

Risk Avoidance and Management for Infrastructure Projects

**London Superconference
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RCM Slides

- RCM – Intro of Panel and Topic
- RCM – uses slides 3 to 8

Sources of Risk

- Design
- Bidding
- Construction
- Operation

Design Risk

- Programming
 - Site Selection
 - Geotechnical Survey
- Schematic
 - Scope Definition and Control
- Detailed Design
 - Engineers Design Estimate
 - Concept for Work Execution
 - Schedule for Execution of Work
 - CAD Models

Bidding

- Estimate Development
- Schedule (Programme) Development
- Scope Translation
 - Drawings
 - Specifications

Construction

- Schedule (Programme) Development
- Schedule Contingency
- Bid Estimate and Cost Control
- Estimate contingency

Operation

- Training
- Operability
- Maintainability
- Reliability

Recognizing Risk

- Outside Environmental Factors
- Changing Technology
- Process Design Failure
- Bad Management

Potential Pitfalls

- Owner Acceleration
- Deficiencies in Current Standard Contracts
- Delay Claims
- New Default/Termination Issues
- Insurability

New Contract Requirements

- Express “Data Exchange” Addendum to general contract
- Clear definitions of ownership, management and security responsibilities of the information transfer
- Responsibilities for software & system compliance
- Promote, not impede collaboration
- One party tapped to manage the exchange process, responsible solely to coordinate notifications

Contract Requirements con't.

- Define specific documents to be accepted electronically (drawings, models, shop drawings, change orders, RFIs, etc.)
- Methods of maintaining version control and a depository of all versions, during and after project
- Reciprocal indemnity obligations for failures and violations
- Determination of insurance and bonding requirements

Standard Contract Clauses - *Caveat Emptor*

- Standardized forms protective of Owner and Engineer
- Data/Electronic information historically originates with Design Professional
- Risk of use is borne on the contractor unless otherwise specified

Example – Engineers Joint Contract Documents Committee provision:

“A. Copies of data furnished by Owner or Engineer to Contractor or Contractor to Owner or Engineer that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user’s sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern. ”

Source: EJCDC C-700 Standard General Conditions of the Construction Contract, 2002 Edition, Subparagraph 3.06 – Electronic Data

Owner -Warning Signs

- Delays and scheduling problems
- Missed Milestone Dates
- Defective workmanship
- Unresolved design/technical problems
- Excessive number of RFIs
- Excessive Change Order requests
- Non-conforming materials and equipment
- Inadequate labor force on site

Owner -Warning Signs

- Inaccessibility or turnover in Contractor's Project team
- Unexplained removal of equipment from site
- Accidents and safety problems – OSHA violations
- Delayed payment of Subcontractors –
- Subcontractor Liens
- Unsupported claims by Contractor

Contractor - Warning Signs

- Late/Defective Design
- Late Payment v. Progress
- Disputed Change Orders/Payment
- Schedule Confusion
- Field Coordination Problems
- Excessive Requests For Information
- Late/Defective Owner supplied materials or equipment
- Unresolved Unforeseen Conditions
- Qualifications/Turnover of owner's project personnel
- Absence of Owner's Maintenance/Operations team

To Terminate or Not to Terminate

- Review adequacy of supporting documentation
- Check reliability of information sources
- Evaluate the impact of termination on the overall Project:
 - Percentage of Project completion
 - Lender requirements
 - Dates for turnover to key tenants
 - Industry conditions – availability of a replacement
 - Contractor and adequate labor
 - Status of long lead-time items
 - Ability to retain key Subcontractors/Suppliers

Termination/Suspension

- Right of Contractor to Terminate for Default
 - When suspension becomes an Owner default
- Right of Owner to Terminate for Default
- Right of Owner to Terminate for Convenience
 - Termination Notice provisions
- Need to act quickly when danger signs appear

Dispute Resolution

- Consolidated mediation and/or arbitration
- Litigation/arbitration at the Owner's option

Owner Termination Issues

- Assume subcontracts and purchase orders
 - (Owner's option)
- Take possession of materials and equipment both off and on site
- Notify the Surety
- Notify Lender and other key parties
- Owner Termination Issues

What if the termination is wrongful?

