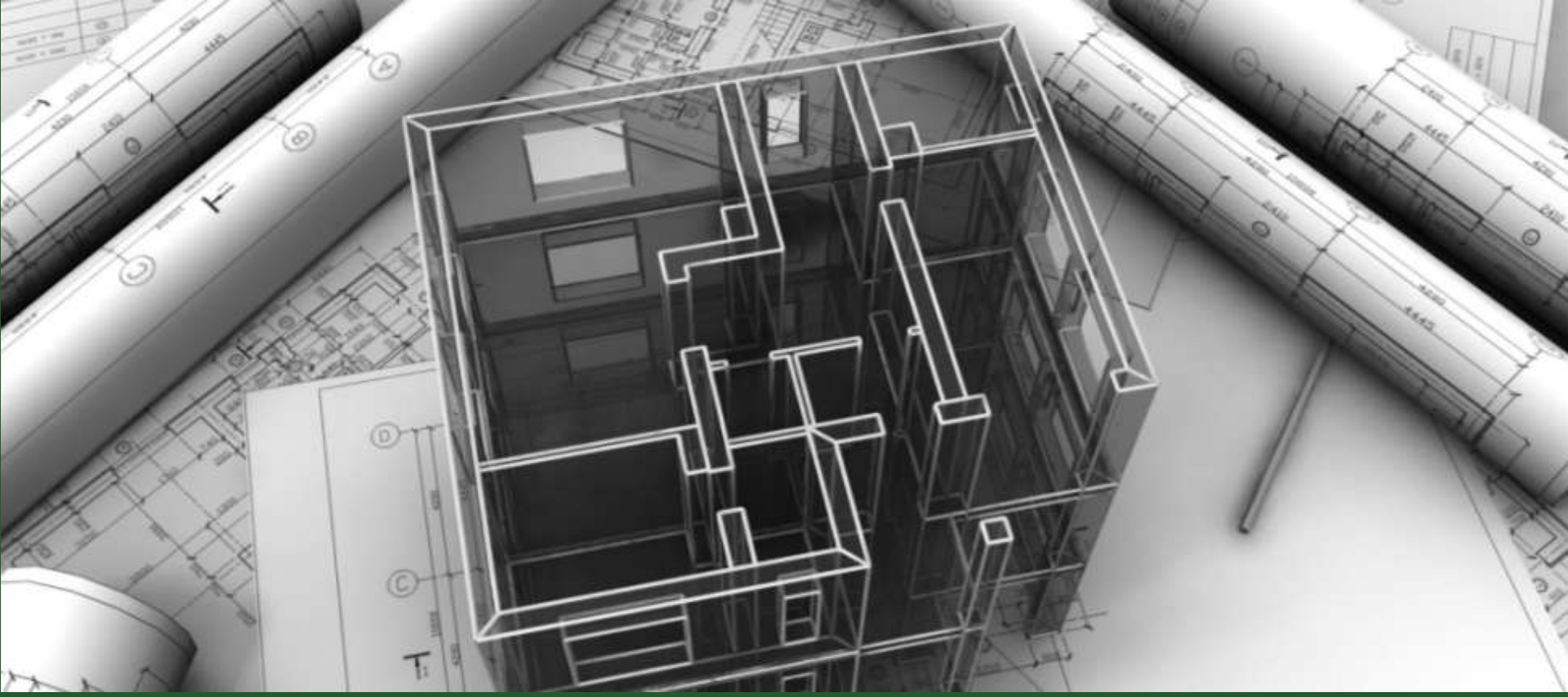
SUSTAINABLE SAVINGS 2012



ADD PRECAST PAVEMENTS MKT

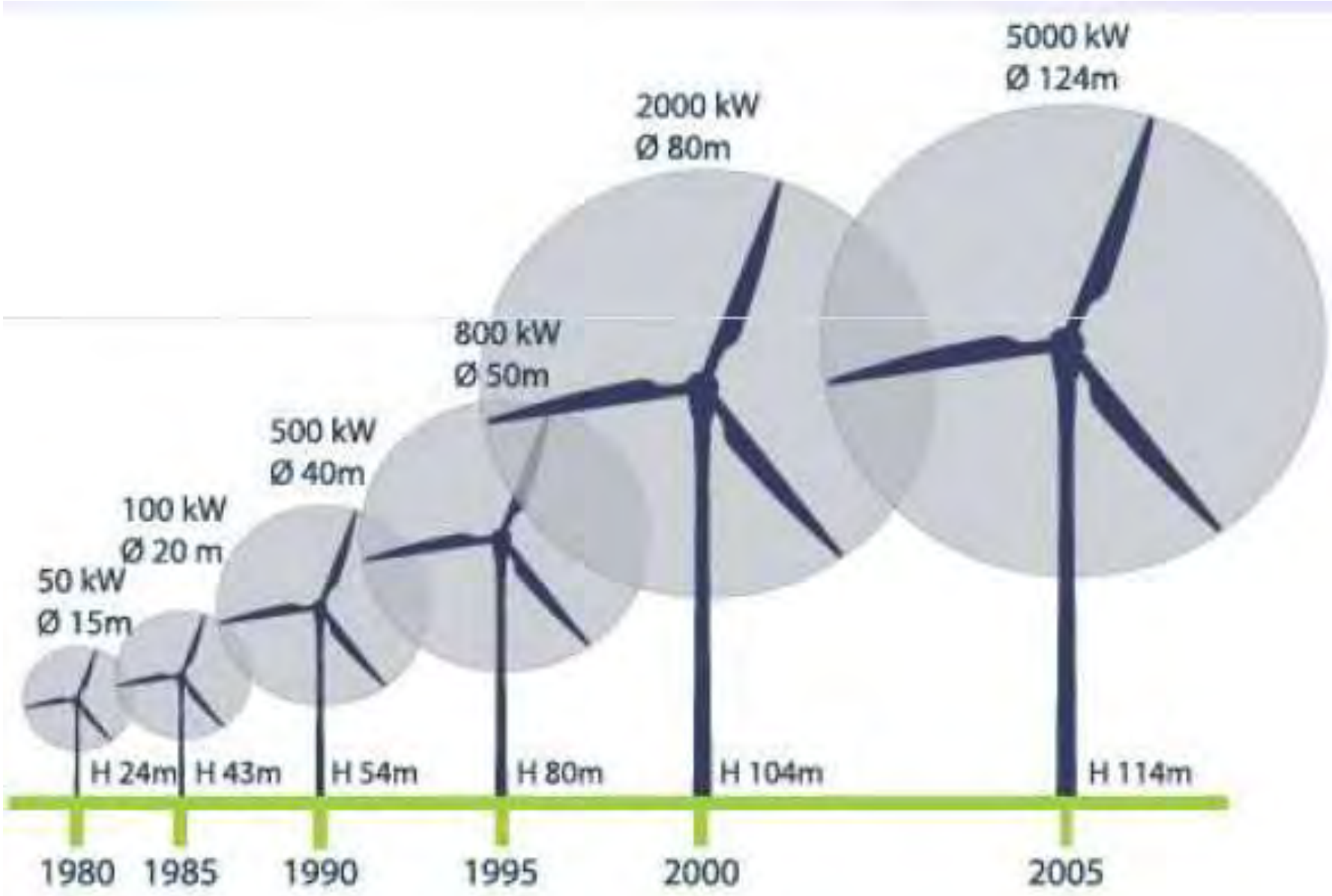
PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012



