Dealing With Natural Disasters
Here Comes The Flood (Of Legal Issues)

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It’s All About the Contract

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St. Louis, MO
Major Risk Frequency and Loss Potential is Increasing

• Natural Risk
  • *Hurricane Katrina* (May 2005) -- $161 billion in damage, including $16 billion in flood insurance payouts
  • *Hurricane Sandy* (October 2012) -- $71 billion in damage including $18.75 billion in insured property losses, excluding flood insurance claims
  • *Hurricane Harvey* (August 2017) -- $125 billion in damage including $19 billion in insured property losses (comprised of $11 billion in flood insurance payouts, among other losses)
  • *Lake Oroville Dam Spillway* (February 2017) -- Spillway compromised due to series of storms with heavy precipitation; cost of repairs currently estimated at $1.1 billion
  • *Christchurch Earthquake* (February 2011) -- $40 billion in rebuild costs among other detrimental impacts to New Zealand economy.

• Human-Caused Risk
  • *Multiple New York City Crane Collapses*
  • *I-35W Bridge Collapse, Minneapolis* (2007)
  • *Florida Intl. Univ. Pedestrian Bridge Collapse* (2018)
  • “*Big Blue*” Crane Collapse, Miller Park
Climate Change

• Long Term Planning
  • Sea Level Rise
    • Florida Statute Section 163.3178(2)(f)1. - Now includes “sea-level rise” as one of the causes of flood risk that must be addressed in the “redevelopment principles, strategies, and engineering solutions” for new development

• Short term impact
  • 500 year storms occur every 50-70 years and 100 year events are routine
  • More construction in sensitive areas
Our Roles

• Jeff-
  • Project Counsel and/or Lead Management and Risk Consultant

• Nathan-
  • Risk Engineer and Modeling
Busch Stadium

- Extraordinary Risk Concerns
  - Earthquake
  - Environmental
  - Schedule
    - Bridging Design/Build

- Terrorism
  - Post 9/11-Limits on Coverage
  - Operations Phase
    - Lender: Is MLB $150M enough?

- Construction Phase
  - Lender: Prove you don’t need to buy expensive “all or nothing” policy (if you can get it)!
Based on a probabilistic assessment, the expected incidents per year for a completed stadium are no greater than 0.0024, and the expected incidents for a stadium under construction would be substantially lower.

No acts of terrorism against a stadium under construction in the United States have been documented in the Bureau of Alcohol, Tobacco, and Firearms’ (ATF) database.

**Domestic Bombing Events January-93 to October-03**

<table>
<thead>
<tr>
<th>Target Type</th>
<th># Incidents</th>
<th># Injured</th>
<th># Killed</th>
<th>Amount of Damage ($ Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>2529</td>
<td>1329</td>
<td>31</td>
<td>$538.48</td>
</tr>
<tr>
<td>Sports Stadium</td>
<td>7</td>
<td>8</td>
<td>0</td>
<td>$5.40</td>
</tr>
</tbody>
</table>

Based on the table above, the number of incidents and the amount of damage caused by bombings vary significantly. Commercial targets have experienced a much higher number of incidents compared to sports stadiums. The amount of damage caused by bombings to commercial targets is also significantly higher, with a range of $538.48 million.

Sports stadiums, on the other hand, have experienced fewer incidents, with only 8 injuries and no fatalities. The amount of damage caused by bombings to sports stadiums is relatively low, with a total of $5.40 million.
Blast Assessment

- Investigate various blast charge weights at selected locations
- Develop loss assessments based on the potential damage to the facility
Risk Identification and Assessment

Model Major Risks (PML)

Insurance Market Exploration

Determine available coverages, required contingencies

Create Contractual Risk Allocation Strategy

Finalize Risk Matrix

It's All About the Contract

The Project Counsel’s Role

- Create framework that maximizes opportunities for success, including:
  - Proper project delivery and risk management system
- Identify project risks and develop cost effective strategies that abate, allocate or transfer risk
- Create project management risk matrix that documents a complete and comprehensive risk management approach
- Memorialize all processes and agreements in proper front end documents

