OUTDOOR STAGE EQUIPMENT SAFETY COMMITTEE

LSA Staff:

Anne Haley, Attorney for the Committee
Chris Baker, Fiscal Analyst for the Committee

Authority: IC 2-5-34.7

Legislative Services Agency
200 West Washington Street, Suite 301
Indianapolis, Indiana 46204-2789
Tel: (317) 233-0696 Fax: (317) 232-2554

MEETING MINUTES[1]

Meeting Date:	**September 5, 2012**
Meeting Time:	**10:00 A.M.**
Meeting Place:	**State House, 200 W. Washington St., Senate Chamber**
Meeting City:	**Indianapolis, Indiana**
Meeting Number:	**1**

Members Present: **Rep. Robert Cherry, Co-Chairperson; Rep. William Davis; Rep. Ed DeLaney; Sen. James Merritt, Co-Chairperson; Sen. Brent Steele; Sen. Timothy Lanane; Sen. Greg Taylor; Joseph Wainscott, Jr.; James Greeson; David Hannum; Jim Kelly.**

Members Absent: **Rep. Terri Austin.**

Senator Merritt called the meeting to order at 10:05 a.m. After Committee members were introduced, Senator Merritt said that the Committee would hear presentations concerning the August 13, 2011, State Fair stage collapse.

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[1] These minutes, exhibits, and other materials referenced in the minutes can be viewed electronically at http://www.in.gov/legislative Hard copies can be obtained in the Legislative Information Center in Room 230 of the State House in Indianapolis, Indiana. Requests for hard copies may be mailed to the Legislative Information Center, Legislative Services Agency, West Washington Street, Indianapolis, IN 46204-2789. A fee of $0.15 per page and mailing costs will be charged for hard copies.

Scott G. Nacheman, MSc.Eng., AIA, Thornton Tomasetti

Mr. Scott Nacheman provided a Powerpoint presentation (Exhibit 1) on the Indiana State Fair stage collapse incident report prepared by Thornton Tomasetti and previously presented to the Indiana State Fair Commission. The text of the incident report is located at http://www.in.gov/sfc/2343.htm After discussing how the incident investigation was conducted, Mr. Nacheman provided the Committee with the report findings and recommendations.

During the Committee discussion that followed, Mr. Nacheman made the following points:

- The failure of a temporary structure can be as catastrophic as the failure of a permanent structure. Structures should not be exempted from permitting and inspection requirements based only upon their temporary nature. The same risk criteria, occupancy factors, and other factors that are analyzed for permanent structures should be analyzed for temporary structures.

- The owner of the property upon which a temporary structure is erected should be ultimately responsible for any failure, in the same way that a property owner is responsible for the failure of a permanent structure. The owner has the responsibility to hire a competent person to erect the structure.

Charles E. Fisher, Preparedness Operations, Witt Associates, and Ann Vonweller former president of the International Code Council

Mr. Charles Fisher stated that in conducting its investigation into the Indiana State Fair stage collapse, Witt Associates looked at three things: (1) the overall state of preparedness of the Indiana State Fair Commission; (2) the events leading up to the stage collapse; and (3) the response to the stage collapse incident. Mr. Fisher discussed the measures taken by the Indiana State Fair Commission after the incident, including adopting a comprehensive emergency management plan. Mr. Fisher said that for purposes of their investigation, Witt Associates contracted with Ms. Ann VonWeller, former president of the International Code Council, to analyze Indiana's Code and code enforcement. Ms. VonWeller made a Powerpoint presentation of her findings and recommendations (Exhibit 2). Ms.VonWeller said that her recommendations for legislation is located in Appendix P (Exhibit 3) of the Witt Associates investigative report. The text of the entire report is located at http://www.in.gov/sfc/2343.htm

Ms. VonWeller said that a design release is not required for an outdoor stage, but the plans must still be reviewed and approved by the state to in order to obtain the required amusement and event permit. The Committee discussed the time constraints, costs, and staff involved in requiring design releases for temporary stages and the frequency with which releases should be issued for stages that are disassembled and reassembled or reconfigured many times. The Committee indicated that it would be helpful to have information provided to the Committee at the next meeting regarding the following:

- Senate Enrolled Act 273 (P.L. 92-2012) and the emergency rule adopted by the Fire and Building Safety Commission implementing SEA 273.

- The inspection and permitting process of outdoor stages and stage equipment before and after SEA 273.

- Modification by 675 IAC 13-2.5-17 of International Building Code provisions concerning wind loads.

Next meeting

Sen. Merritt said that the next meeting of the Committee is scheduled for September 27, 2012 at 10:00 a.m. in the Senate Chambers. He said that public testimony would be taken at that meeting. He adjourned the meeting at 12:10 p.m.

Thornton Tomasetti

Indiana State Fair Collapse Incident

August 13, 2011 Collapse Incident Investigation
Report on Findings to the Indiana State Fair Commission

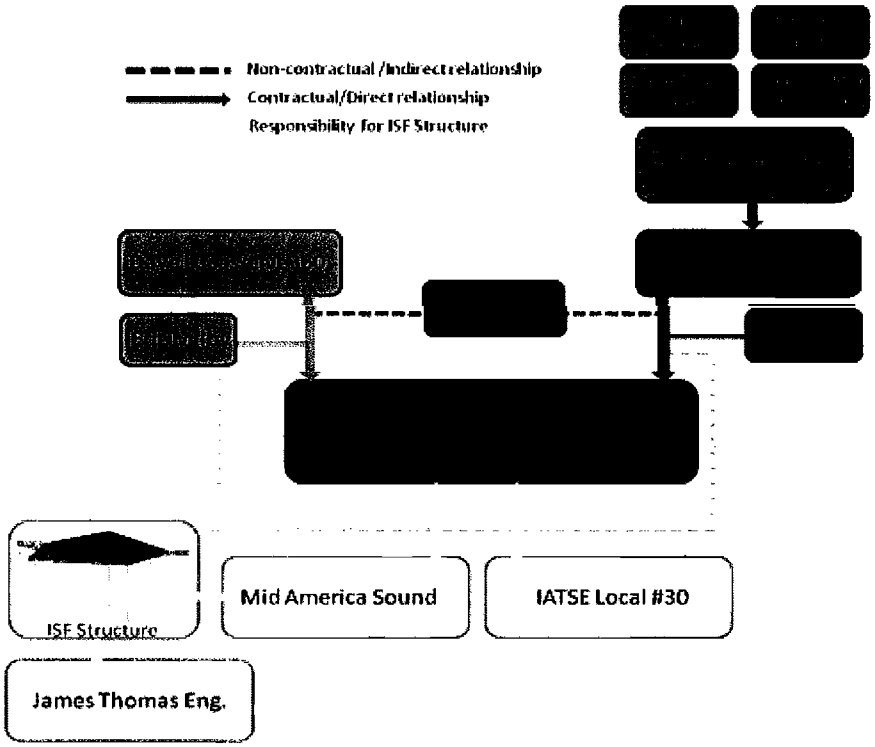
Scott G. Nacheman, MSc.Eng., AIA
Vice President

April 12, 2012

EXHIBIT 1
SEPTEMBER 5, 2012
OUTDOOR STAGE EQUIPMENT
SAFETY COMMITTEE

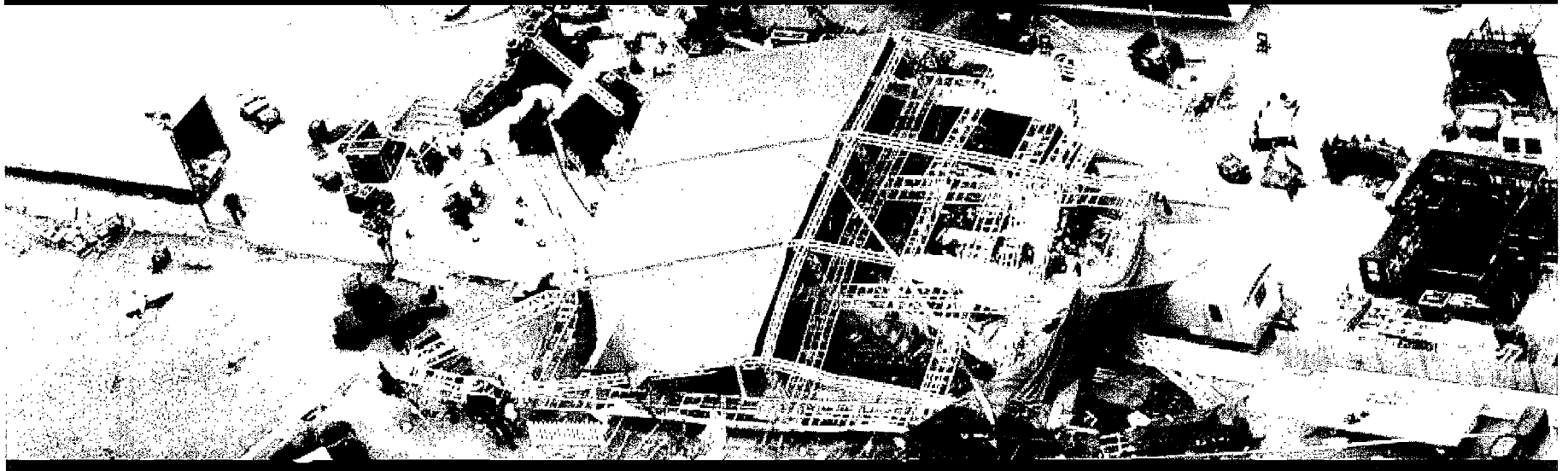
Role of Thornton Tomasetti

- Independent Engineering Cause and Origin Investigation
  - Documentation of site components
  - Access Protocols
  - Chain of Custody Protocols
  - Coordination with other agencies and parties
  - Code analysis
  - Analysis of collapse
  - Limited Document Review
- Final report
  - Findings
  - Recommendations


Non-contractual /Indirect relationship
Contractual/Direct relationship
Responsibility for ISE Structure
ISE Structure
Mid America Sound
IATSE Local #30
James Thomas Eng.

Thornton

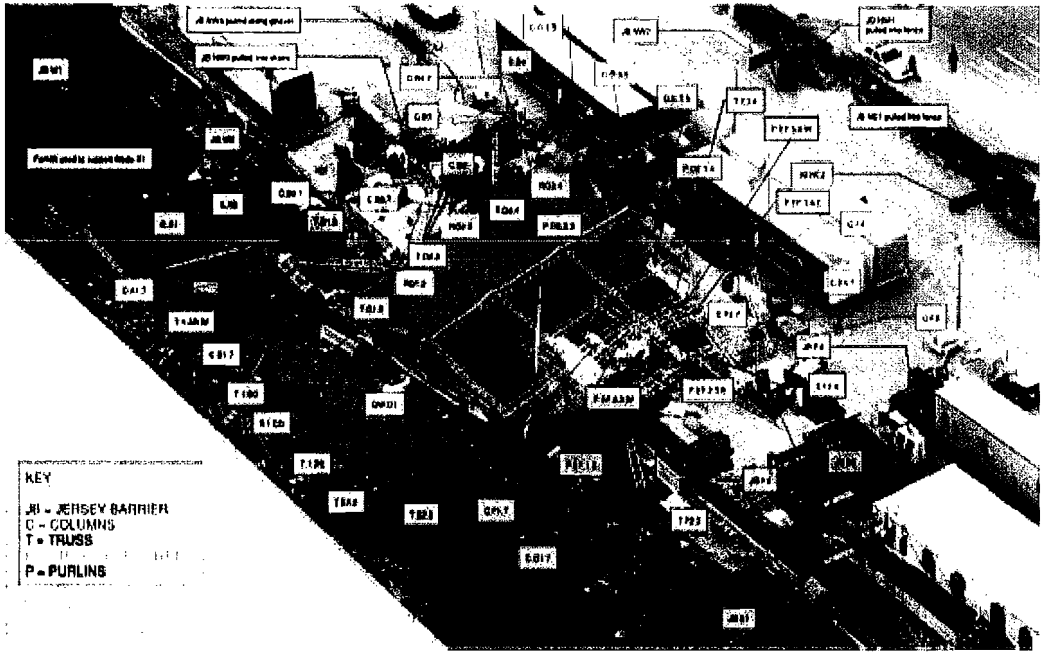
Investigation Methodology



Site Survey
On-site Testing
Wind Tunnel Testing

Metallurgical Evaluation
Computer Modeling
Analysis / Calculations

"Tag" system



Items in database:

Unique "serial number" for all components on site.

RAFTER TRUSS
BETWEEN GRID LINES B AND C
ON COLUMN LINE 1
WEST SECTION

RF.CD.1.W

RAFTER TRUSS

GABLE WEB TRUSS
COLUMN LINE C
SECTION 1
GRID LINE 1

GW.C1.1

GABLE TRUSS

[redacted]

Forensic Database:

>Over 2500 entries

>Superstructure

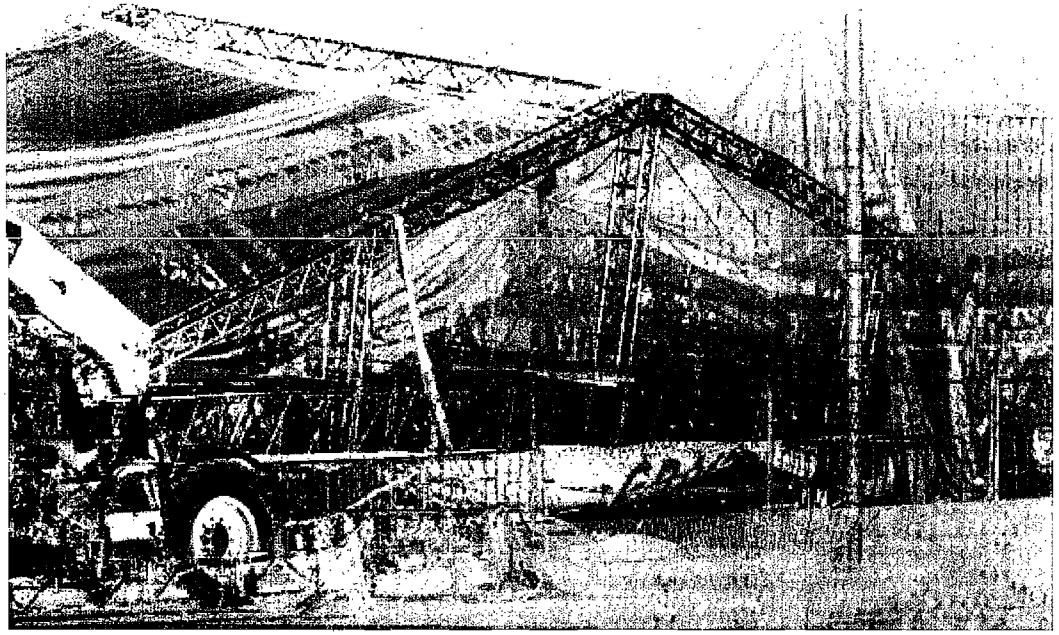
>Suspended Trusses

>Entertainment Tech. Eqpt.