WIND TOWERS

PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

EVOLUTION



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SUSTAINABLE SAVINGS 2012

Conventional Shape

Steel or concrete tower

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SUSTAINABLE SAVINGS 2012

Recent Concrete Options

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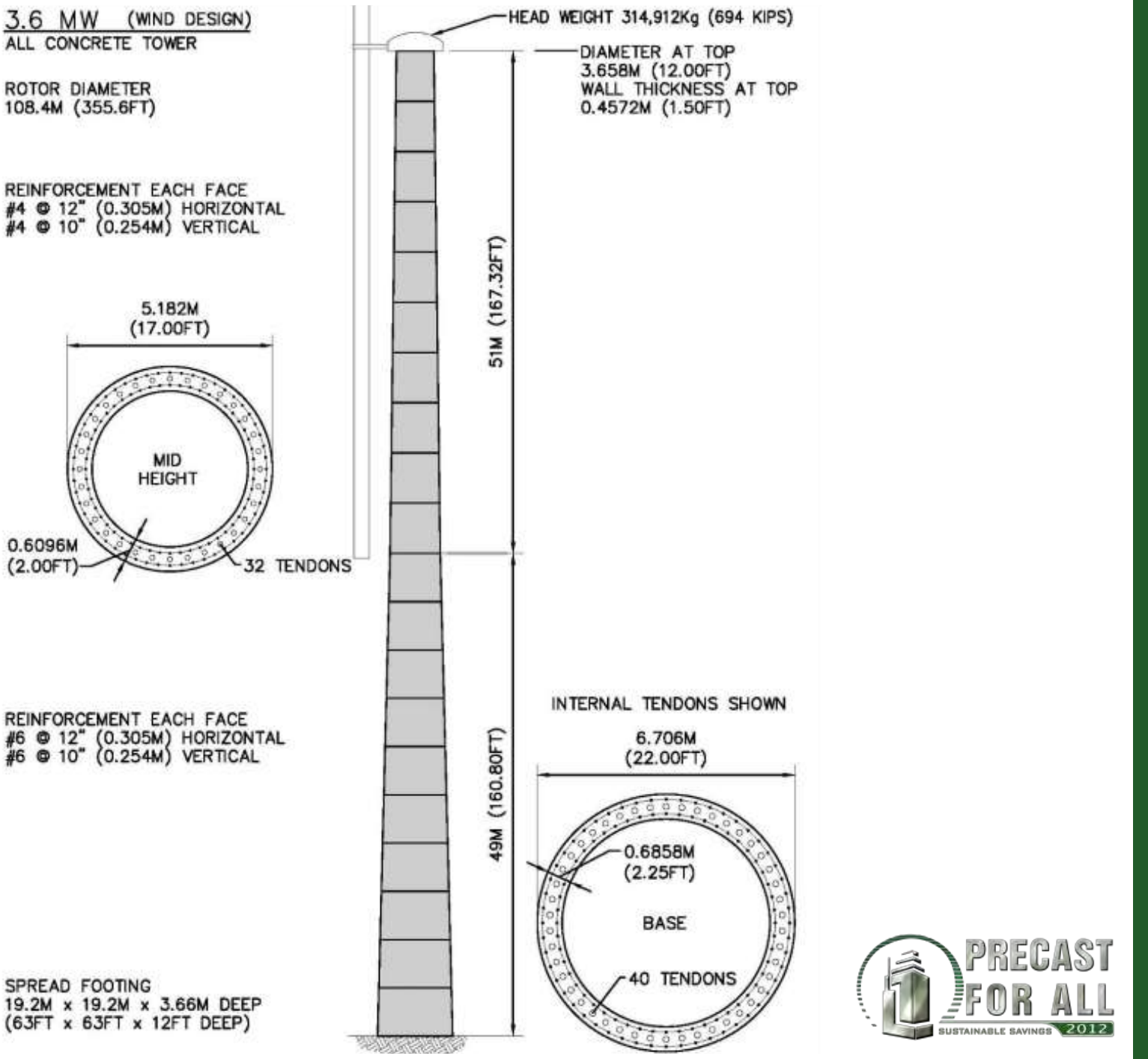
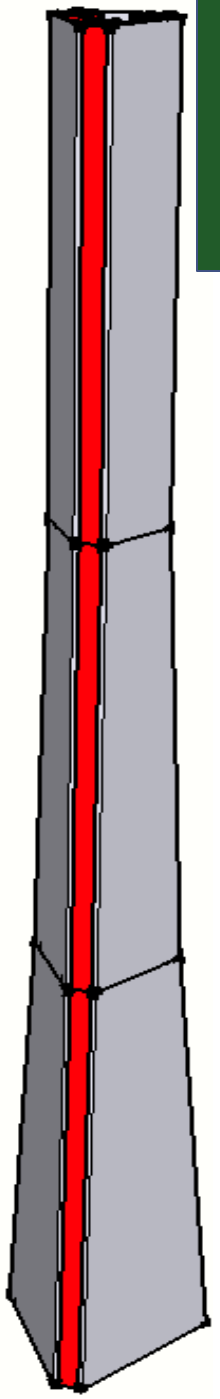
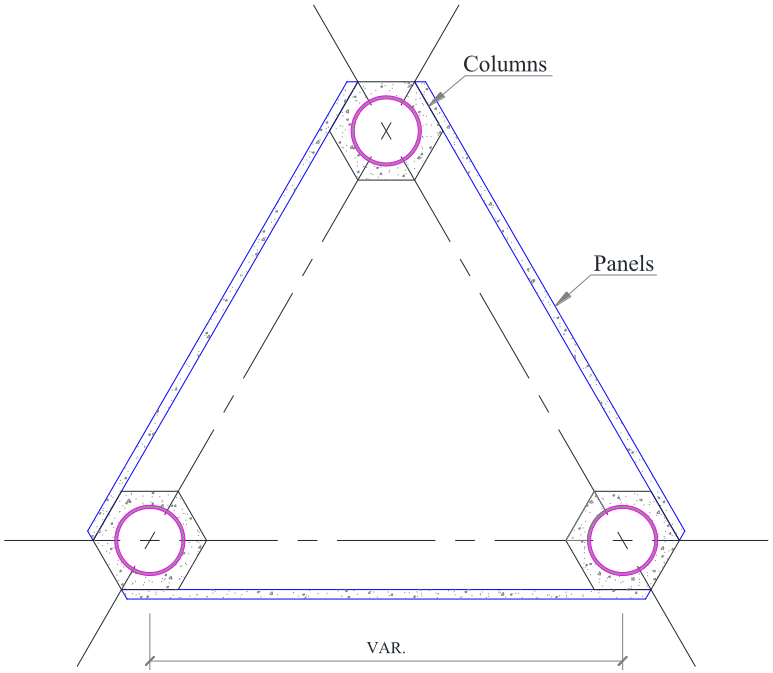
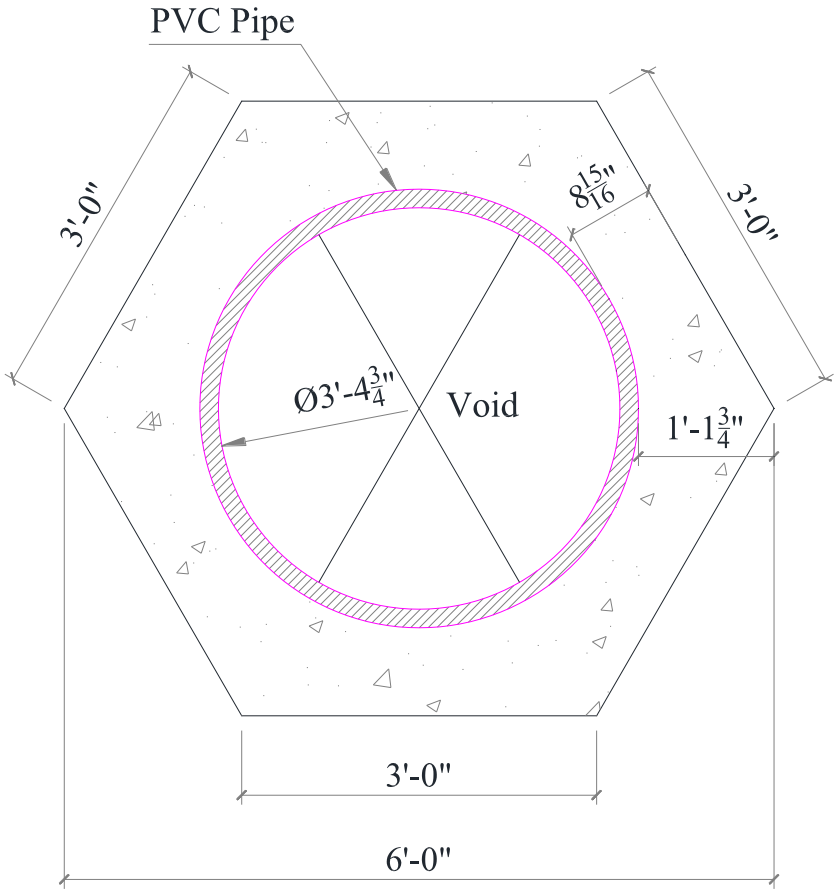
SUSTAINABLE SAVINGS 2012