- Abate Risk
  - Minimize Risk with corrective systems and processes
- Allocate Risk
  - Establish fair sharing of risks and rewards among stakeholders
- Transfer Risk
  - Place risk with vehicle or entity most capable of absorbing risk (insurance, bonds, contingencies, etc.)
The Risk Management Matrix

<table>
<thead>
<tr>
<th>Risk Event</th>
<th>Probability</th>
<th>Impact</th>
<th>Likelihood</th>
<th>Recommend Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 1</td>
<td>High</td>
<td>Severe</td>
<td>High</td>
<td>A</td>
</tr>
<tr>
<td>Item 2</td>
<td>Medium</td>
<td>Moderate</td>
<td>Medium</td>
<td>B</td>
</tr>
<tr>
<td>Item 3</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>C</td>
</tr>
</tbody>
</table>

**Risk Management Strategies**

- Mitigation
- Transference
- Avoidance
- Acceptance

**Notes**

- Always consult with the project team before implementing any risk management strategies.
- Regularly review the risk management matrix to ensure it remains up-to-date.
- Prioritize risks based on probability and impact.

**Key Stakeholders**

- Project Manager
- Lead Engineer
- Contractor

**Risk Log**

<table>
<thead>
<tr>
<th>Risk ID</th>
<th>Risk Description</th>
<th>Probability</th>
<th>Impact</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Material Delays</td>
<td>High</td>
<td>Severe</td>
<td>Implement mitigation strategies.</td>
</tr>
<tr>
<td>R2</td>
<td>Labor Shortage</td>
<td>Medium</td>
<td>Severe</td>
<td>Hire additional labor.</td>
</tr>
<tr>
<td>R3</td>
<td>Equipment Failure</td>
<td>Low</td>
<td>Low</td>
<td>Replace equipment.</td>
</tr>
</tbody>
</table>

**Risk Reviews**

- Monthly risk review meetings with the project team.
- Quarterly review of the risk management plan.

**Risk Assessment**

- Use a qualitative and quantitative approach to assess risks.
- Consider external factors such as market changes and regulatory requirements.

**Risk Mitigation Plan**

- Develop contingency plans for high-impact risks.
- Implement risk response strategies to reduce the likelihood and impact of risks.
### Risk Management Matrix

- Lists 70-100 Risks
- Shows allocation of responsibility
- Shows risk transfer tool
- Contingencies
- Insurance coverage
- Shows GMP treatment
- Shows contractual delay treatment
- Excusable
- Compensable
- Liquidated Damage
- Shows process and other remedies
- Provides detailed commentary
Broad Categories of Risks (75-100 specific risks listed)

- Owner Financial Obligations
- Site-Related
- Environmental/Geotechnical Risk
- Other Owner Caused Delay/Cost Risks
- Public Process Risks
- Design Phase/Professional Performance Risks
- Cost Evaluation/Pricing/Procurement Risks
- Construction Performance Risk
- Bodily Injury
- Property Damage due to Builder’s Risk Event
- Other Property Damage
- Economic Loss due to Builder’s Risk Event
- Other Project Delay and Economic Loss
- Third Party Risk
Risk Identification is a Group Process

- Workshop Exercise
- Investigation Assignments
- Responsibilities set forth on Differentiation Document and Development Schedule
  - Environmental, Geotechnical, FAA, Special Studies
  - Risk Modeling for Major Risks
Differentiation Document (Hotel Example)

- During investigation and design phase, about 50 separate consultants listed for convention hotel project
- Lists all investigation, design, engineering, procurement and installation tasks on project by phase (about 1,000 tasks on convention hotel project)
- Assigns primary and secondary responsibility
- Living document during early investigation and design phase and becomes a contract exhibit
## Risk Management Matrix

**Confidential $500M Events Center Project**

**Revised 10-31-08**

<table>
<thead>
<tr>
<th>Risk</th>
<th>City</th>
<th>Developer</th>
<th>Design Team</th>
<th>Other Developer Consultants</th>
<th>Construction Manager</th>
<th>Contingencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner Financial Obligations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Failure or delay to obtain Developer financing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2. Failure or delay in City financing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>3. Failure to make timely payment to CM, A/E, etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