>Guy Lines

>Jersey Barriers (K-Rails)

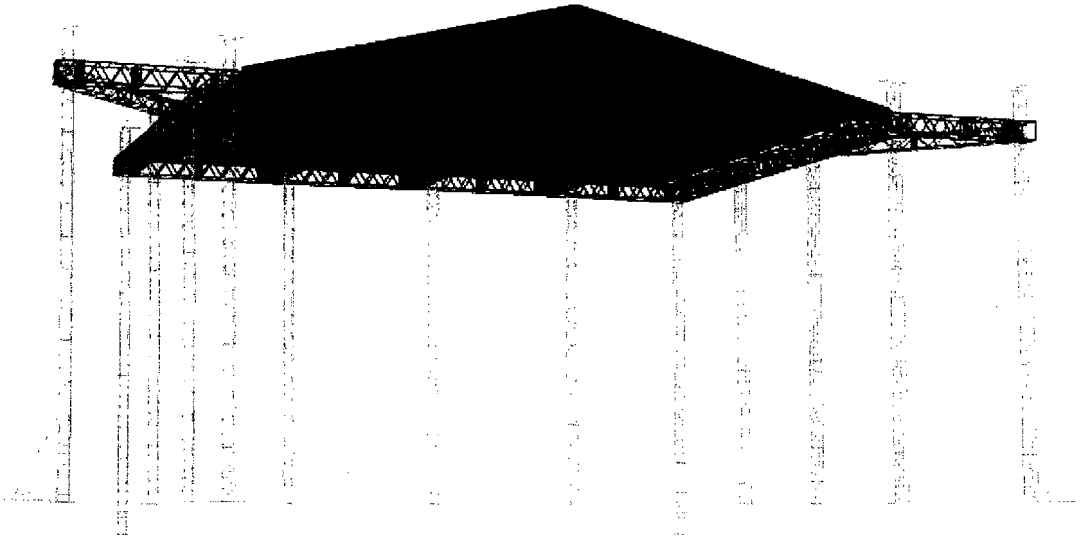
[redacted]



TDS, Inc.

3-Dimensional Point Cloud

Millions of Measured Points



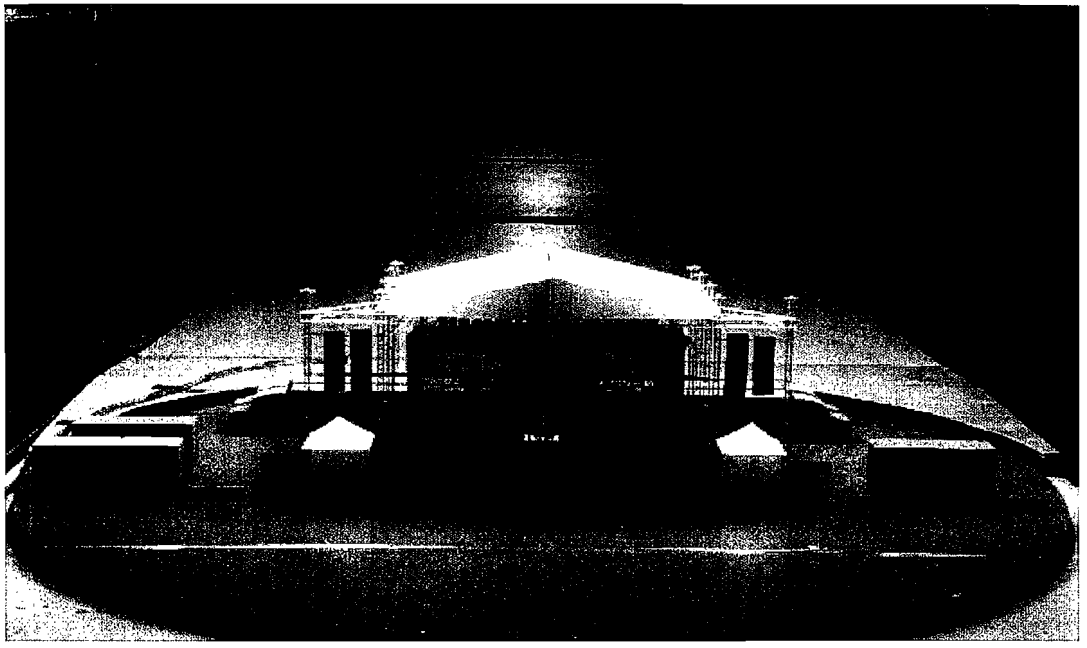
Finite Element Analysis

Site measurements

Catalog data

Reverse engineering of structure

"Reasonable Engineer" Study



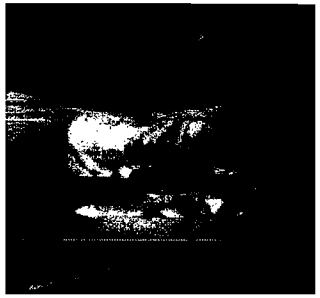
RWDI:

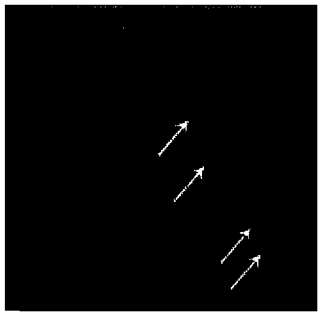
Review of weather data

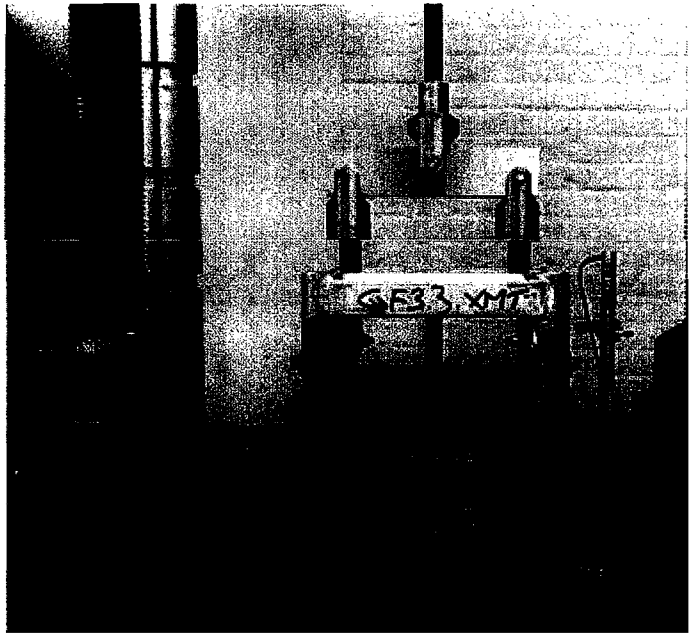
Wind analysis and modeling

Wind Tunnel Force Balance Tests

Determination of wind speeds at site







Lucius Pitkin, Inc.:

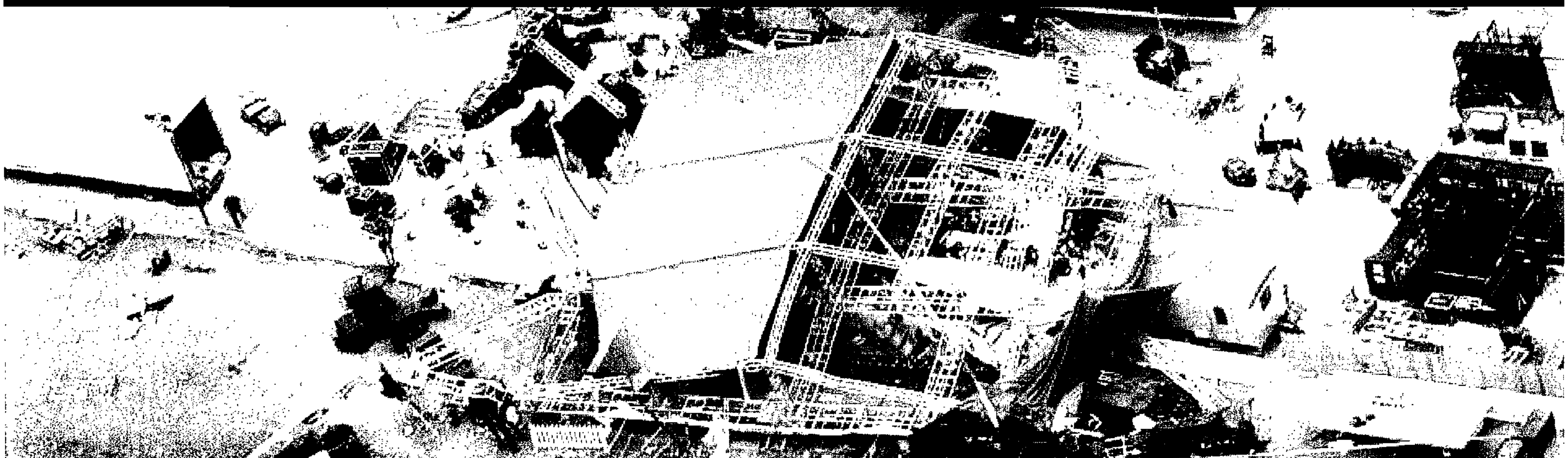
Physical testing

Microscopy

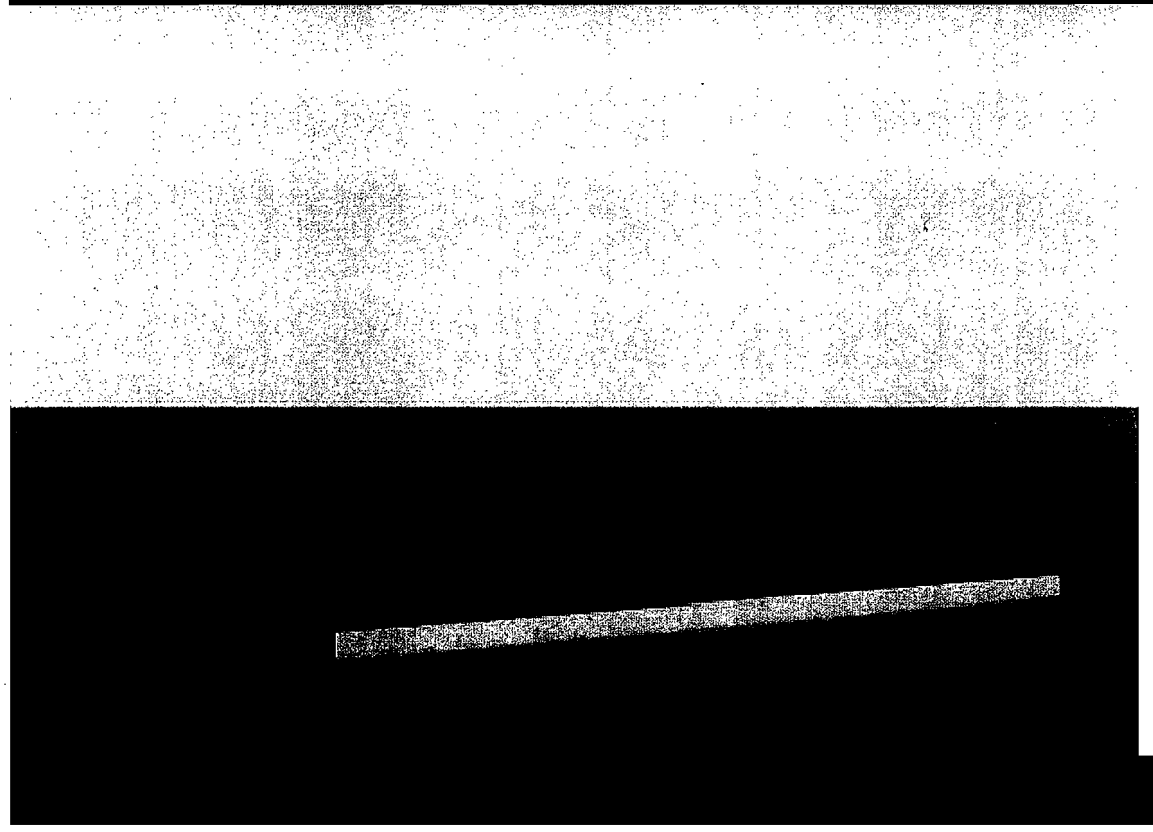
Alloy and filler metal identification

Components of the ISF Structure

Thornton



Components of the ISF Structure

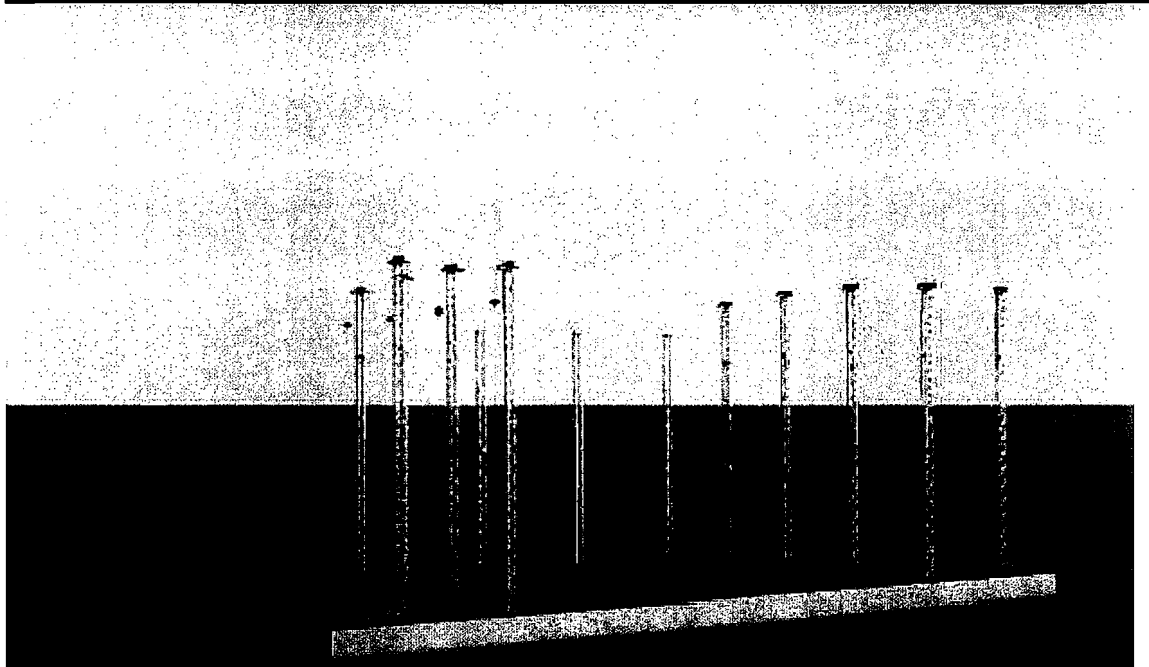


The Stage

Reinforced Concrete

Below-grade rooms

Components of the ISF Structure

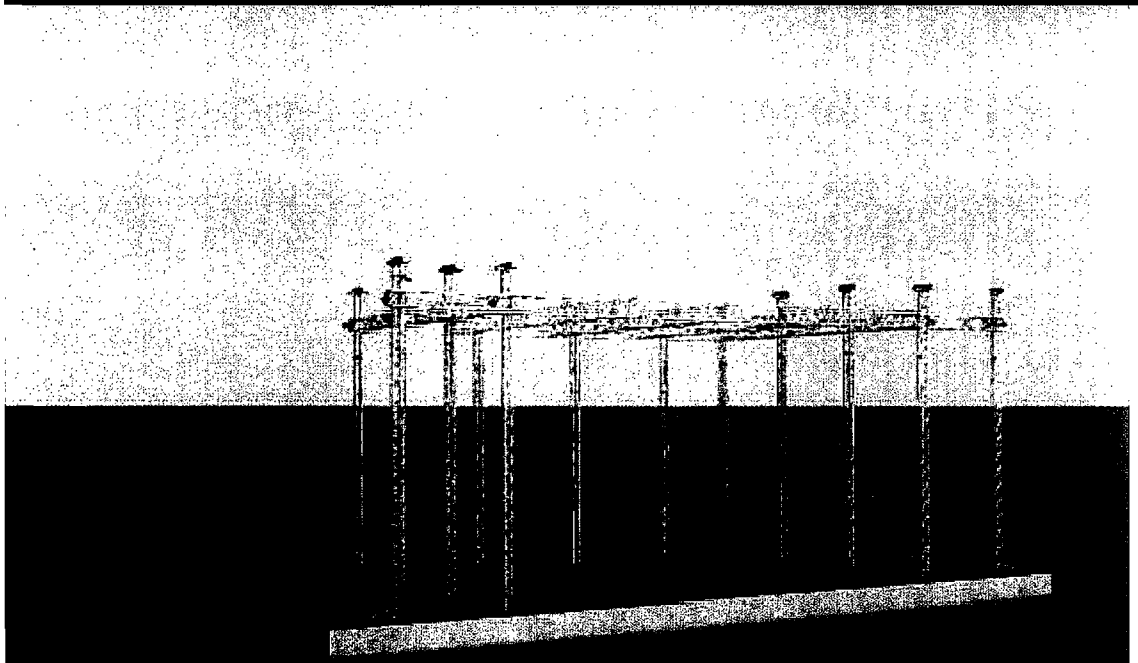


Columns:

10 Primary

3 Supplemental

Components of the ISF Structure



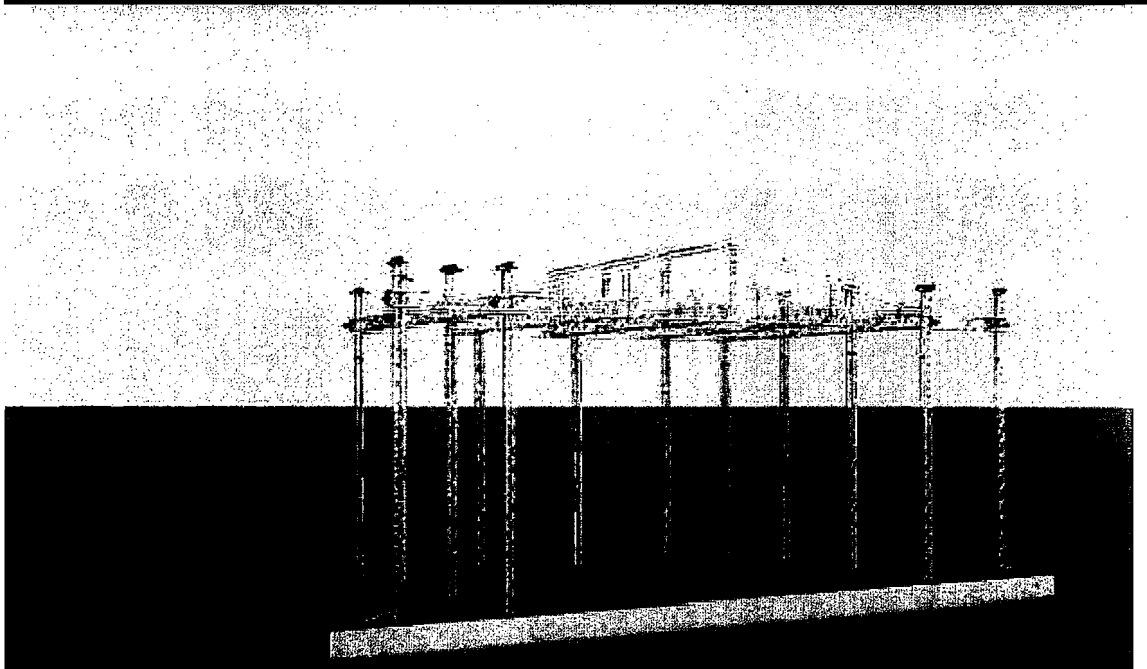
Main Trusses:

2'-6" x 2'-2" box trusses

8' length modules

Includes connective 'Nodes'

Components of the ISF Structure



Gable Roof:

Rafter Trusses

Gable Web Trusses

Ridge Trusses

Components of the ISF Structure

Purlin Trusses

14 Trusses

Lashed to Main Trusses

15" and 20.5" Square

10' Length

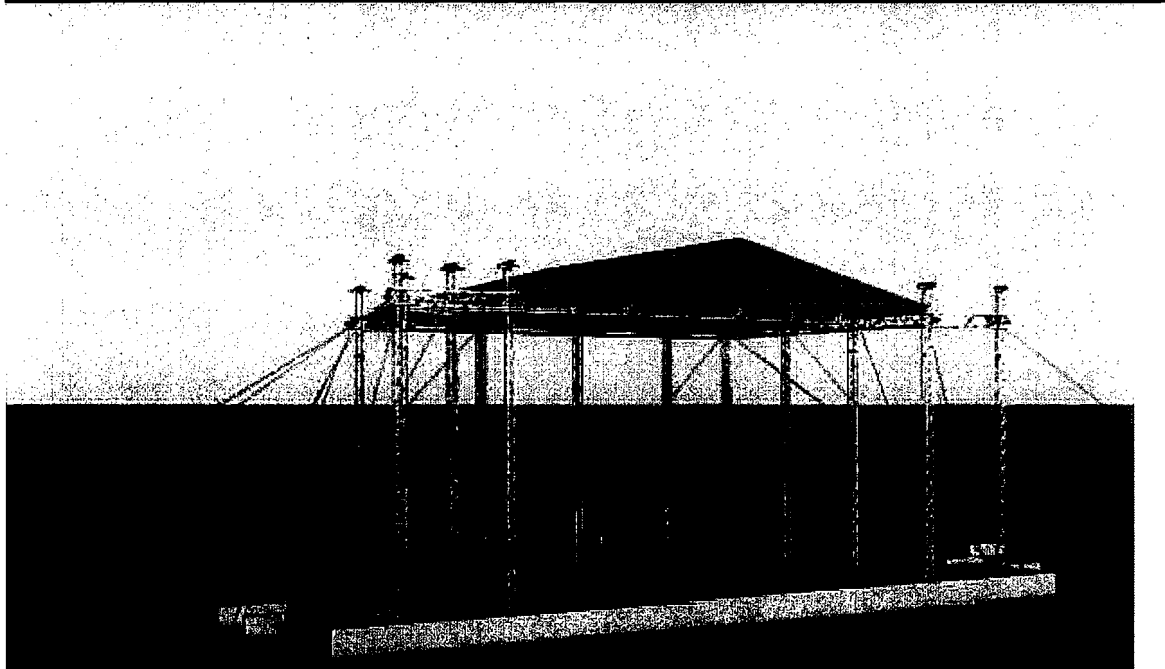
Components of the ISF Structure

Tarp/Membrane:

3 sections:

Connected at Perimeter

Components of the ISF Structure



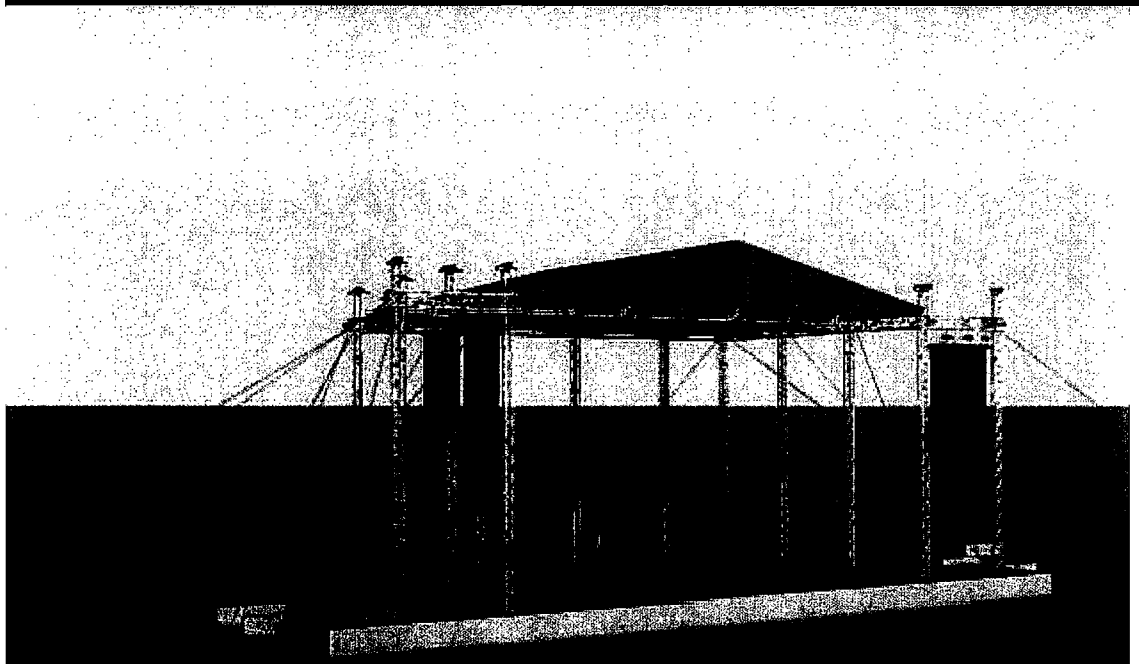
Guy Lines/Ballast:

10 Jersey Barriers

14 Guy Lines

- Wire Rope
- Ratchet Straps

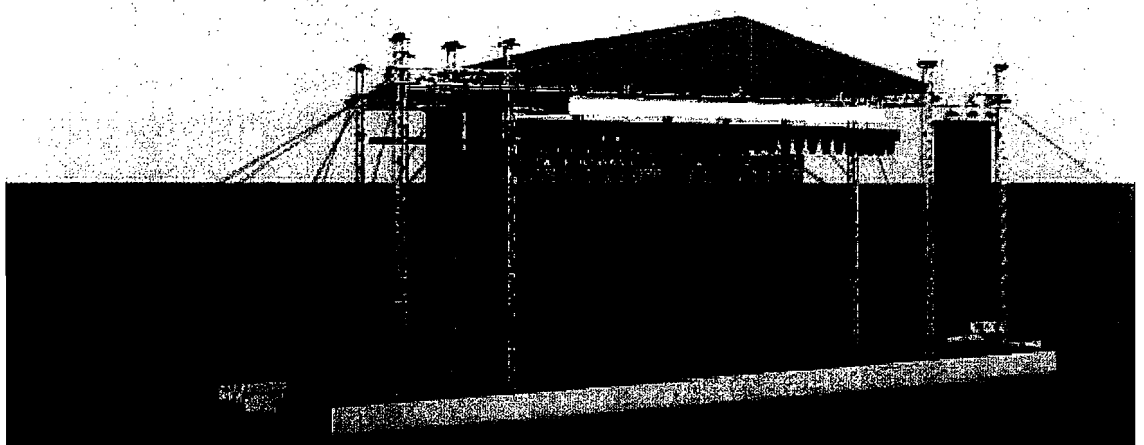
Components of the ISF Structure



PA Wings:

4 Banks of Speakers

Components of the ISF Structure

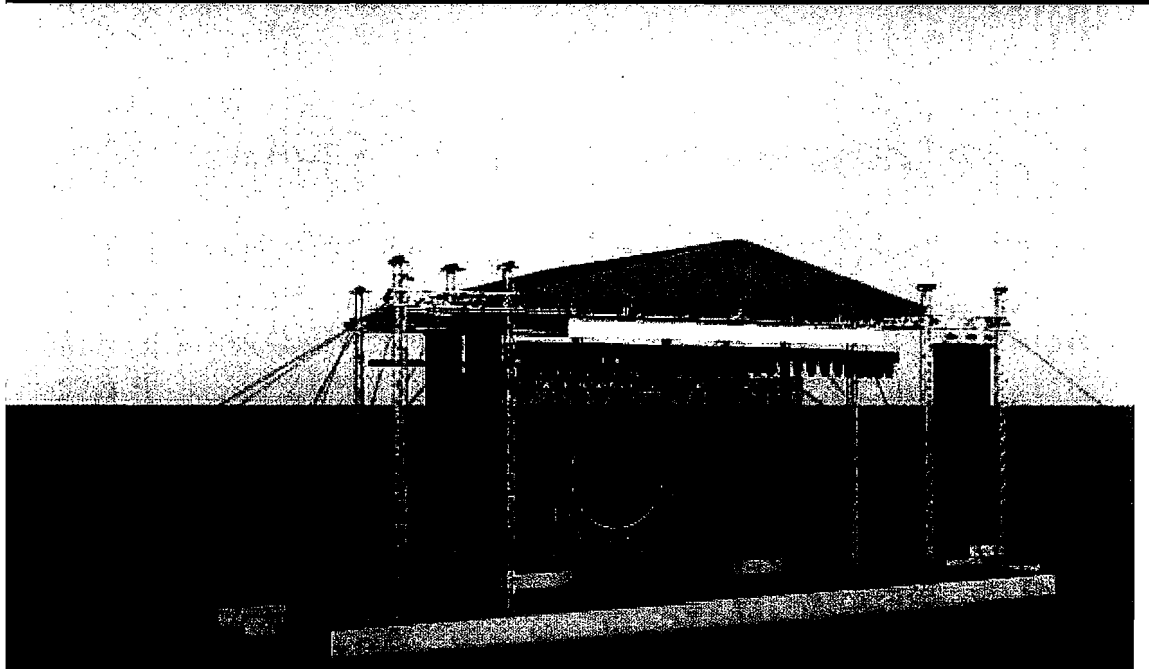


Entertainment Technology Equipment:

Sugarland Set:

- 6 Lighting Trusses
- LED Scrim

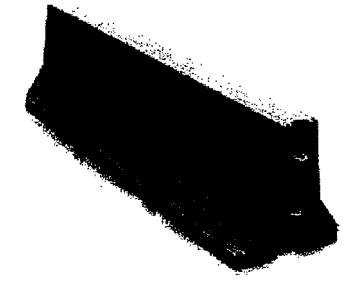
Components of the ISF Structure

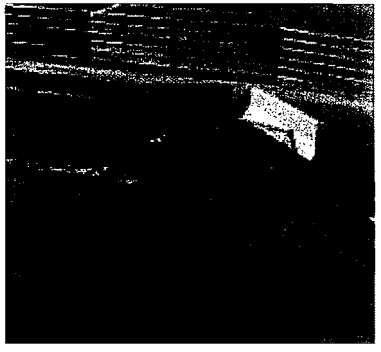


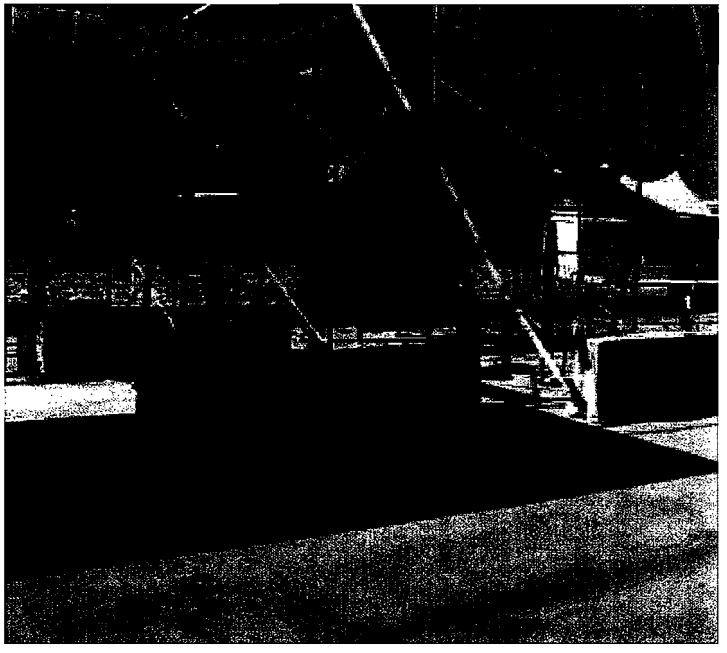
Entertainment Technology Equipment:

Sugarland Set:

- 6 Lighting Trusses
- LED Screen
- LED Scrim
- Chandeliers
- Vertical Trusses





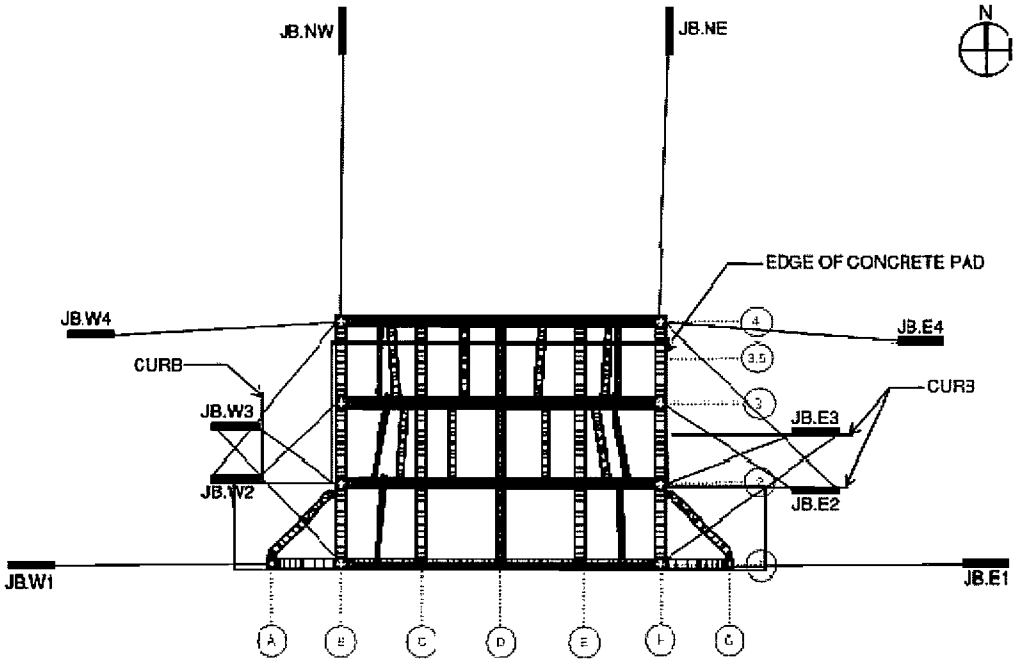


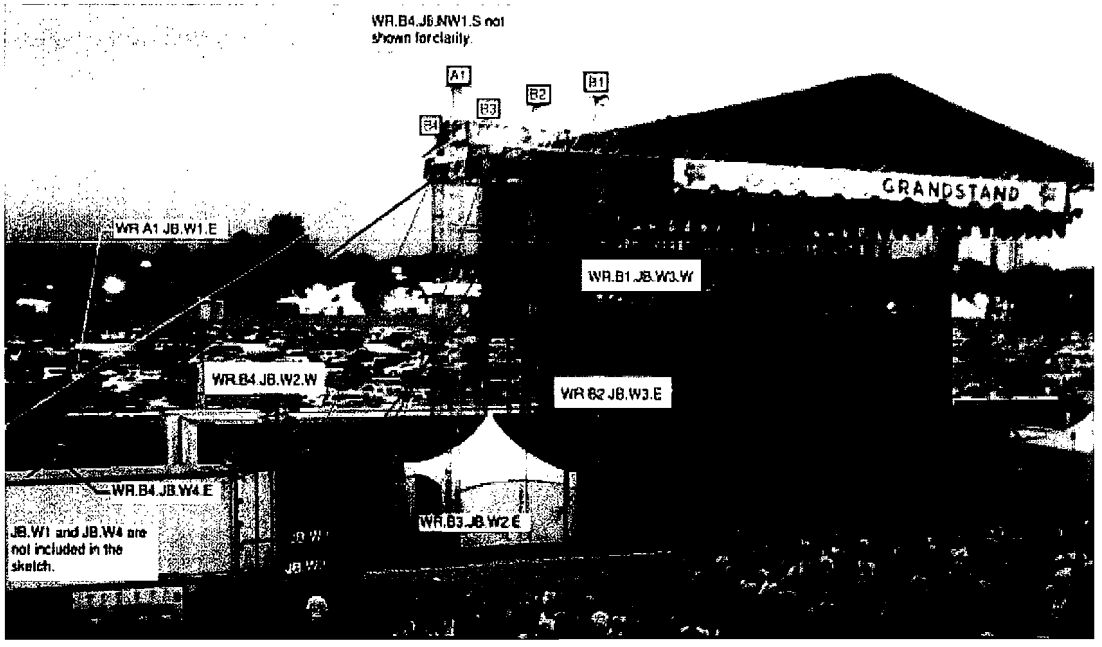
Jersey Barriers (K-Rails):

Reinforced Concrete

4100 – 4300 pounds

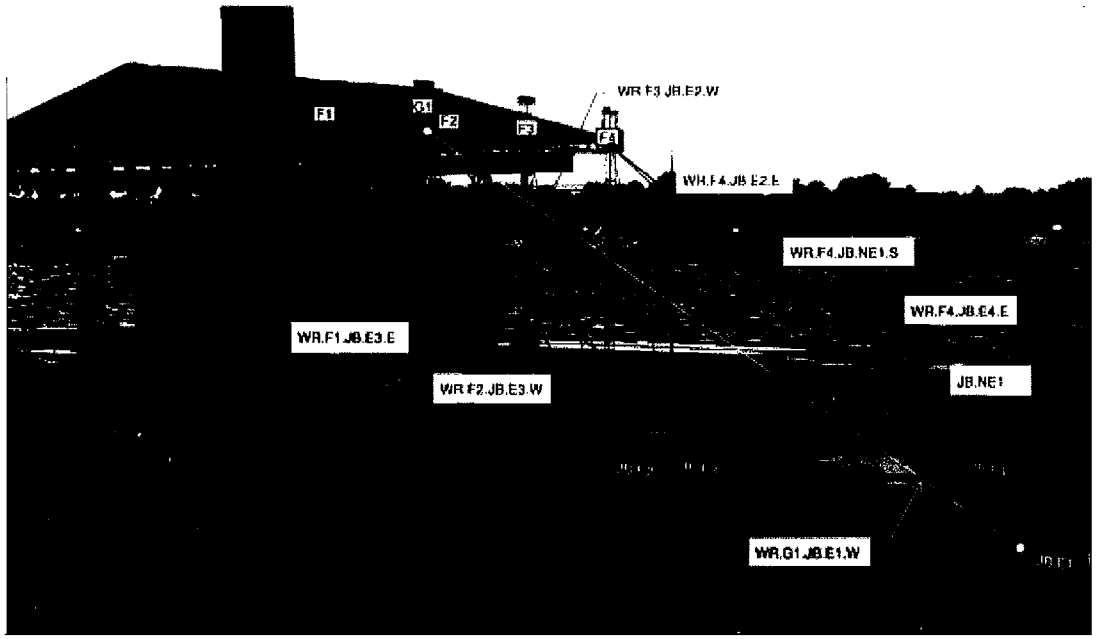
Jersey Barriers – Plan View





Jersey Barriers – West:

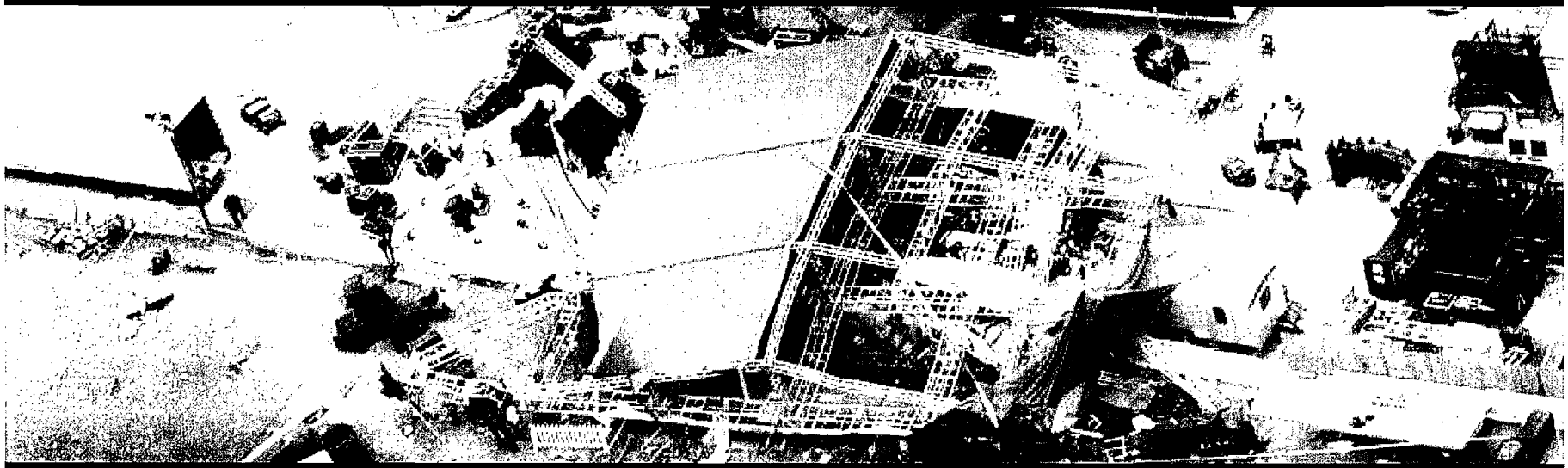
4 Barriers

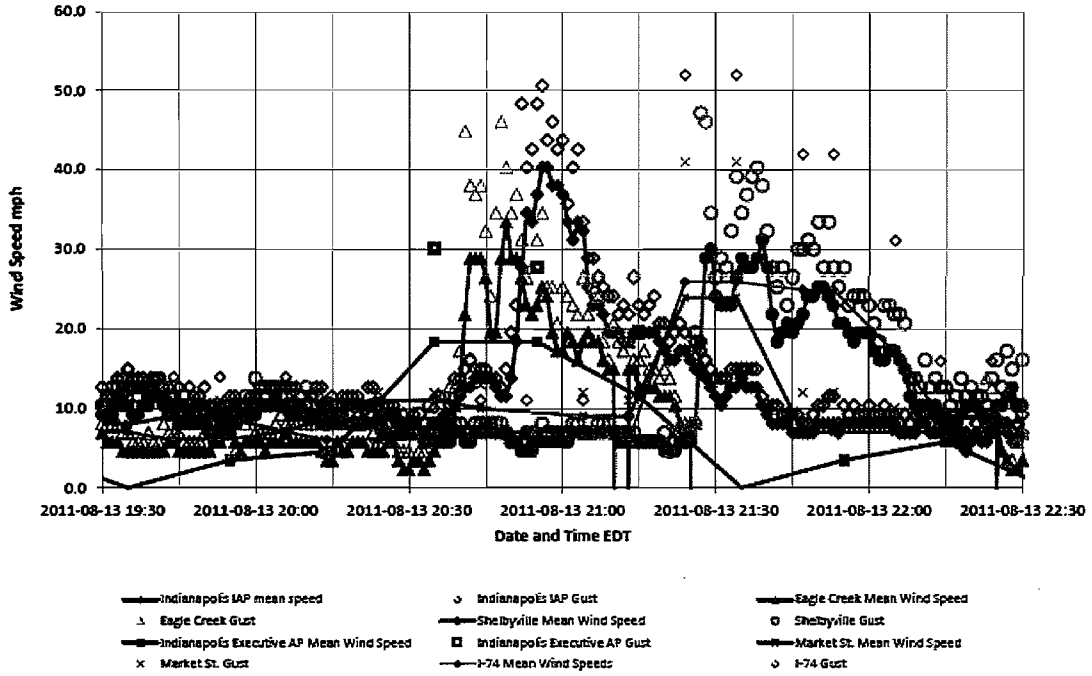


Jersey Barriers – East:

4 Barriers

Analysis

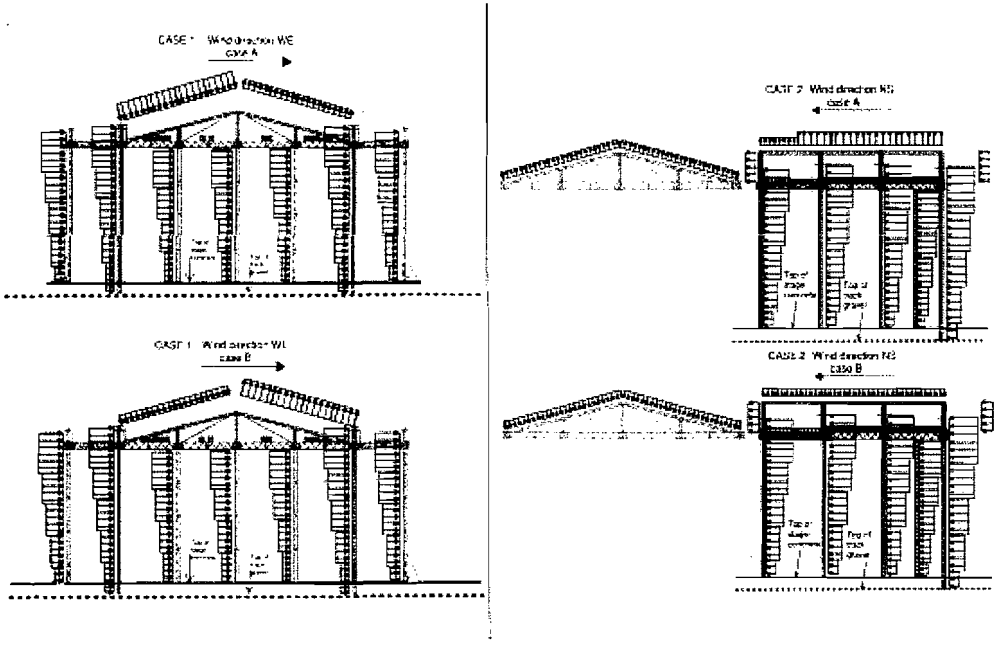




Maximum Gusts:

- > 51 mph
- > 46 mph
- > 30 mph
- > 47 mph
- > 41 mph
- > 52 mph

Data review and analysis for local conditions: 59 mile per hour gust



Wind Loading:

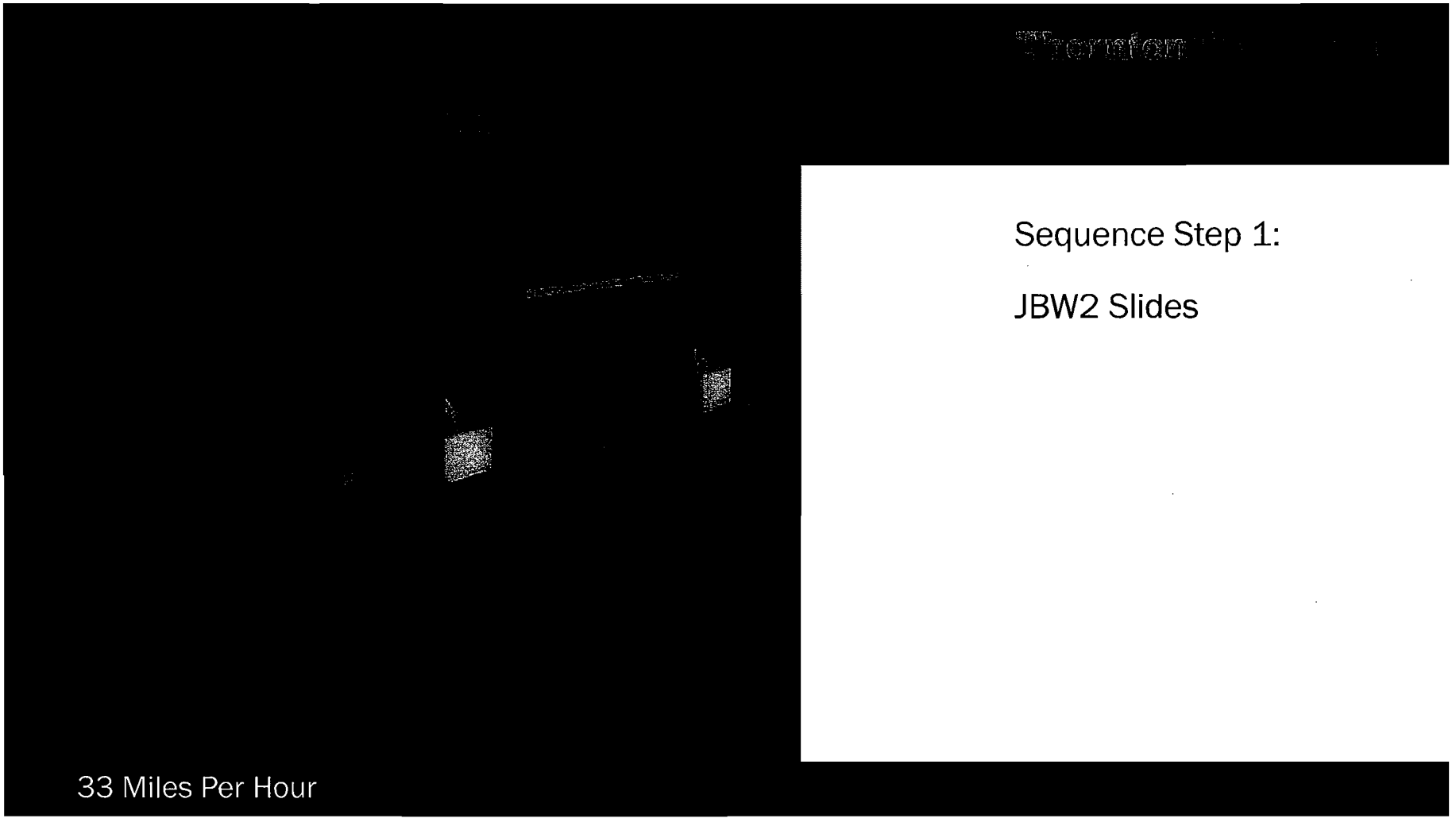
West Wind Case

North Wind Case

NW Wind Case

ISF Structure as Erected

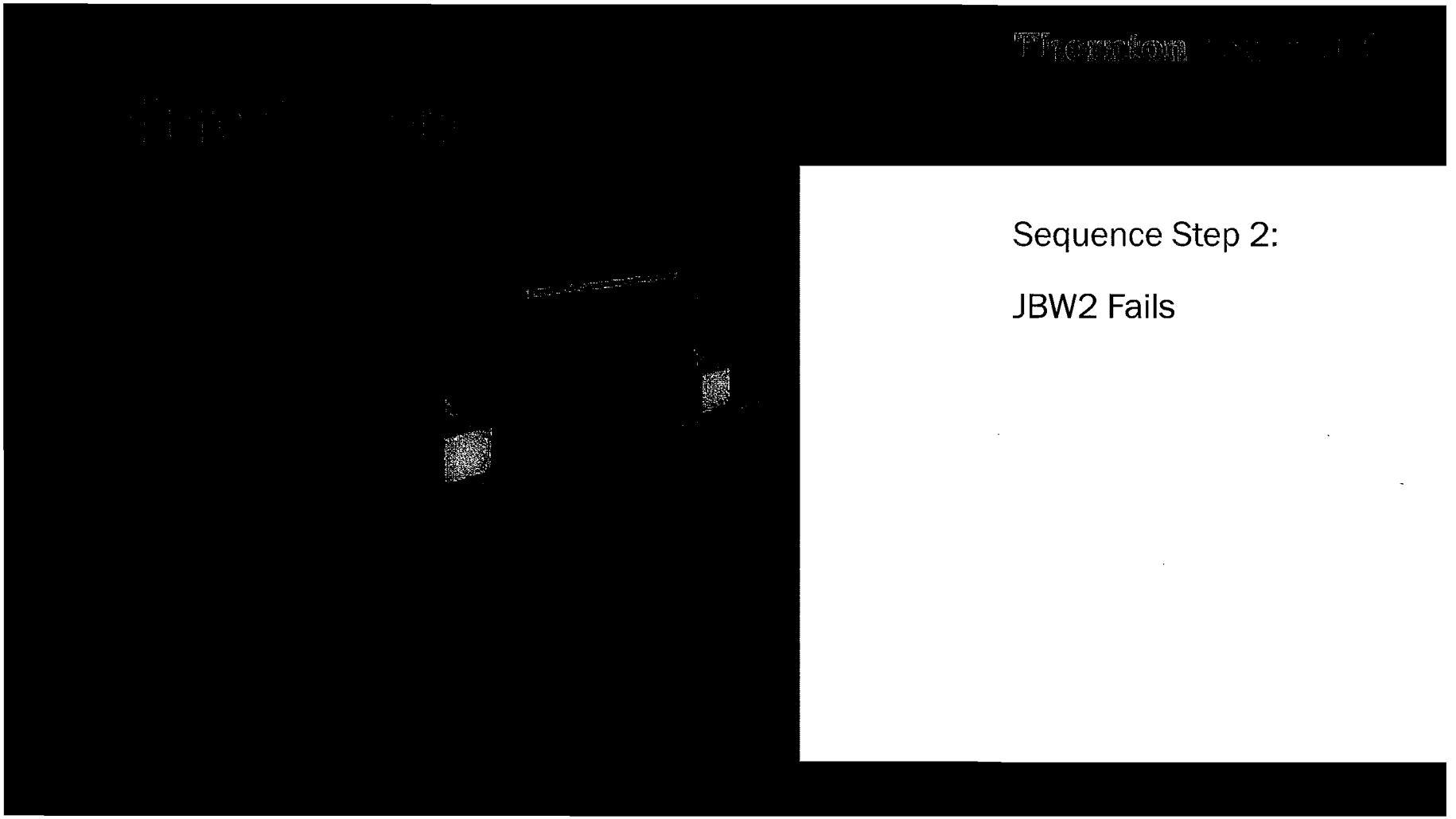
Note: Displacements exaggerated for visual clarity

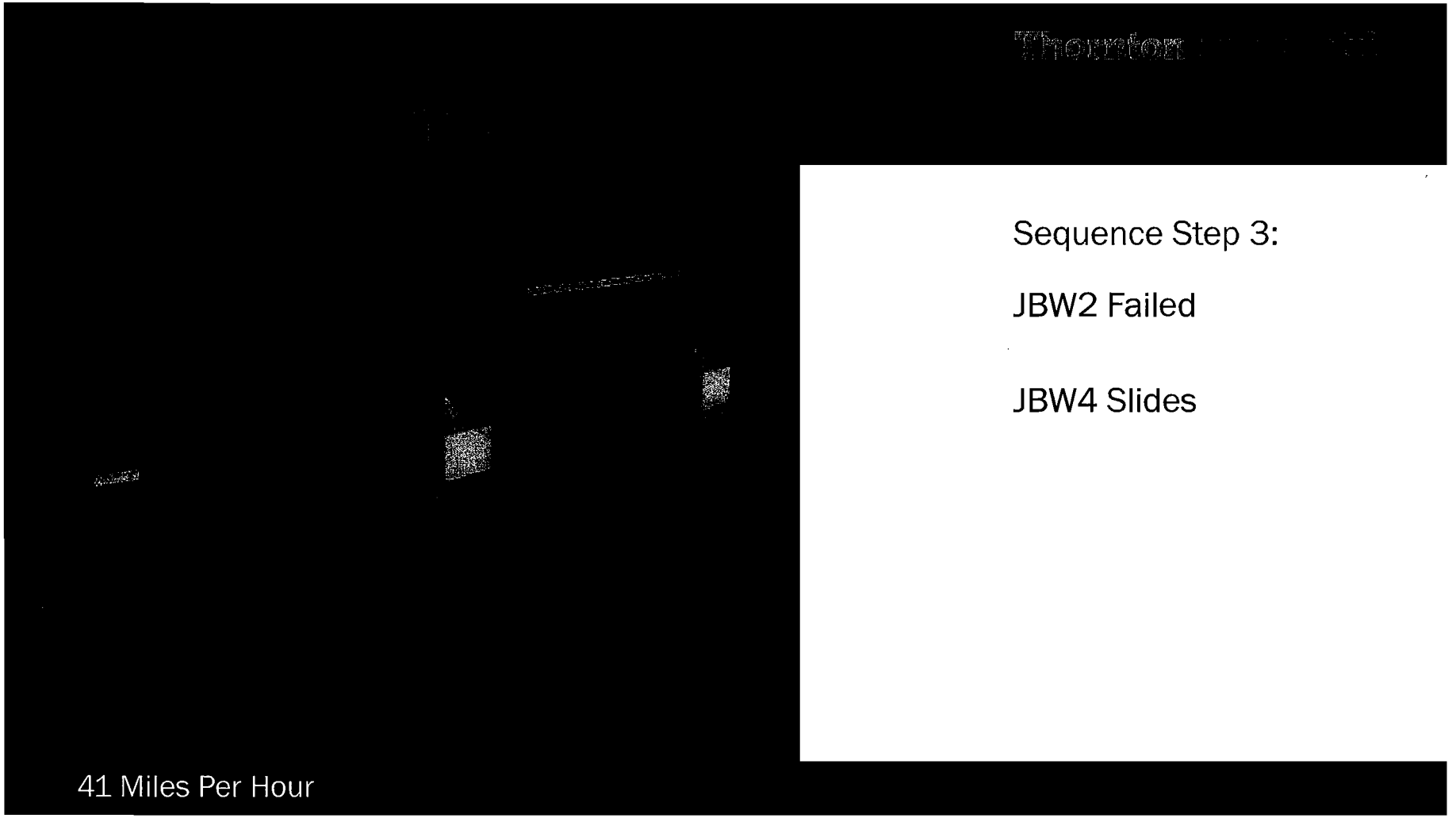


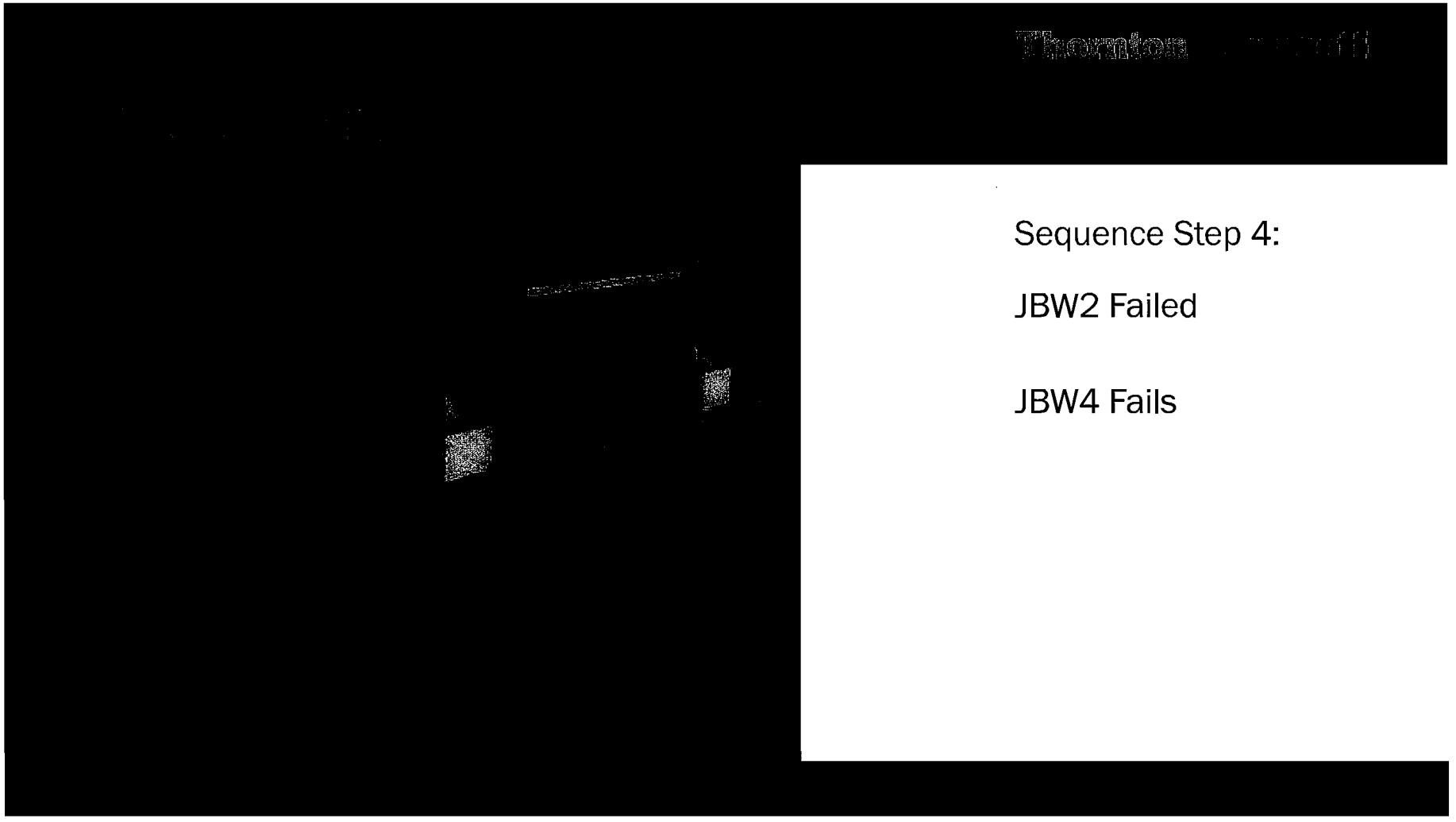
Sequence Step 1:

JBW2 Slides

33 Miles Per Hour


Thermion
Sequence Step 2:
JBW2 Fails


Thornton
Sequence Step 3:
JBW2 Failed
JBW4 Slides
41 Miles Per Hour



Sequence Step 4:

JBW2 Failed

JBW4 Fails

Sequence Step 5:

JBW2 Failed

JBW4 Failed

JBW3 Slides

43 Miles Per Hour

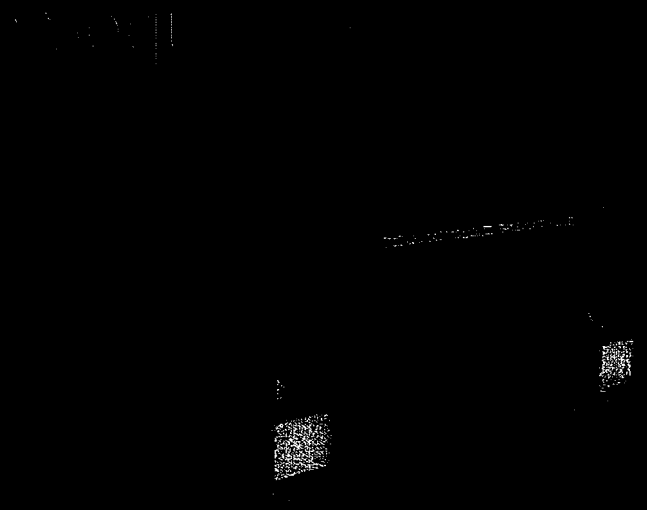
Sequence Step 6:

JBW2 Failed

JBW4 Failed

JBW3 Fails

Thornton



Sequence Step 7:

JBW2 Failed

JBW4 Failed

JBW3 Failed

JBW1 Fails

43 Miles Per Hour

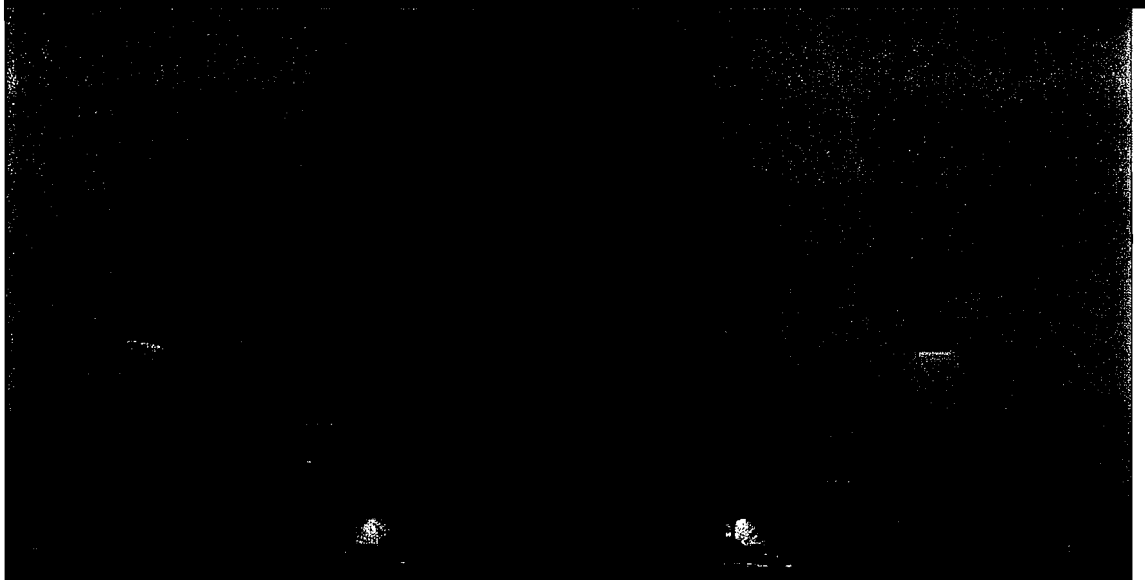
[redacted]

Subsequent Failure as a Result of Second Order Effects (P-Delta)

Failure Sequence

ISF Structure as Erected

Failure Sequence



33 Miles Per Hour

Sequence Step 1:

JBW2 Slides

Failure Sequence

Sequence Step 2:

JBW2 Fails

Failure Sequence

41 Miles Per Hour

Sequence Step 3:

JBW2 Failed

JBW4 Slides

Thornton

Failure Sequence

Sequence Step 4:

JBW2 Failed

JBW4 Fails

Thornton Tomasetti

Failure Sequence

Sequence Step 5:

JBW2 Failed

JBW4 Failed

JBW3 Slides

43 Miles Per Hour

Failure Sequence

Sequence Step 6:

JBW2 Failed

JBW4 Failed

JBW3 Fails

Failure Sequence

43 Miles Per Hour

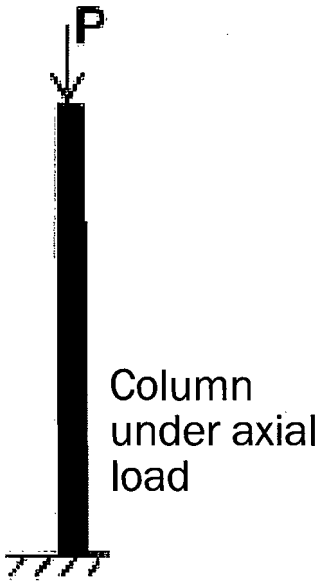
Sequence Step 7:

JBW2 Failed

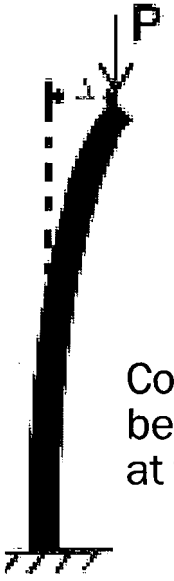
JBW4 Failed

JBW3 Failed

JBW1 Fails



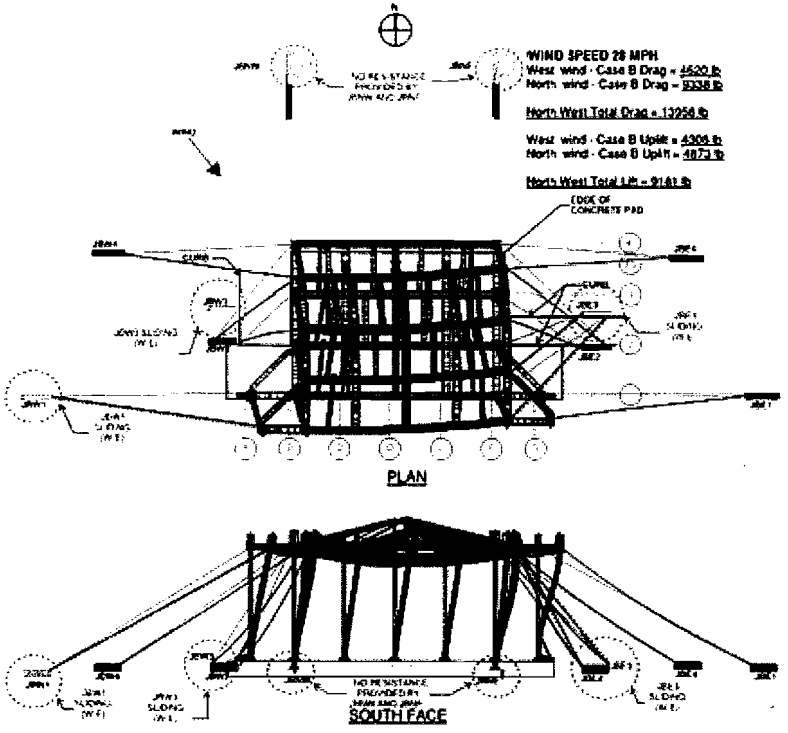
Column under axial load



Column under axial load with bending due to displacement at top of column

P-Δ (Delta) Effects:

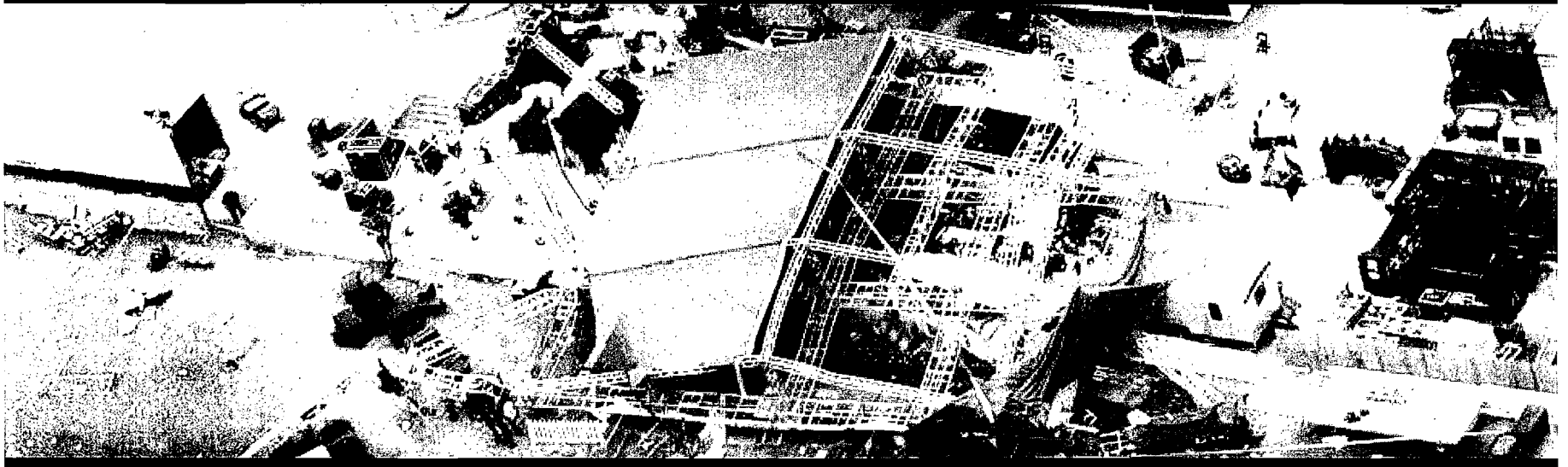
After a defined displacement, the Structure retains no ability to self-support.



Failure Sequence:

SAP 2000 output
Full Displacements

Key Findings



Finding #1:

> The ISF Structure failure was due to the inadequate capacity of the lateral load resisting system, which was comprised of guy lines connected to concrete "Jersey barrier" ballast.

Finding #2:

> The ISF Structure was shown to fail at wind speeds lower than those specified under even the most liberal provisions of applicable building codes and reference standards.

Finding #3:

> Based on testing and calculation, it was determined the lateral load resisting system of the ISF Structure as rigged on August 13, 2011 was capable of resisting winds speeds ranging from 25 miles per hour to 43 miles per hour (depending on wind direction).

With LED Scrim / LED Screen:	Without LED Scrim / LED Screen:
North: 25 mph	North: 38 mph
Northwest: 28 mph	Northwest : 40 mph
West: 43 mph	West: 53 mph

Note: Winds speeds are at ultimate capacity, not *initial* failure of an element

Finding #4:

> Calculations and in-situ physical testing determined the Jersey barrier ballast system had grossly inadequate capacity to resist both the minimum code-specified wind speed and the actual wind speed that was present at the time of the failure.

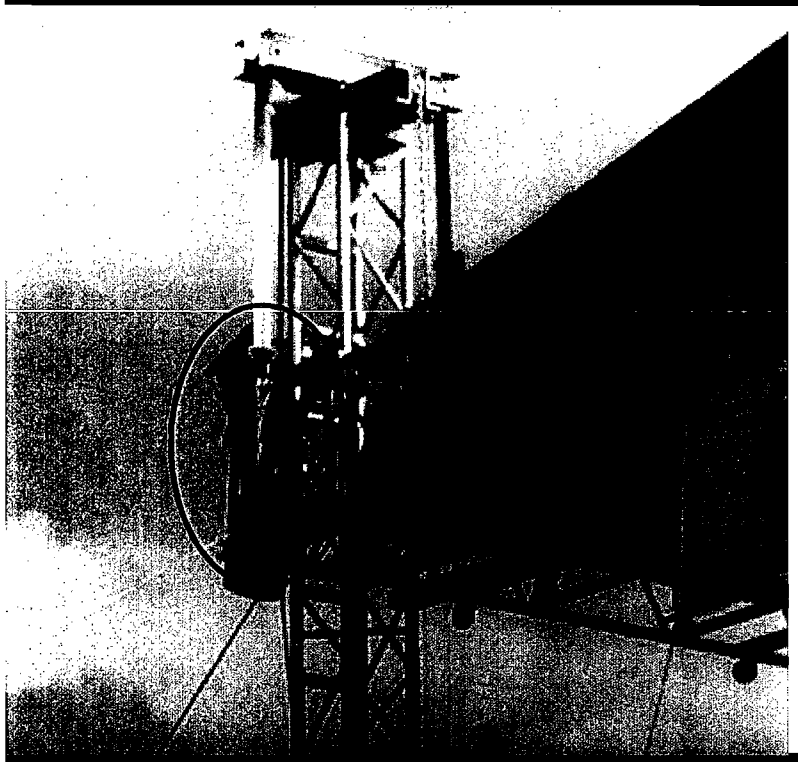
- Full code wind speed (ASCE 7): 90 miles per hour
- Temporary Structure Reduction (ASCE 37): 68 miles per hour
- August 13, 2011 Wind Speed: 59 miles per hour

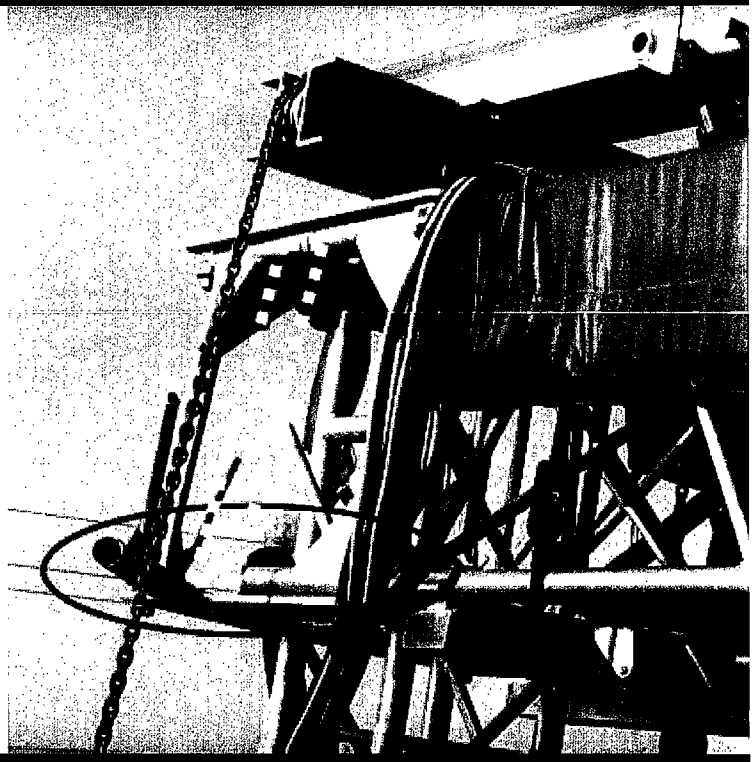
Finding #6:

> Even if the ballast system and guy line system had provided sufficient strength to resist the wind loads, the "fin plate" connections to the structure did not have sufficient strength to resist forces resulting from the North, West and Northwest wind cases under the wind loads of August 13, 2011 that were of a smaller magnitude than the code-specified requirements.