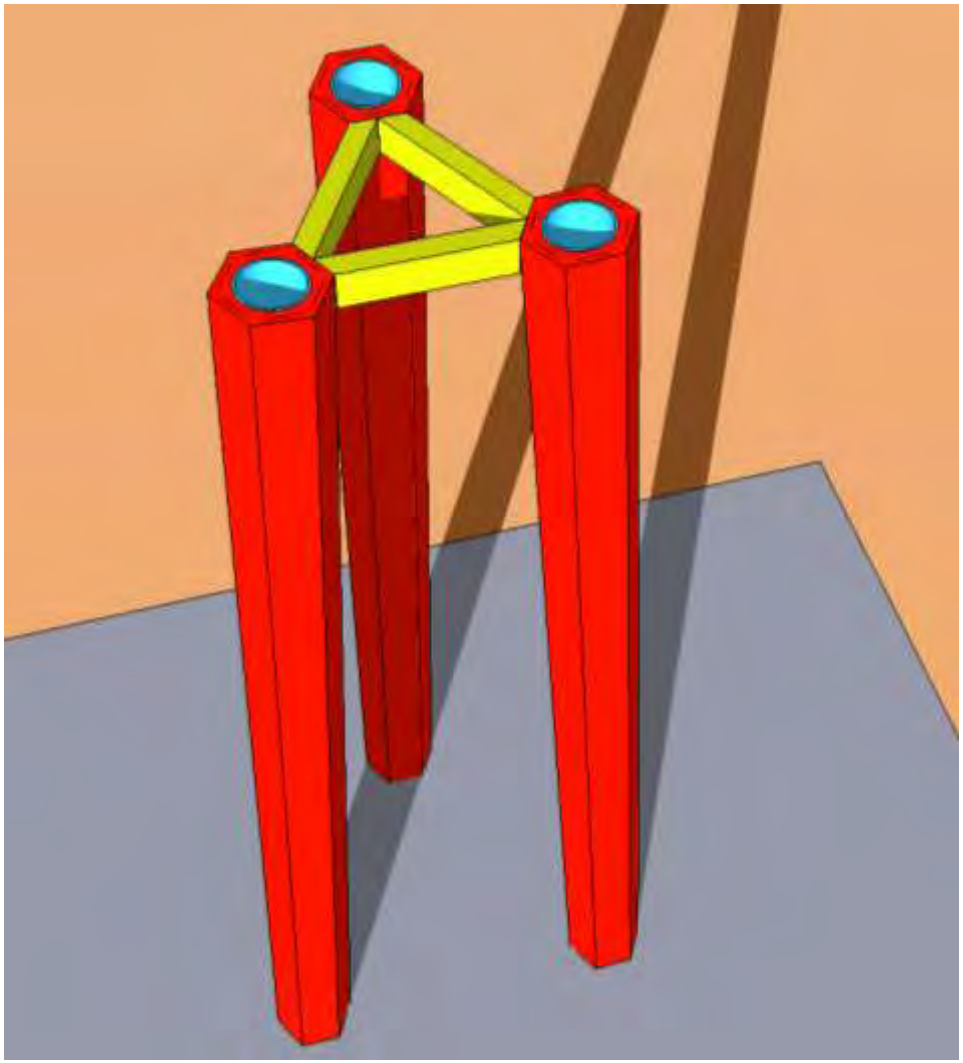
3. PROPOSED SYSTEM
DESCRIPTION

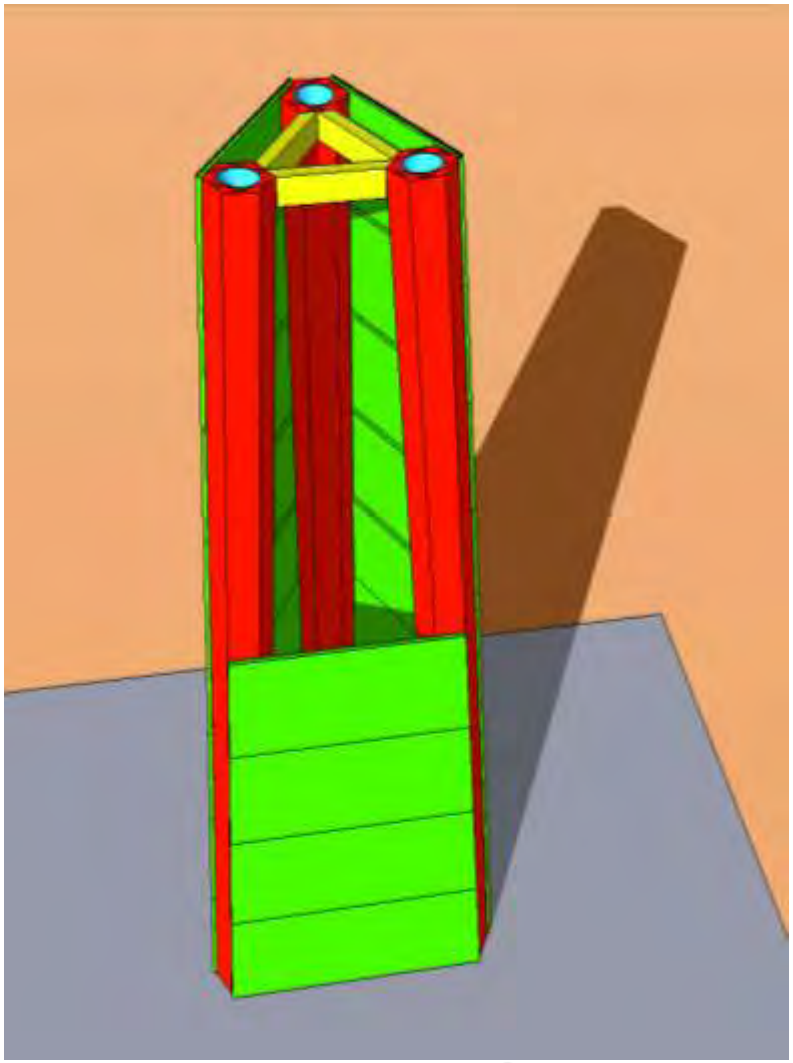






3. PROPOSED SYSTEM CONSTRUCTION SEQUENCE





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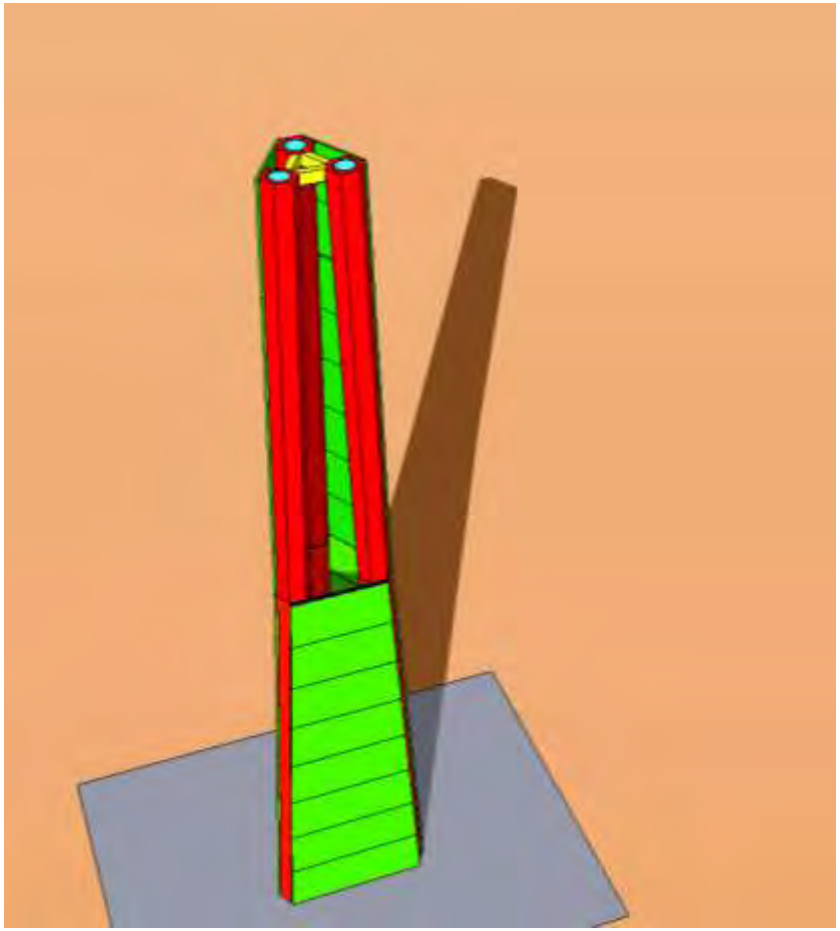