"1" first required.
Risk Profile of Owner, A/E and Contractor

- Owner retains all risk unless transferred
- A/E assumes professional liability risk by contract
  - Limited by standard of care
- Contractor assumes contractual risk associated with performance and workmanship
<table>
<thead>
<tr>
<th>Risk Management Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confidential $500M Events Cent</td>
</tr>
<tr>
<td>Project Revised 10-31-08</td>
</tr>
</tbody>
</table>

### Contingencies
- Owner/Developer
- Insurance
- Deductible
- Design
- CM (Within GMP)
- Premium Time

<table>
<thead>
<tr>
<th>Risk Management Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;1&quot; first recourse; &quot;2&quot; second recourse</td>
</tr>
</tbody>
</table>

**Owner Financial Obligations**
- Failure or delay to obtain Developer financing: 1
- Failure or delay in City financing: 1
Owner’s Contingency

• Design Modifications and Growth
• Compensable and Excusable Delay
• Changed Conditions
• Deductible and Sublimit Exposure
• **Spearin Gap**
  • If A/E is not negligent, Owner must respond to Spearin Gap Losses, including cost of delay

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**The Spearin Rule:**

“The Owner warrants (to Contractor) the adequacy of plans and specifications”

United States v Spearin, 248 U.S. 132 (1918)
**Contractor’s Contingency**

- Must be for Cost of the Work
- Covers buy out losses and gaps in scope, delays and overruns within contractors control, additional required means and methods

**Negotiation Points:**
- Contractor’s negligence?
- Amount and approval process
- Shared savings?
- Phased reduction (with excess used to buy pre-planned add alternates)
<table>
<thead>
<tr>
<th>Cost of the Work within the GMP?</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Y&quot; Yes</td>
</tr>
<tr>
<td>&quot;N&quot; No</td>
</tr>
<tr>
<td>&quot;D&quot; Yes-Deductible</td>
</tr>
<tr>
<td>Primary Stakeholder Responsibility</td>
</tr>
<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td>Risk Management Tools</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Risk Profile of Owner, A/E and Contractor

- Owner retains all risk unless transferred
  - PLL - Cleanup of Pollution Conditions
  - Builders Risk - Direct physical loss to structure and Time Element coverage
  - OPPI—Excess Professional Liability

- A/E assumes professional liability risk by contract
  - Limited by standard of care
  - Prof. Liability—BI, PD and Economic Loss

- Contractor assumes contractual risk associated with performance and workmanship
  - Worker’s Comp and Employer’s Liability - BI to workers
  - CGL-Third party BI and PD/Completed Operations
  - CPL-Contractor caused pollution
  - Subcontractor Default – Performance Bonds or SDI
Sample Insurance Program

Workers’ Comp
- Statutory Limits
- Insures Injury to employees of owners and enrolled contractors at project site

Excess Liability
Employer's Liability
Commercial General Liability
- Insures Owners and Contractors working at site for 3rd party claims for bodily injury and property damage
- 10 year Completed Operations

Pollution Liability (PLL+CPL)
- BI, PD or Cleanup arising from new or unknown conductions or arising from contractor’s activities

Railroad Protective
- Insures railroad for work performed by contractors

Owner Protective Professional Indemnity
- Insures owner for errors and omissions of professional firms
- 5 – year extended reporting period

Consultant's Underlying Insurance/Retention

Builders Risk
- Ensures loss or damage to Project during construction
- Limits equal to Replacement Cost, subject to sub-limits
- Delay in Completion
- Expediting and Contractor's Extra Expense
- Resulting Loss (Design and Construction Defect)
- Terrorism

Deductible

Workers’ Compensation

Employers’ Liability

General Liability

Pollution Liability

Railroad Protective

OPPI

$200M/$200M (Minimum)

$1M/$1M/$1M

$2M/$4M

$30M/$30M

$30M/$30M

$1M/$1M/$1M

$2M/$4M

$30M/$30M

$40M/$40M
Policy Limits:
$40M Per Claim
$40M Project Aggregate

Sample OPPI Program

Prime Architect
• $10M Practice Policy (MIR)
• Limitation of Liability

Other Professionals”
$2 MIR

Practice Retention

Practice Retention

$1M Policy Retention

$50M Coverage
The Types of Catastrophic Loss

• Bodily Injury
  • If arising out of contractor’s activities
    • Employees—WC
    • Third Parties—GL+Excess/Umbrella
  • If due to A/E negligence—Professional Liability
  • If due to pollution condition—PLL or CPL