Finding #6:

Inadequate Structure Connection Capacity





Finding #5:

> Even if the ballast system had provided sufficient resistance, the synthetic webbing ratchet straps and wire rope guy lines used did not have sufficient strength to resist forces resulting from the North wind case under the wind loads of August 13, 2011 that were of a smaller magnitude than the code-specified requirements.

- At 59 mph:
  - Wire Rope Capacity (13,000 lbs ultimate) exceeded at F4, B4 @ 92%
  - Ratchet Strap Capacity (10,000 lbs ultimate) exceeded at F4, B4
  - For NW wind ratchet strap capacity at F4 exceeded.
  - Note, all values are below the "allowable" capacity of components

Finding #5:

Inadequate Guy Line Capacity

Finding #5:

Inadequate Gas Line Capacity

Thornton

Finding #6:

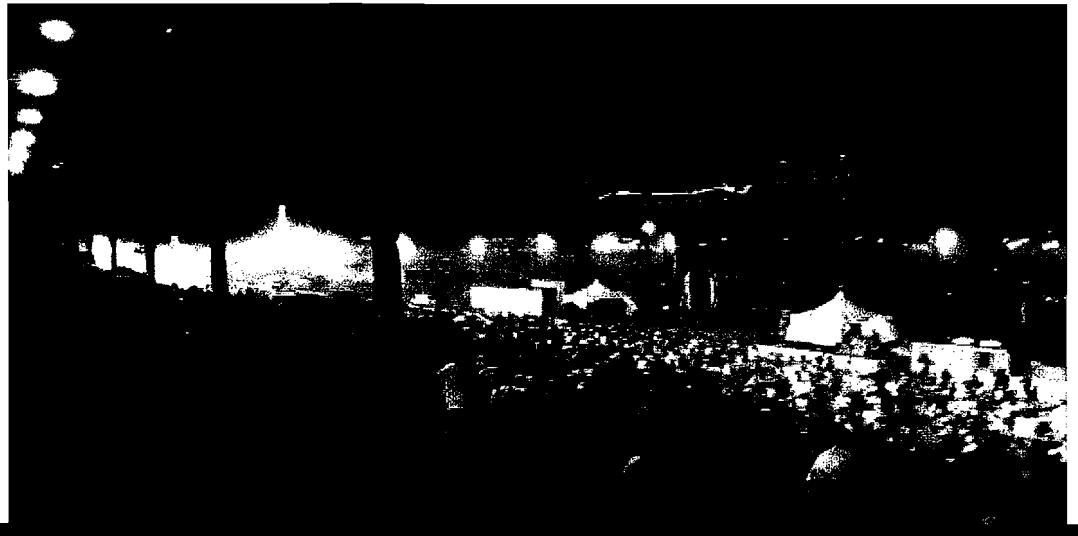
> Even if the ballast system and guy line system had provided sufficient strength to resist the wind loads, the "fin plate" connections to the structure did not have sufficient strength...

Load Case	Node	DCR	Node	DCR	Node	DCR	Node	DCR
North Case A	F2	1.53	B4-N	1.23	F4-N	1.66		
North Case B	B2	1.15	F2	1.7	B4-N	1.31	F4-N	1.81
West Case A	B4-W	2.66	B3	1.23	B2	1.02		
West Case B	B4-W	2.5	B3	1.13				
Northwest Case A	B4 -W	2.57	B2	1.5	B4 -N	2.25	F4-N	3.28
Northwest Case B	B4 -W	2.47	B2	1.22	B4-N	2.15	F4-N	3.14

Table 2: Demand-capacity ratios (DCR) of fin plates under 59 mph wind load cases

Finding #7:

> The ISF Structure was shown to fail at the August 13, 2011 wind speed without the addition of loading caused by the roof tarp displacement.



Finding #8:

> Timing of the roof tarp ridge panel release would not have had an effect on maintaining stability of the ISF Structure.

Finding #9:

> The technical information presented in the James Thomas Engineering catalog is insufficient to adequately design a structure such as the ISF Structure, yet there is no explicit direction to engage the services of a licensed design professional to analyze complex loading configurations or conditions.

Finding #10:

> Structural analysis performed by James Thomas Engineering's structural engineer falls short of adequately addressing the actual loading conditions of the Sugarland set and suspended entertainment technology equipment for the 2010 show (for which the structure was analyzed) or the code-defined environmental loading conditions to which the ISF Structure could be subjected.

- No review of wind load on LED scrim or LED screen.
- Improper use of code provisions for Pressure Coefficients, Uplift.
- No defined load path for lateral system (ballast or ground anchor).
- Unrealistic contingency plans (lowering of grid).

Finding #11:

> There is no evidence of an engineering review of the "2011 Sugarland Rigging Plot" by a licensed design professional prior to August 13, 2011.

Finding #12:

> Regardless of the inadequacy of the directions of James Thomas Engineering's structural engineer, Mid America Sound Corporation's installation of the ISF Structure deviated from the directions provided in the calculations performed by that structural engineer with regard to the lateral load resisting system.

- ½" Diameter Wire Rope Guy Lines
- Braced at 4 corners, at 45 degrees in plan
- Supplemental Columns – various configurations

Finding #13:

> Mid America Sound Corporation's configuration and erection of the ISF Structure did not include a review by a licensed design professional to determine the capacities or limitations of the ISF Structure.

Finding #14:

> The current interpretation of governing code language in the State of Indiana waives requirements for the appropriate design, review, permitting or inspection of structures such as the ISF Structure, despite the fact that these are highly complex constructions erected in the vicinity of high population densities.

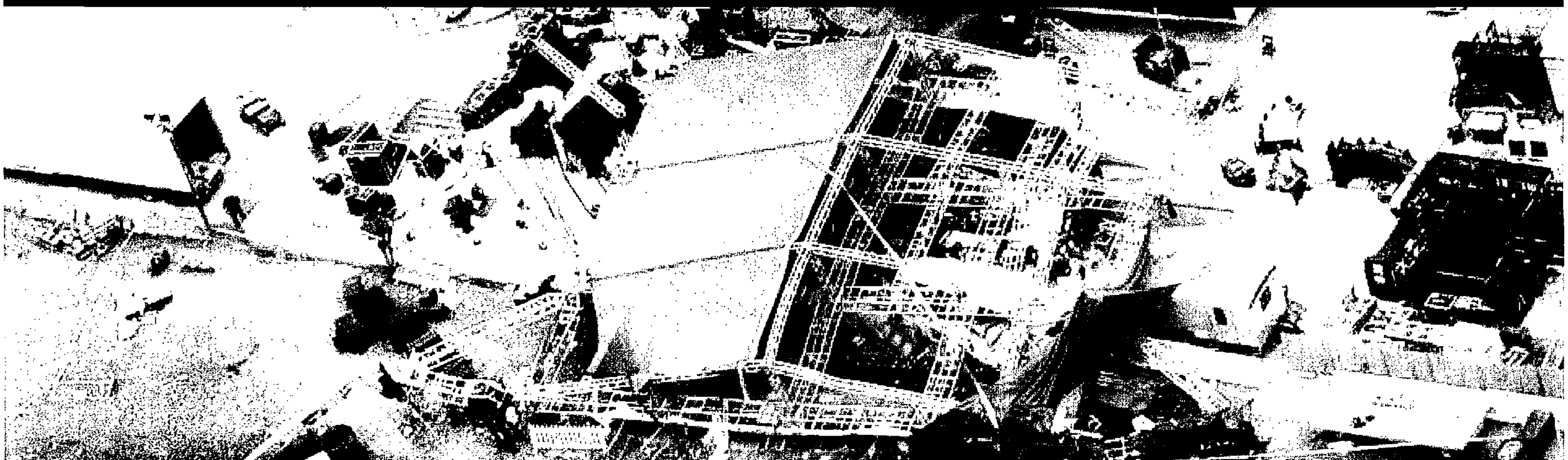
Finding #15:

> The Indiana State Fair Commission staff has no records, documentation, plans, engineering reports or related technical data regarding the ISF Structure that is erected at the Fairgrounds on an annual basis.

Finding #16:

> The Indiana State Fair Commission staff does not have knowledge regarding the wind limitations of the ISF Structure sufficient to establish an appropriate risk mitigation plan for the Grandstand Stage site.

Key Recommendations



Recommendation #1:

> Entertainment structures should be designed by a licensed design professional with experience in the design and evaluation of temporary entertainment structures with complex loading configurations. Analysis should be performed for the engineered structure and for the establishment of highly specific rigging rules and limitations for its use. For productions that do not conform to the resulting "pre-approved" rigging configurations, a separate engineering analysis should be performed.

Recommendation #2a:

> The design referenced above should be subject to all code and permitting requirements of Class 1 structures...

IC 22-12-1-4
"Class 1 structure"

Sec. 4. (a) "Class 1 structure" means any part of the following:

(1) A building or structure that is intended to be or is occupied or otherwise used in any part by any of the following:

(A) The public.

(B) Three (3) or more tenants.

(C) One (1) or more persons who act as the employees of another.

Recommendation #2b:

> ...in addition to a third-party peer review if the authority having jurisdiction (AHJ) does not have adequate capability to perform the plan review...

Recommendation #2c:

> ...This review should be performed for the engineered structure and for the established rigging rules and limitations for its use. For productions that do not conform to the "pre-approved" rigging configurations, a separate review should be performed.

Recommendation #3:

- A Special Inspection of the completed structure should be completed by an independent licensed design professional with experience in the design and/or evaluation of temporary structures.

Recommendation #4:

- Operational controls implemented or considered in the design and use of entertainment structures should reflect the complexity of modern productions, including the limited ability to rapidly reduce loads by removing the suspended entertainment technology used in these productions. Systems should be designed for the appropriate code-prescribed wind speeds, and operational contingency plans should also be developed to address extreme events such as high winds.

Recommendation #5:

- Environmental and site-specific loading conditions should be analyzed for the specific structure to be erected and the suspended entertainment technology equipment to be suspended.
  - Based on the full details of proposed Entertainment Technology Eqpt.
  - Based on the restrictions of the site (anchor locations, obstructions, etc.)

Recommendation #6:

- Structure Class and Occupancy classifications of entertainment structures should be based on both the risk and hazards associated with their failure and on their cumulative exposure to risk from wind loads and varying rigging loads, rather than their exposure in an individual season of use.
  - •Balance of statistical risk of recurrence intervals and actual time
  - •Occupancy based on number of persons adjacent to structure, not just those that are 'within' the structure.

Recommendation #7:

> Modifications to model codes and reference standards should not alter the intent of the original code language with regard to life-safety, nor should local amendments partially delete model provisions that are not properly addressed elsewhere in those local amendments.

BUILDING CODES

*Indicates those counties with extreme variation and shall require investigation by the design professional, or owner when a design professional is not required, to determine the actual minimum ground snow load at each site; however, the determined minimum snow load (p_g) shall be at least thirty (30) pounds per square foot. Ground snow load determination for such counties shall be based on an extreme value statistical analysis of data available in the vicinity of the site using a value with a two percent annual probability of being exceeded (50-year mean recurrence interval).
3. Foundation is the minimum foundation depth to bottom of footing from the top of the grade above the footing in inches.

(8) Amend Section 1609.1.1, Determination of wind loads, by deleting the text and substituting to read as follows: Wind loads on every building or structure shall be determined in accordance with Table 1608.2.

(9) Delete Section 1609.1.2, Protection of openings, without substitution.

675 IAC 13-2.5-17: Note 8 deletes Section 1609.1.1 of IBC-2006

Recommendation #8:

> Guy line anchor systems for entertainment structures should utilize fixed, mechanical anchors whenever possible.

Recommendation #9:

> The entertainment industry would benefit from the development of comprehensive engineering-based documents related to the design, construction and use of entertainment structures.

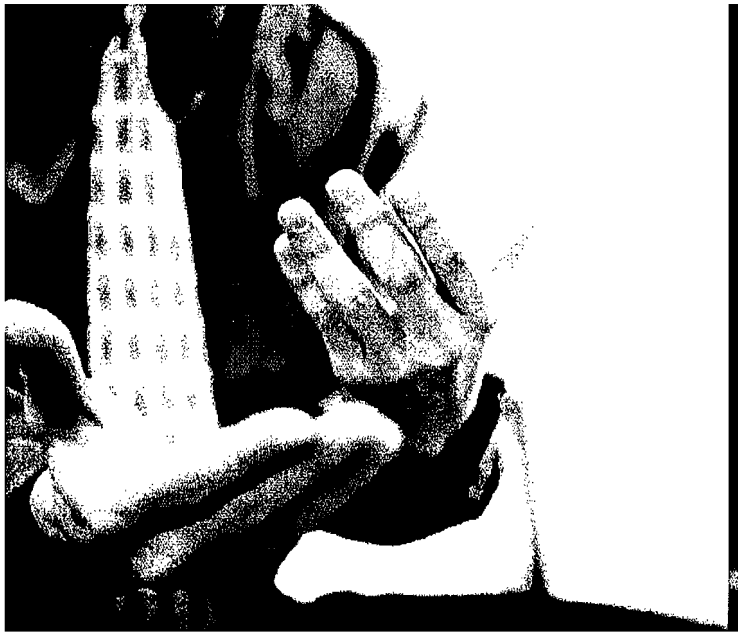
IStructE : Temporary demountable structures. Guidance on procurement, design and use. 3rd Ed.

