Innovation and Technology at Large Scale

Erleen Hatfield, PE, AIA
A Global Firm of Engineers and Technical Designers

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A Guiding Principle...

...That engineering considerations influence planning and architecture and that good designs result only when there is genuine harmony between the artistic and the practical.

- Sir Ted Happold
  (1929-1996)
First Retractable Roof of its kind
Largest Scoreboard in Sports
On track to become the first LEED Platinum Stadium
First use of ETFE Facades in the US
PROJECT DETAILS

- **Owner**: Georgia World Congress Center Authority
- **Architects**: HOK Architecture (Kansas City), TVS, GVSA, SBS
- **Contractor**: Holder, Hunt, Russell, Moody, a Joint Venture
- **Structural Engineers**: BuroHappold Engineering + Sykes Consulting (Foundations)
- **Mechanization**: Chuck Hoberman and UniSystems
- **MEP**: WSP
PROJECT DETAILS

- **Opening**: 2017

- **Use**: NFL Games, MLS Matches, Basketball, Entertainment

- **Approximately**: 1.9M square feet

- **Capacity**: 75,000 seats
INITIAL DESIGN GOALS

- Stadium design should make an attractive choice for:
  - NFL Super Bowls
  - FIFA World Cups
  - NCAA Final Four
STADIUM BREAKDOWN

- Façade
- Bowl Seating
- Bowl Structure
- Foundation
STADIUM BREAKDOWN

Roof Structure
Façade
Bowl Seating
Bowl Structure
Foundation
RE-THINKING THE ROOF DESIGN

- Smaller pieces
- Lighter weight
- Moving shorter distances
- New façade materials
- Holistic approach
- Video board integration
3-D PRINTING

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FIXED ROOF
NFL SCOREBOARD SIZES

The New #1 Atlanta Falcons (2017)

60' x 1,100'

Jacksonville Houston Dallas Tennessee Miami New England Green Bay

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ROOF STRUCTURE
BOTTOM CHORD SPLICE

- 50ksi Steel
- 65ksi Steel

- Sizes – W14x30 to W14x873 (largest size)
TRUSS CONFIGURATION
- 4 Primary Trusses
- Rotated 45 degrees
- Supports Video Halo
- Supports Downward Rail
- Create Octagon Opening
- Supports Video Halo
- Supports Downward Rail
C TRUSSES

- Parallel to A & B Trusses
- Supports Upward Rail
- Petals run on A, B & C Trusses
- Downward rails on A & B Trusses
- Upward rails on C Trusses
OPERABLE ROOF PANELS
OPERABLE ROOF STRUCTURE

3D Axonometric: Petal Framing

Petal Configuration

- Primary Cantilever Trusses
- Secondary Cantilever Trusses
- Transverse Heel Trusses

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OPERABLE ROOF STRUCTURE
ETFE FRAMING

HSS POSTS

ETFE PILLOW

PANEL FRAMING

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OPERABLE ROOF STRUCTURE

Bogie Isometric

Source: Uni-Systems Engineering
OPERABLE ROOF STRUCTURE

- Drag Strut
- Spherical Plain Bearing
- Outer Rail
- Steel Weldment
- Pivot Axl
- Rollers
- Uplift Roller Isometric
METAL PANEL FACET = ETFE AT EAST WINDOW
FAÇADE CONNECTIONS TO BOWL
COMPLEX GEOMETRY
ETFÉ – SINGLE LAYER

- ETFE single layer construction is not new
- Used in Europe
- Transparency and Lighter weight allows:
  - Freedom to create unusual structural forms
  - Smaller structural members
- Cables improve the single layer structural performance
- Reduced weight and inherent “give” of the fabric allow for a smaller structure
Due to automated manufacturing, façade geometry is not beholden to repetition.

Detailing is important aesthetically and structurally.

Using proven materials (but new to the US) can achieve new and iconic results.
FACADES – DURING CONSTRUCTION
MODELING
BIM – MULTI-DISCIPLINARY
Better coordination with other trades
3D MODEL – AS DELIVERABLE
STEEL DELIVERY PROCESS

- **Tekla Model** was the deliverable for Steel

- Contractor can *rely* on the model for Steel information

- PDFs still required for:
  - General Notes, Specs, Typical Details

Someday this will be the standard of care
- Digital Shop Drawing Review
- Multi-monitor
- High-powered workstations
SECTION 05121 - STRUCTURAL STEEL MODEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes provisions for the use of the Steel 3D Model including model responsibilities and procedures.
B. Related sections include the following:
1. Division 3 Section “Structural Steel”
2. Division 5 Section “Steel Deck” for field installation of shear connectors
3. Division 6 Section “Architecturally Exposed Structural Steel”
4. Division 9 painting Sections and Division 9 Section “High-Performance Coatings” for surface preparation and painting requirements.

1.3 DEFINITIONS:
A. Contract Documents: As defined in the Owner/Contractor Agreement, which includes the Drawings, Specifications, and the 3D Data Base.
B. Work: In addition to its definition in General Conditions, the term “Work” refers to and means that work indicated on the Contract Documents as specifically identified in the Owner/Contractor Contract.
C. Steel 3D Model: One or more electronic three dimensional models provided in TEKLA Structures version 16.0 software format. The model may be translated to 3DXML format by Buro Happold for use in the field.

Project Name: ATLANTA FALCONS NEW STADIUM
Date: September 2, 2014

ISSUE FOR 50ksi STEEL MILL ORDER

POSTING NOTES FOR USE OF THE TEKLA STEEL 3D MODEL

1. A Tekla model of the steel roof has been made available to HHFM for distribution to the steel fabricator and erector only. This model is for procurement of 50ksi steel, all other members are for reference only.

2. The Tekla file has been created in Tekla version 20.0 with a file name of BH_RooMModel_ver4.0.db1.

3. Additional documents related to this posting include:
a. Specifications sections: 051000 Structural Steel, 051201 Structural Steel Modeling, and 053000 Steel Deck dated June 16, 2014
b. Structural 2D drawings dated September 2, 2014
c. Architectural and MEP drawings dated June 16, 2014

4. Please see specification section 051201 Structural Steel Modeling for specific model use and procedural requirements.

5. For the 50ksi steel members included in the Tekla Model, the model will govern all member property information including size, material properties, and geometry. The contractor has the right to rely on the model for 50ksi steel members and the drawings are issued for reference.
... PUT IN CONTEXT WITH 3D
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STAMPING WITH TEKLA’S IN MODEL REVIEW

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... PUT IN CONTEXT WITH 3D

ASSEMBLY
LOCATION
REVIEW STATUS
MATERIAL
GLOBAL
COORDINATES
WEIGHT
AREA
ELEVATION

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The Revit converted Unity models can be built to view on phones with a simple download. This **METHOD** of model viewing will make it possible for anyone to see 3D models.

Optimized for Google Cardboard
IMMERSIVE EXPERIENCE

This is a video for presentation purposes however, it is a 360 degree panorama that is 100% interactive with rotation and zooming features.

YOU’RE IN CONTROL!
POSSIBLE BRAINSTORMING SESSIONS

AUGMENTED REALITY would help explain by showing things such as steel connections in place.
WRAP UP
mercedesbenzstadium.com

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Partner, BuroHappold Engineering