• Property Damage
  • If arising out of contractor activities ---CGL (BR covers resulting loss)
  • If due to A/E negligence— Professional Liability
  • If due to Builder’s Risk event—BR Coverage
    • Subject to deductibles and sublimits
  • If due to a Pollution Condition—PLL or CPL

• Delay and Economic Loss
  • Most complex issues for insurance and contract negotiation
Contractual Remedy
Excusable Delay?
Compensable Delay?
Liquidated Damages?
Three Categories of Delay, Causes and Consequences

**Excusable and Compensable:**

- Critical path delay
- Caused by, or within the control or responsibility of the owner
  - Examples: Failure to provide site access; Differing site conditions; Owner changes; Suspension of work; Inadequate plans and specifications
- Contractor entitled to **time and money**

**Negotiation/Drafting Considerations:**

- Strict Notice Provisions
- Demonstration of true Critical Path Impact
- Owner may seek:
  - No Damage for Delay Clauses (Allows time but no money)
    - Restricted by Law
    - Potentially onerous and counterproductive
  - Damage Limitation Provisions
    - Example: Direct Cost reimbursed but no Profit or Home Office Overhead
Three Categories of Delay, Causes and Consequences

**Excusable** *(but not Compensable):*

- Critical path delay
- Beyond the control of the owner or contractor
  - Examples: Acts of God; Unusual weather; Industry labor disputes; Unusual material or equipment delays; Unavoidable casualties
- Contractor entitled to **time but not money**

- Negotiation/Drafting Considerations:
  - Strict Notice Provisions
  - Demonstration of true Critical Path Impact
  - Owner may also seek:
    - Time extension “deductible”
  - Contractor may seek:
    - Limited Compensation for Delay
      - Direct Cost
      - Compensation after reasonable period
    - Reasonable Suspension/Termination Remedies in event of Delay
Three Categories of Delay, Causes and Consequences

Non-Excusable:

- Delay within control of contractor...not caused by owner
  - Examples: Contractor failure to properly man project; Delay due to faulty workmanship; Subcontractor failure to perform
- Contractor receives **neither time nor money**
- Contractor may have exposure to owner for damages

- Negotiation/Drafting Considerations:
  - Withholding of Payment
  - Liquidated Damages in lieu of Actual Damages (including Consequential
    - Calculation
    - Milestone dates
    - Cumulative cap
    - Application of contractor contingency
Delay Remedies and Risk Management Tools

• The owner’s primary tools for addressing losses that stem from delays are:
  • Contingency funds
  • Contractual risk allocation provisions, such as a liquidated damages clause
  • Insurance (in certain cases)
Builder’s Risk -- Delay Coverage

- Example of Decisions Required (and Landmines)
- Risk to Insure:
  - Risk of “downstream” construction cost due to a wind event (60 mph wind knocks down masonry wall and causes project delay requiring acceleration of downstream contractors)

- § A.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance, to reimburse the Owner for loss of use of the Owner’s property, or the inability to conduct normal operations due to a covered cause of loss.

- § A.2.4.2 Ordinance or Law Insurance, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.

- § A.2.4.3 Expediting Cost Insurance, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.

- § A.2.4.4 Extra Expense Insurance, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.

- § A.2.4.5 Civil Authority Insurance, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.

- § A.2.4.6 Ingress/Egress Insurance, for loss due to the necessary interruption of the insured’s business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.