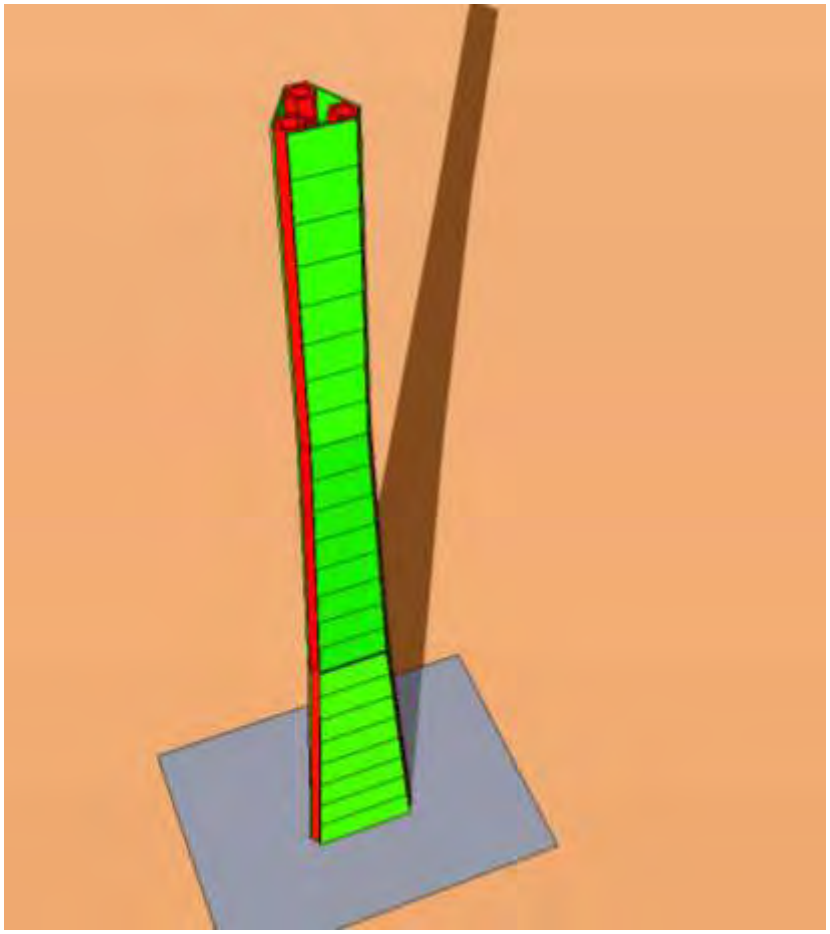
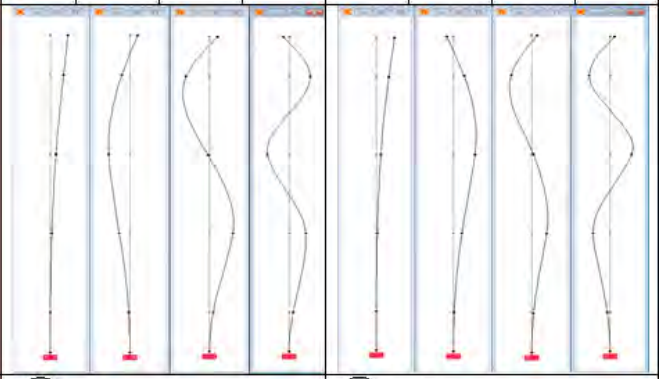
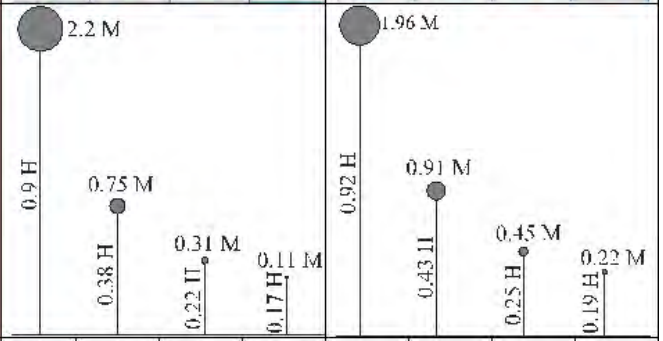
SUSTAINABLE SAVINGS 2012

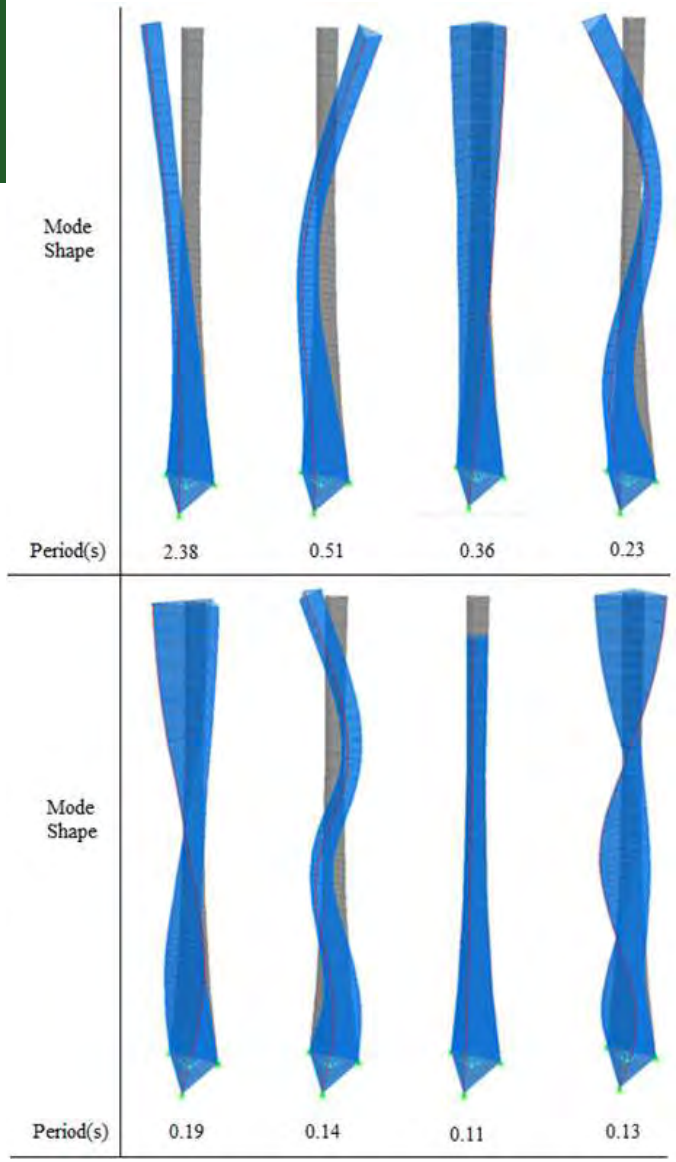
3. PROPOSED SYSTEM CONSTRUCTION SEQUENCE