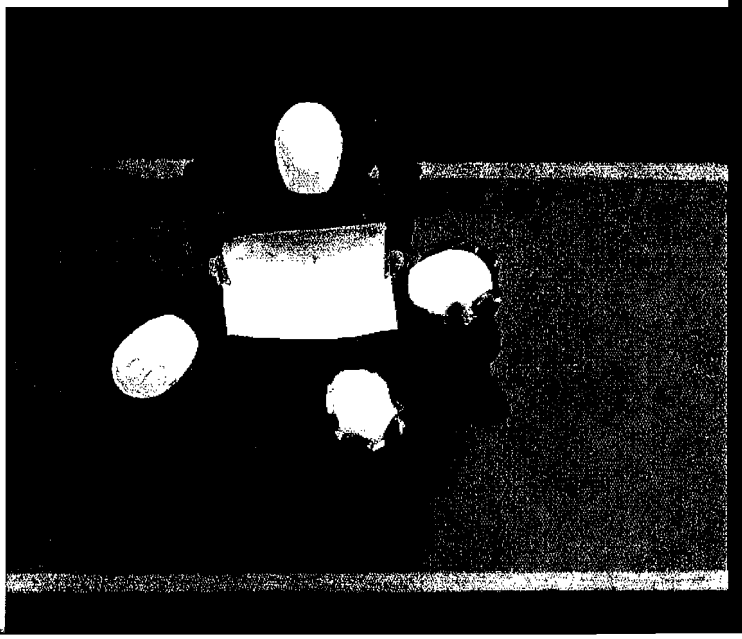
Thornton

www.ThorntonTomasetti.com

Thornton Tomasetti
330 North Wabash Avenue
Suite 1500
Chicago, IL 60611
312.596.2000

MITIGATION | PREPAREDNESS | RESPONSE | RECOVERY | STRATEGIC ADVICE





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Charlie Fisher, Vice President
Anne von Weller, Building Code Specialist
Testimony Before Indiana Outdoor Stage Equipment Safety Committee

Indianapolis

September 5, 2012

EXHIBIT 2
SEPTEMBER 5, 2012
OUTDOOR STAGE EQUIPMENT SAFETY COMMITTEE

Indiana State Fair Commission
Actions taken since April

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- Accepted recommendations from report
- Retained Witt Associates to oversee implementation of recommendations
- Created new Chief Operating Officer position
- Filled COO position with David Shaw
- Filled Public Safety position with Jessie Olvera

Indiana State Fair Commission
Actions taken since April

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- **Developed with public safety partners, and implemented, a new Comprehensive Emergency Management Plan (CEMP)**
  - Spells out protocols for decisions including whether to delay, postpone or cancel a show
  - Clarifies one individual responsible to make those calls
  - Trained over 1,000 employees on the plan
  - Conducted a workshop to exercise the plan

- **CEMP Utilized During 2012 State Fair**
  - 6 Severe Thunderstorms during the 17-day event
  - 4 Evacuations required
  - Swine Flu
  - Stagecoach
  - Pedestrian accident
  - Ted Nugent Concert

Background

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- Building and fire codes are sets of regulations designed to detail minimum acceptable levels of safety for buildings and other structures
- When appropriately adopted, observed, and enforced, they can substantially improve the public safety, and general welfare of occupants in and around buildings
- In most cases codes are enforced by the local government or a designated agency within a state

Model Building and Fire Codes

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- Authority for regulating building construction and fire prevention in the US resides with the states
- Most states utilize the "model code system"
- Nonprofit organizations develop model codes through a national consensus process
- They incorporate by reference other consensus standards such as ASCE 7 and ANSI 117.1
- Codes are updated every three years through open processes
- Model codes only become law when adopted by a governmental entity
- Most adopting authorities amend model codes to meet local needs

Dominant Model Codes in the U.S.

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- **Building Code**
  - Every state in the US has to some extent adopted the International Building Code (IBC) promulgated by the International Code Council

- **Fire Codes-Two fire codes are commonly used in the US**
  - The most adopted fire code is the International Fire Code (IFC) promulgated by the International Code Council
  - NFPA 1-Fire Code (NFPA 1) promulgated by the National Fire Protection Association is also widely used

Indiana Code

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- The Indiana Fire Prevention and Building Safety Commission adopted the 2006 IBC and IFC with Indiana specific amendments through administrative rules in 2008 .

- **In effect at the time of the collapse:**
  - Structure was regulated as part of a place of "amusement and entertainment"
  - Structure was required to "conform to the structural strength, fire safety, ...requirements of this code to ensure public health, safety and welfare "[IBC]
  - Structure was required "to be adequately roped, braced, and anchored to withstand defined elements of weather and to prevent collapsing..." [IFC]

Indiana Code (continued)

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- **Significant deletions & omissions at the time of the collapse:**

- Deletion of a requirement for a structural permit for temporary structures [IBC]
- Deletion of a requirement for submission of construction documents for temporary structures [IBC]
- Deletion of requirements for permits and approval of membrane canopies [IFC]
- Deletion of requirements for standby fire personnel and crowd managers [IFC]
- The requirement for plan review, also known as design release, was exempted for temporary structures [675 IAC]

Indiana Code Enforcement

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- **The Division of Fire and Building Safety had jurisdiction at the State Fair in August of 2011. This assessment found the Division complied with Indiana code enforcement requirements in place at the time:**

- The Division issued the required amusement and entertainment permit to the State Fair as a whole
- The Division conscientiously completed the required fire safety inspections at the fair
- Division personnel participated in the daily safety meetings with state fair officials

- **The Division did not have legal authority or responsibility to inspect structural elements of the temporary outdoor stage equipment**

Survey of Code Regulation and Inspection

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- Outdoor stage canopies are extremely specialized, complex and must accommodate a wide variety of changing components such as audio equipment, video walls and scenery
- Structures are constantly evolving, as the demand for larger and more complex performances grows
- Model codes address these types of structures only in very broad terms and extraction of requirements can be cumbersome
- Few fire or building inspectors have extensive experience with outdoor stage canopies

State Surveys

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- Interviewed individuals working for state agencies from 16 different states regarding temporary stage canopies. Half were Midwestern states.

- Common themes:

- ***Imperfect/Incomplete Information***-many reported receiving plans lacking in detail and admitted spending little, if any, time doing structural review
- ***Exemption from Codes***-Several states had similarly exempted temporary structures
- ***Inconsistent Inspections***-Some reported enforcement could be uneven due to lack of specific knowledge of outdoor stage canopies
- ***Licensing of Contractors***-Even where contractors were licensed, rarely were canopy erectors required to be licensed
- ***Shared Responsibility***-Many regulators and industry representatives remarked promoters and tour managers need to be more attentive to the risks around temporary structures (pressure to go on after concerns are raised)

Cities with Large Outdoor Venues

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- We sought out regulators in cities known to host a number of large outdoor events. They exhibited a good deal more sophistication in this area.

- Robust regulatory programs incorporate a balanced approach consisting of:
  - Structurally engineered stability of the canopy
  - Complete inspections
  - Environmental monitoring
  - Emergency operation plan

- A consistent pattern of their best practices follows:

Best Practices

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- Permits are issued through the Fire Department with complex canopies also structurally reviewed by Building Inspection Department

- Construction documents sealed by a registered engineer to include:
  - Operating limits of the structure (max. allowed wind, snow, etc.)
  - Details for anchorage, such as ground anchors, guys, ballast, etc.
  - Engineered drawings required on site for inspections

- Operational plans with predetermined actions upon outlined triggers

- Thorough inspections by certified or licensed inspectors

Short Term & Long Term Recommendations

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- **Short Term-**Fire Prevention and Building Safety Commission Rules should include provisions to regulate outdoor stage equipment until such time as the 2015 IBC and IFC are adopted (probably in 2017)
- **Longer Term-** The best way to ensure the safety of temporary stage safety on a broad basis is through concise regulation with a balanced approach to be incorporated into nationally recognized codes. Indiana should adopt future editions of the IBC and IFC with minimal amendments regarding temporary structures
- **On Going-**Provide adequate resources to ensure enforcement

Note: We recommended legislation as included in Appendix P of our report

Increased Interest by Model Code Organizations

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- **Recognition that better regulation is needed for temporary stage canopies with much interest in improving regulations**
  - Vast majority of code regulations originate following a tragedy
  - Numerous articles in trade magazines
  - Formation of study groups reviewing Thornton-Tomasetti, Witt reports and the Indiana emergency rule (specifically the ICC Fire Service Membership Council)
  - Acknowledgement temporary stage canopies are very specialized and complex structures while current requirements are very general
  - Admitting the model codes requirements, especially structural, for these structures are somewhat nonspecific and difficult to enforce
- **Change proposals for the 2015 IFC are due next January and proposals for the 2015 NFPA 1 are due next March. It is very likely changes will occur to improve applicable requirements.**

General Comments Emergency Rule #12-219 (E)

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- Clearly establishes responsibilities and raises the safety standards
- Captures the essential elements for structural stability, inspection, and an emergency operations plan
- Places the majority of the responsibility on the property owner where an event takes place
- Requires the owner to submit plans and specifications to the local inspection authority
- Rule does not require a design release for temporary outdoor stage equipment.

Specific Comments Emergency Rule #12-219 (E)

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- **Section 1 (c)-** Consider adding "positively" before "anchored" to clarify. When positively is used in building code context it means elements are physically connected (as in bolted, nailed, bracketed, etc).

- **Section 1 (d)-**Consider striking ~~standalone.~~ In many cases, as at the 2011 fair, outdoor stage equipment is dependent on a permanent stage or platform to provide a foundation for the columns to support the imposed loads above. That equipment is not precisely standalone.

- **Section 2 (b)-**Verify the legislative intent of SB 273 was not to require a design release for temporary outdoor stage equipment.

Specific Comments Emergency Rule #12-219 (E)

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- **Section 4 (a)-** Consider adding an area restriction to limit the size of exempt temporary outdoor stage equipment.

- **Section 9-** Consider adding "independent," before "competent". This would ensure another set of eyes on the installation and also ensure the installer would not be self inspecting. Also at the end of the section add "A complete set of plans as described in SECTION 5 shall be made available to the inspector during installation." It is critical the inspector have access to the plans for a structure this complex to ensure compliance.

Specific Comments Emergency Rule #12-219 (E)

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- **Section 10-** Consider encouraging the owners of the outdoor stage equipment to assist the property owner with documents required by SECTION 5 (c) (2, 3, 4, 5, 6 and 9), (d) and (e) as well as verification of compliance with SECTION 6.

- **Section 12 (a)-** Consider adding "or securing" after "dismantling". A complete dismantling of outdoor stage equipment may prove very difficult in the time between a severe weather warning and the arrival of the event. Evacuating the surrounding area or removing speakers and/or video screens to lower a roof and secure the vicinity can be accomplished much more quickly.

Appendix P: Recommended Code Changes and Legislation for Indiana Code

Indiana should change a number of aspects regarding construction regulation of temporary membrane structures. In general, practices such as requiring structural permits and design release for temporary structures, statewide licensure of contractors, mandatory building code certification for inspectors who inspect structural components and a requirement that approved engineered plans be available for all inspections would greatly improve the overall quality of construction regulation including that of temporary stage canopies.

During the preparation of this report, the Indiana General Assembly passed SB 273 regarding the regulation of outdoor stage equipment. The Governor signed the legislation into law in March 2012. Among its other requirements, the new law:

- Calls on the Fire Prevention and Building Safety Commission to adopt rules to regulate outdoor stage equipment used in connection with an outdoor performance as a Class 1 structure, with a January 1, 2014 sunset; and,
- Creates a study committee to study the issues related to the regulation of outdoor stage equipment and recommend permanent legislation to the General Assembly to regulate the use of outdoor stage equipment in Indiana for the purpose of protecting the safety of persons at an outdoor performance. The law requires the Witt Associates and ThortonTomasetti reports to be submitted to the study committee.

There is a definite need to provide improved regulations for temporary stage canopies. The most effective way to accomplish that goal is through clear, concise and practical codes and laws.

Indiana Recommended Legislation

Recommendation:

IC 22-12-1-X, add definition:

"Temporary stage canopy" means a temporary ground-supported structure used to cover stage areas and support equipment in the production of outdoor entertainment events.

Also, add a new section to chapter IC 22-14-3, as follows:

IC 22-14-3-X

Temporary Stage Canopies; special requirements

Sec. X. (a) All temporary stage canopies shall comply with this chapter and a nationally recognized standard for temporary ground supported overhead structures used to cover the stage areas and support equipment in the production of outdoor entertainment events.

EXHIBIT 3
SEPTEMBER 5, 2012
OUTDOOR STAGE EQUIPMENT
SAFETY COMMITTEE

(b) Temporary stage canopies in excess of 400 square feet shall not be erected operated or maintained for any purpose without first obtaining approval and a permit from the division.

(c) Temporary stage canopies shall not be erected for a period of more than 45 days.

(d) All of the following documents shall be submitted to the division for review before a permit is approved:

(1) Construction documents shall be prepared by a registered professional engineer. Construction documents shall include:

(A) A summary sheet showing design criteria, loads and support reactions.

(B) Detailed construction and installation drawings.

(C) Design calculations.

(D) Operating limits of the structure explicitly outlined by the professional engineer including environmental conditions and physical forces.

(F) Effects of additive elements such as video walls, supported scenery, audio equipment, vertical and horizontal coverings.

(G) Means for adequate stability including specific requirements for guying and cross-bracing, ground anchors or ballast for different ground conditions.

(2) The user shall designate in writing a person to have responsibility for the temporary stage canopy on the site. The designated person shall have sufficient knowledge of the construction documents, manufacturer's recommendations and operations plan to make judgments regarding the structure's safety and to coordinate with the authority having jurisdiction.

(3) An operations plan that shall reflect manufacturer's operational guidelines, procedures for environmental monitoring and actions to be taken under specified conditions consistent with the construction documents.

(e) The owner of a temporary stage canopy shall employ a qualified, independent approved agency or individual to inspect the installation of a temporary stage canopy. The inspecting agency or individual shall furnish an inspection report to the authority having jurisdiction. The inspection report shall indicate the stage canopy was inspected and was or was not installed in conformance with the approved construction documents. Discrepancies shall be brought to the immediate attention of the installer for correction. If any discrepancy is not corrected, it shall be brought to the attention of the authority having jurisdiction and the designated responsible party.

(f) Temporary stage canopies shall be located a distance from property lines and buildings to accommodate distances indicated in the construction drawings for guy wires, cross-bracing, ground anchors or ballast. Location shall not interfere with egress from a building or encroach on fire apparatus access roads.

Detailed reasons for legislation:

A definition is added to describe the specialized structure to be regulated.

Temporary stage canopies are complex structures and further guidance is needed to ensure their safety. The proposed legislation creates a new section under Regulated Places of Amusement or Entertainment.

(a) A standard exists which is specifically targeted to temporary stage canopies. ANSI E1.21-2006 was produced by the Entertainment Services and Technology Association (ESTA). ESTA recently merged with an international organization, Professional Lighting and Sound Association (PLASA). PLASA is in the process of updating ANSI E1.21 to address the changing industry needs. The new standard should be available by the fourth quarter of 2012. Our recommended legislation refers to a 'nationally recognized standard'; at this time the ESTA standards is the only one which meets the description that follows. We have reviewed the updated PLASA standard and it is preferred when it is approved by ANSI. The Fire Prevention and Building Safety Commission should include the latest available edition of ANSI E1.21 in administrative rule. The proposed legislation is consistent with both standards.

(b) The trigger starting regulation at 400 square feet in consistent with the current Indiana Fire Code.

(c) The 45 day duration is consistent with ANSI E1.21.

(d) The section is a summary of the relevant requirements of ANSI E1.21 necessary to provide guidance to regulating authorities. Stage canopies are subject to more diverse loads than most permanent structures. Because of the variable weights of equipment for different shows, the need to monitor changing weather conditions and the requirement to be able to raise and lower the roof to install equipment, there is a necessity for a registered engineer to fully analyze the structure and a need to designate a responsible person on site who understands this complexity of considerations.

(e) Due to the nearly unique design of temporary stage canopies, it is likely very few building inspectors or fire inspectors will be familiar with the specialized nature of these structures. That is the reason we are recommending a qualified specialized inspector be employed by the owner to inspect and report to the authority having jurisdiction and the designated responsible person. An Entertainment Technician Certification Program (ETCP) certification exists which would demonstrate competence in the field.

(f) This language is for general safety and is consistent with the Indiana Fire Code.

National Code Change Recommendations

In addition to Indiana-specific changes, proposed changes should be submitted to the nationally recognized IBC, IFC and NFPA 102 codes to achieve better understanding, consistency and regulation of temporary stage canopies. The earliest opportunity for broad acceptance would be through incorporation in the 2015 and 2018 editions. Proposed changes follow below.

X. The Office of the State Fire Marshall within the Department of Homeland Security, should be responsible for enforcement.