- § A.2.4.7 Soft Costs Insurance, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.
<table>
<thead>
<tr>
<th>Risk Management Matrix</th>
<th>Confidential $500M Events Center Project</th>
<th>Revised 10-31-08</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Owner Financial Obligations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Failure to obtain Developer financing</td>
<td></td>
<td>FCA $4.1.1 Required site delivery by 7/1/08. Site has been acquired.</td>
</tr>
<tr>
<td>2 Failure or delay in City Financing</td>
<td></td>
<td>FCA does not place limit on what City must spend to acquire site. FCA $4.1.2 Required site delivery by 7/1/08. Site has been acquired.</td>
</tr>
<tr>
<td>3 Failure to make timely payment to CM, AE, etc.</td>
<td></td>
<td>A/E Aprt. $2.1.4 Requires Architect to review applicable laws and design documents must comply with applicable laws.</td>
</tr>
<tr>
<td><strong>Site Related</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Delay in obtaining site</td>
<td></td>
<td>A/E Aprt. $2.1.4 Requires Architect to review applicable laws and design documents must comply with applicable laws.</td>
</tr>
<tr>
<td>5 Site acquisition cost overrun</td>
<td></td>
<td>A/E Aprt. $2.1.4 Requires Architect to review applicable laws and design documents must comply with applicable laws.</td>
</tr>
<tr>
<td>6 Delay or failure to obtain historic area designation</td>
<td></td>
<td>A/E Aprt. $2.1.4 Requires Architect to review applicable laws and design documents must comply with applicable laws.</td>
</tr>
<tr>
<td>7 Failure to assess height restrictions (off-site)</td>
<td></td>
<td>A/E Aprt. $2.1.4 Requires Architect to review applicable laws and design documents must comply with applicable laws.</td>
</tr>
<tr>
<td><strong>Delay or non-compliance in environmental appraisals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Delays or non-compliance in planning or zoning</td>
<td></td>
<td>FCA §2.4.3 Requires City to remediate known environmental conditions.</td>
</tr>
<tr>
<td>9 Delays in permitting caused by A/E or Consultants</td>
<td></td>
<td>FCA §4.6.3 City must obtain relaxing, land use approvals, site location and dedications.</td>
</tr>
<tr>
<td>10 Delays in permitting not caused by City</td>
<td></td>
<td>FCA §4.6.3 City must obtain relaxing, land use approvals, site location and dedications.</td>
</tr>
<tr>
<td>11 Delays in permitting caused by CM</td>
<td></td>
<td>FCA §2.4.3 Requires City to remediate known environmental conditions.</td>
</tr>
<tr>
<td>12 Delays in permitting caused by A/E or Consultants</td>
<td></td>
<td>FCA §2.4.3 Requires City to remediate known environmental conditions.</td>
</tr>
<tr>
<td>13 Delays by utilities (public or private) in providing services to the site or stadium</td>
<td></td>
<td>FCA §4.6.3 City must obtain relaxing, land use approvals, site location and dedications.</td>
</tr>
<tr>
<td><strong>Unforeseen hazardous materials identified prior to construction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 Unforeseen hazardous materials identified prior to construction</td>
<td></td>
<td>FCA §4.6.3 City must assess, analyze and remediate if environment condition does not result from construction. Should be owned by City.</td>
</tr>
<tr>
<td>15 Unforeseen hazardous materials found after construction</td>
<td></td>
<td>FCA §4.6.3 City must assess, analyze and remediate if environment condition does not result from construction. Should be owned by City.</td>
</tr>
</tbody>
</table>
Crisis Management Plan

• Identification of Response Team and chain of command
• Confirmation of notifications required by law (e.g. OSHA)
• Steps required to secure the site
• Plan for notification of local medical, fire, police and other first responders
• Preservation of evidence
• Communication protocol for project stakeholders, insurers, affected individuals, as well as external communication (media and social media)

Expect the best, plan for the worst, and prepare to be surprised.

- Denis Waitley

Make development of the plan a contract requirement
Big Cranes

• “Big Blue” Disaster -- Miller Park- 7/14/99
• 3 ironworker deaths
• Opening day delayed 1 year
Big Crane Delays

• Issue: Delay caused by downed crane
  • $30M Crane
  • Normally not part of BR (not work under construction)
  • Other policies cover BI, PD and damage to crane—but what about delay?
• One Solution: Include on BR Equipment Endorsement with nominal sublimit for replacement but full time element coverage
• Levi Stadium---Earthquake Risk
  • Design Build
  • Stadium Replacement Cost $800M+
  • Lender Lawyer’s Requested Coverage?
  • Amount of Available Coverage Worldwide?
  • Proper Amount of Coverage to Address the Risk?
Levi’s Stadium