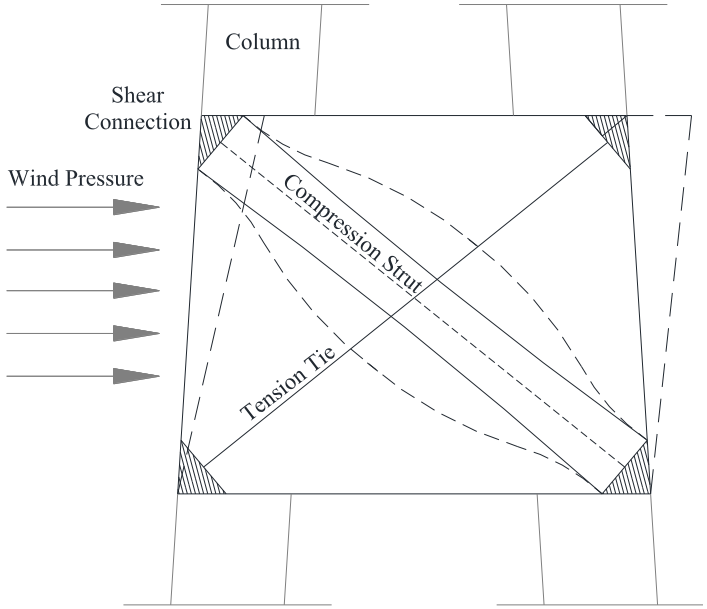
3. PROPOSED SYSTEM DYNAMIC CONCRENS [CONT.]

System	Triangular (proposed)				Circular (current)			
Mode	1	2	3	4	1	2	3	4
Natural period (s)	2.37	0.39	0.14	0.09	2.56	0.43	0.17	0.10
Mode Shapes								
Effective modal masses and heights								
Top deflection contribution	98 %	1.3 %	0.3 %	0 %	98 %	1.7 %	0.08 %	0 %
Base shear contribution	65 %	22.2 %	9.4 %	3.4 %	55.4 %	25.7 %	12.6 %	6.3 %
Base moment contribution	84 %	12.1 %	3.0 %	0.8 %	76.7 %	16.6 %	4.8 %	1.9 %

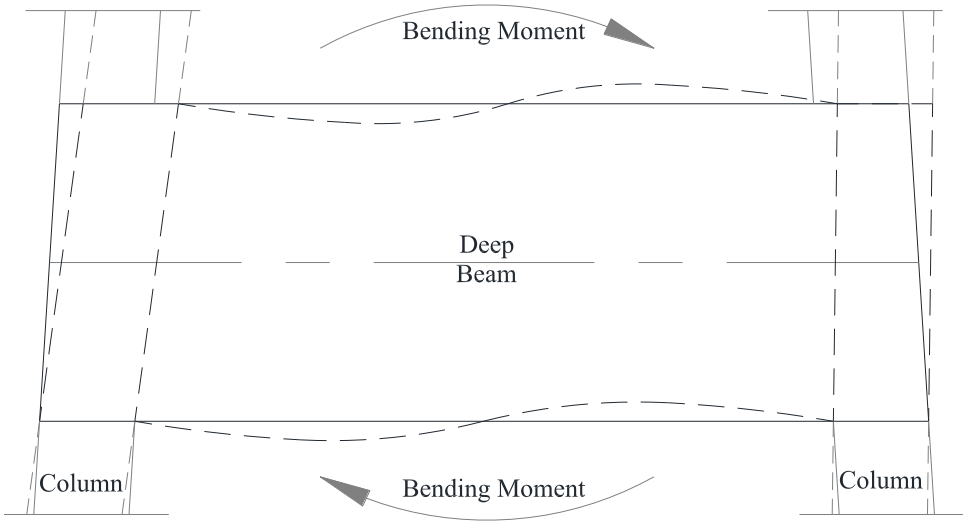


PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

5. ANALYSIS AND DESIGN MODELLING [Cont.]



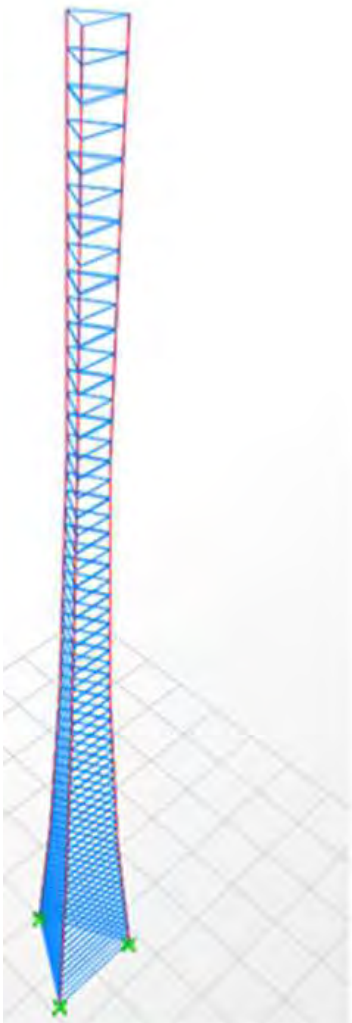
X-Bracing Model



Deep Beam Model

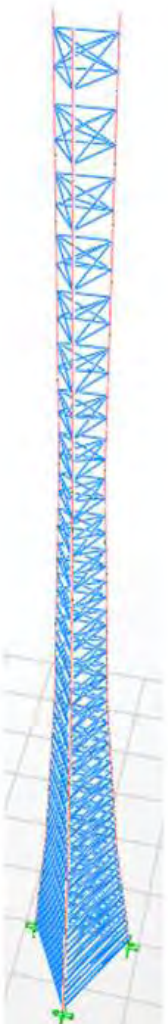
PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