Deterministic vs Probabilistic Seismic Analysis

<table>
<thead>
<tr>
<th>Fault</th>
<th>Maximum Magnitude $^2$</th>
<th>Distance (km) $^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hayward</td>
<td>7.33</td>
<td>11.9</td>
</tr>
<tr>
<td>Monte Vista-Shannon</td>
<td>6.50</td>
<td>13.7</td>
</tr>
<tr>
<td>Calaveras</td>
<td>7.03</td>
<td>15.1</td>
</tr>
<tr>
<td>San Andreas</td>
<td>8.05</td>
<td>19.1</td>
</tr>
<tr>
<td>Mount Diablo Thrust</td>
<td>6.70</td>
<td>38.6</td>
</tr>
</tbody>
</table>

Summary of Major Nearby Faults, Magnitude and Distance to the Site $^1$
Probabilistic Loss Analysis

ASTM E2026-99 defines probable loss as follows:

Probable Loss (PL): The PL is based on a probabilistic analysis of both the earthquake hazard and the damageability, and is defined as the earthquake loss to the building associated with a specified return period event and probability of exceedance.

*Probabilistic Loss approx. 25% less than Deterministic Loss*
Proper Amount of Earthquake Coverage

• Full Replacement Cost Value
• Amount suggested by “deterministic” PML
• Amount suggested by “probabilistic” PML
• Less than PML indicated amount

• What Lender’s lawyer requests
  • Unnecessary—far beyond indications of PML
  • Virtually impossible to obtain—beyond world-wide capacity for specific fault.

• Still may be excessive in terms of
  • Reasonable risk assessment
  • Capacity to obtain
  • Cost

• Should be reasonable and may be obtainable
  • The value is proper and fully defensible

• Insufficient coverage
  • Places project at risk
  • Makes project non-financeable
• Named Storm Risk
  • Retractable Roof in various stages of construction (and temporary support) over 3 years
• Storm Surge (Stadium sits 5 feet above sea level)
Hurricane Wilma struck southwestern Florida on October 24, 2005, as a Category 3 storm and resulted in approximately $29 billion in damage.
Storm Surge Modeling

- Develop Possible Water Depths
- Provide Feedback to Designers and Contractors
- Consider Relocation of Critical Equipment
Vulnerability Curves by Zone

Zone Specific Damage Curves

Curves represent specific materials, elements

Building components:
1. Retractable roof and associated elements
2. Fixed roof and upper bowl
3. Wall cladding and support system
4. A – Concrete Structure
5. B – Balance to Fit Out
6. C – Bowl Systems
7. Luxury Box Level
8. Site work
• Target Field
• Risk: Train Impact
Event Tree Analysis

**Train Accident**
- **1.22E-03**
  - **Column Impact**
    - **2.92E-04**
      - **Structural Damage**
        - **1.46E-04**
          - **Release**
            - **1.17E-07**
          - **No Release**
            - **1.46E-04**
      - **Non-Structural Damage**
        - **1.46E-04**
          - **Release**
            - **1.17E-07**
          - **No Release**
            - **1.46E-04**
  - **No Column Impact**
    - **9.26E-07**
      - **Release**
        - **6.53E-07**
      - **Flammable**
        - **7.86E-08**
      - **Explosive**
        - **6.87E-09**
  - **No Release**
    - **9.24E-04**

* Lead locomotive striking column
Train Impact Scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Locomotive Velocity</th>
<th>Angle of Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35-mph</td>
<td>0°</td>
</tr>
<tr>
<td>2</td>
<td>35-mph</td>
<td>45°</td>
</tr>
<tr>
<td>3</td>
<td>35-mph</td>
<td>90°</td>
</tr>
</tbody>
</table>
Levi Stadium/Marlins Park/Target Field Outcome

- Earthquake/Named Storm/Train Risk coverages consistent with PML
  - Enhanced Coverage for Time Element & Acceleration in BR
- Comprehensive BR/OCIP/OPPI
- Limited Damages given for Force Majeure Delay
  - Duty to Mitigate
- Substantial, but capped, LDs
- Lenders and Rating Agencies satisfied with risk profiles and fully funded
- All projects completed on time/in budget!
That's all Folks!