5. ANALYSIS AND DESIGN MODELLING [Cont.]



Deep Beam Model

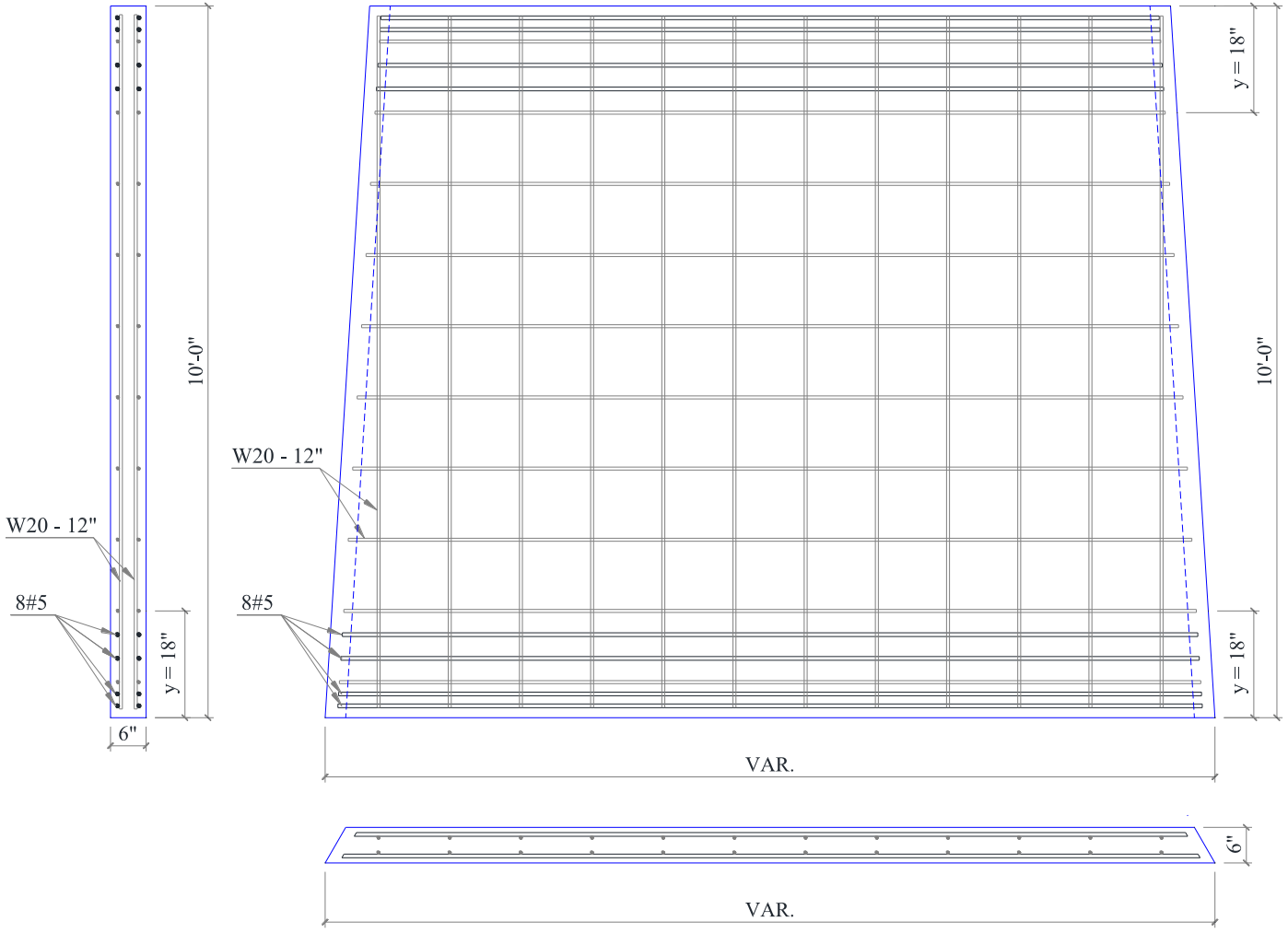
Solid Shell Model



X-Bracing Model

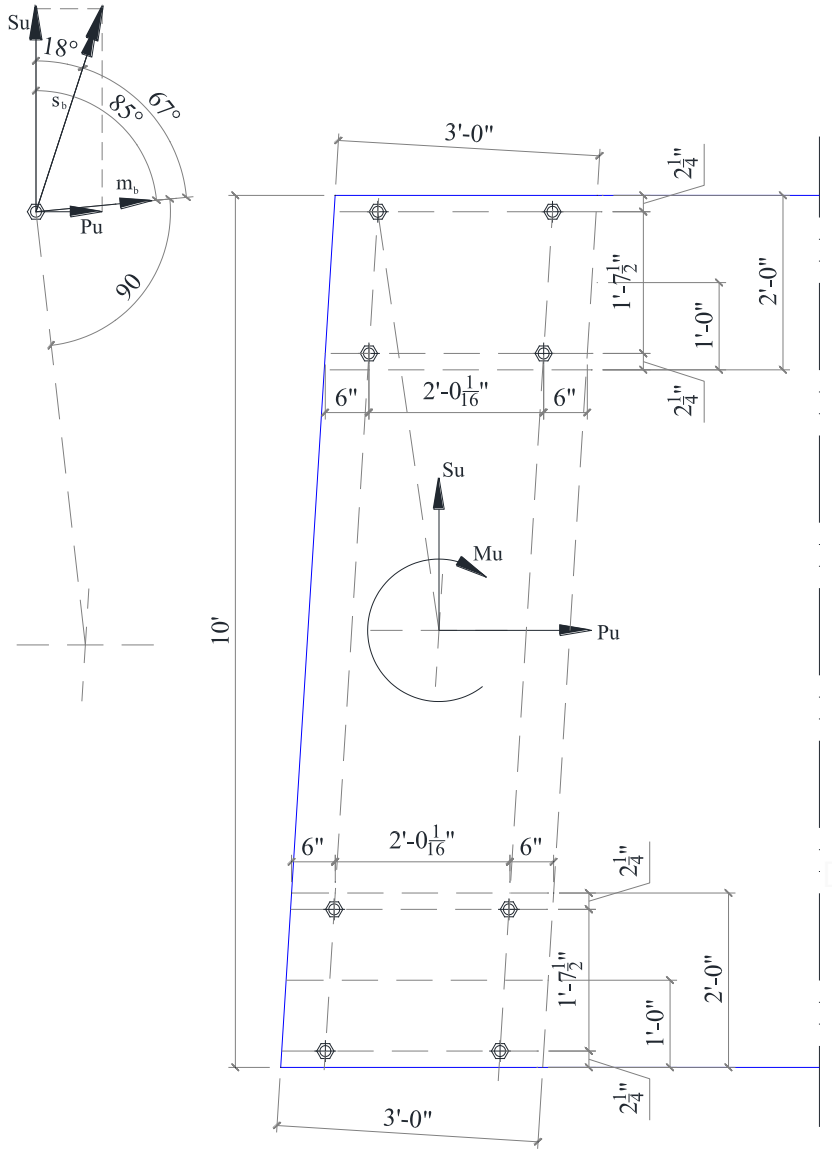
PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

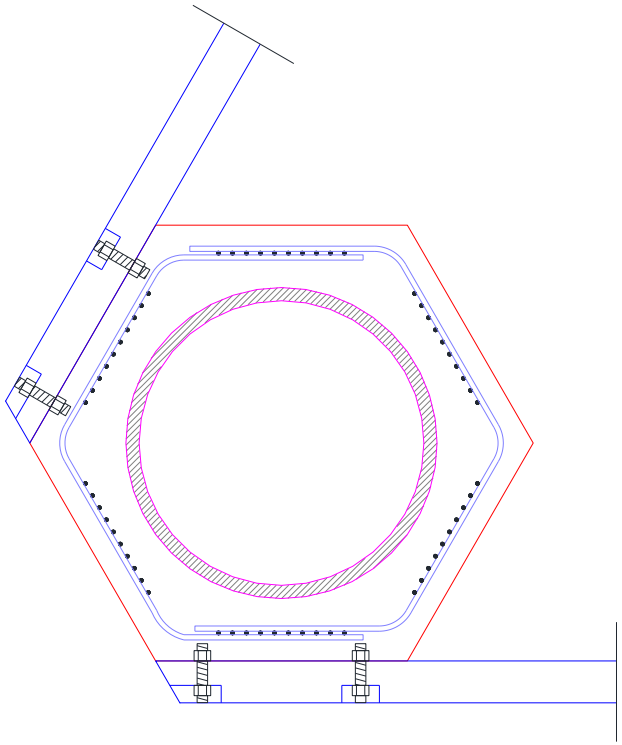
5. ANALYSIS AND DESIGN
PANEL DESIGN [Cont.]



PRECAST FOR ALL
SUSTAINABLE SAVINGS 2012

5. ANALYSIS AND DESIGN
PANEL CONNECTIONS





Four 1½in. A490-N grade 60ksi bolts. (φV_n=79.5 kips)

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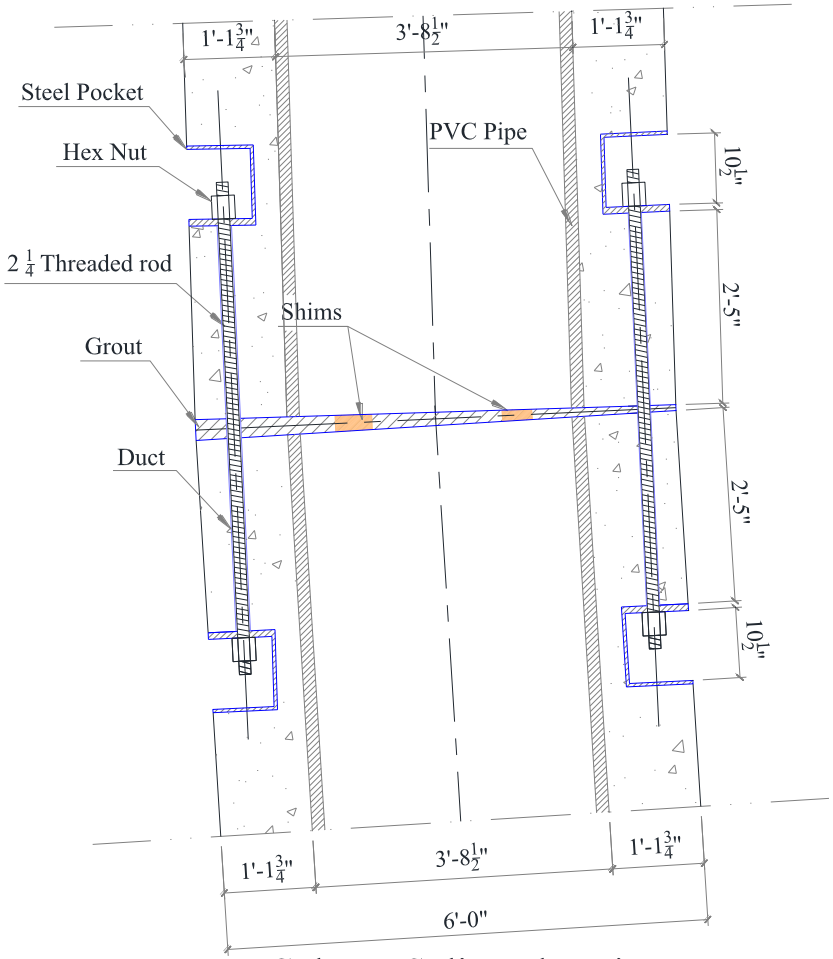
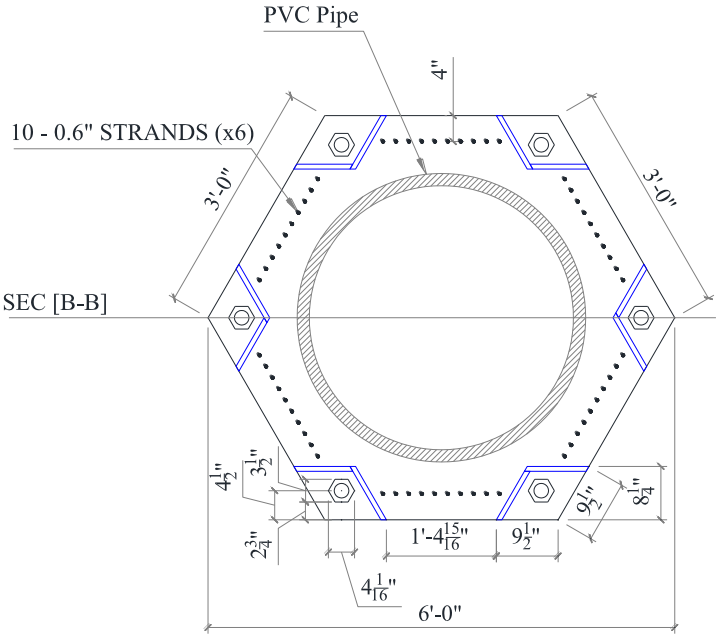
5. ANALYSIS AND DESIGN

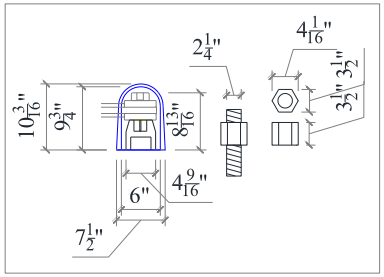
COLUMN SPLICE



Column Splice Elevation
Sec [B-B]



Column Splice Cross Section



Threaded rod and
pocket dimension

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- The proposed concrete system achieves a competitive solution
- It is adjustable to various heights, now and into the future.
- It only uses column and wall precast products
- Simple construction sequence
- Shipping and handling are conventional
- Attractive aesthetics

Thank you

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