- Owner's potential legal exposure
- Contractor's damages – different theories:
 - “Expectancy damages” (contractor in same position if contract had been performed)
 - Contract price (adjusted for time and cost changes), less saved completion costs; or
 - Unpaid costs plus anticipated profits
 - Reliance Damages (contractor in same position if contract had been performed without a contract)
 - Unpaid costs and profit (not limited by contract)
 - Restitution Damages – Owner’s unjust enrichment
 - Quantum Meruit

Contractor's Response

- Substantial performance by Contractor
- Improper notice of termination
- Failure to allow Contractor a reasonable opportunity to cure
- Project design problems
- Differing site conditions

Contractor's Response

- Owner interference – failure to "cooperate"
- Improper/inadequate contract administration by Owner
- Impossibility/impracticability of performance
- Disguised termination for convenience

Peter Slides

Thanks for Coming!

Our Speakers:

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**Slides available for download at
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New Issues

- **Contract issues/roles and responsibilities**
- **Owner, Designer & Constructor Perspectives**
- **Means and Methods**
- **Bid Packages and Schedules/Resources**
- **Safety**
- **Coordination**
- **Shop Drawing Integration**
- **Progress Input**
- **Record Drawings**

3D CAD- Project Benefits

- **Design**
 - Multi-discipline design environment
 - Consistency of design data
 - Automatic deliverable production
- **Construction**
 - Clash detection during design
 - Visualisation
 - Construction status
- **Operations and maintenance**
 - Effective data handover
 - Online visualisation
 - Maintain design integrity

3D, 4D, nD

- **3D facilitates**
 - Communication,
 - Collaboration,
 - Development of reusable data;
 - Faster decision making for every stakeholder
- **Adding the 4th 'D' - time offers**
 - build-ability checking,
 - workflow planning,
 - creates process change
 - Planner talking to Designer
- **Adding costs, risk, etc (5+D?) brings in more stakeholders, more 'points of view' but lessens the chance for future conflicts.**

Benefits from Owner's Perspective

- **Building Information Modeling (“BIM”) technology promotes efficiency and schedule compression**
- **Enables integrated planning, design, detailing, cost control**
- **Eliminates inaccurate as-built documentation and inconsistent design quality**
- **Ensure better communication, design delivery and coordination**
- **Improves cost predictability**
- **Shift in project delivery by eroding distinctions between planning, design, and construction.**
- **Post-construction efficiencies (maintenance)**

Benefits from Owner's Perspective

- **Project also includes**
 - **48,000 SF Warehouse expansion**
 - **3,000 SF Utility Plant expansion**
 - **Utility Yard expansion**
 - **Many equipment/module vendors providing 3D models for input into project model**

Benefits from Owner's Perspective

- **GNE is using model as construction tool (3D only, not as scheduling tool)**
- **Model is not updated for changes post-isometric issue**
- **Owner concerns:**
 - **Level of detail in model may necessitate “manual” changes to isometrics generated from model**
 - **Not all equipment/module vendors use same 3D package; results are semi-compatible – no assembly details are available in model**

Benefits from Owner's Perspective

- **3D modeling is now standard on large projects and is a “proven” technology**
- **Genentech would like to see results of a 4D or 5D pilot prior to implementation on upcoming projects**

Potential Pitfalls

- **Owner Acceleration**
- **Deficiencies in Current Standard Contracts**
- **Delay Claims**
- **New Default/Termination Issues**
- **Insurability**

Impact on Traditional Roles

- **CMs and Contractors Migrate into Designing**
 - Opportunity to offer “constructability” services (CDs) to owners and designers
 - Design Professionals used as “design intent” consultants during the constructability phase
 - Narrows role of designer to aesthetic and programming piece
- **Increased CM Responsibilities**
 - Contracted by Owners to collect information from all consultants & designers
 - Construct Owner’s BIM to minimizing errors and omissions in the field
 - Minimizing impact on traditional design firms who can submit 2D drawings as they always have
- **Or Design Professionals Take control**
 - assume responsibility for being building information managers
 - leveraging BIM as a way of consolidating the information into a comprehensive database
 - Deliver database to Owner after project for building operation and maintenance

Cultural Changes for Widespread Implementation

- **Collaborative design process is novel**
 - **Change in the traditional notion that control of design is in the hands of the design professional**
 - **Information provided by design professionals was traditionally limited to design intent only**
 - **BIM adds new electronic construction data provided by design professionals in their models**
 - **New information involves architects in means & methods, quantities and construction execution**
 - **Blurs traditional lines of responsibility**

Consistency of Design Data

- **Data exchange with other systems**
 - IP&ID data transfer to 3D CAD model
 - Pipe stress analysis
 - Material management system
 - Sub contractor interfaces
- **Specification and parametric driven design**
- **Enforces standards & methodology**
- **Utilizes standard specs and catalogues**

Automatic deliverable production

- **Orthographics (Plans & Sections)**
- **Isometric and Field Fabrication drawings**
- **Equipment Arrangements (Layouts)**
- **Bill of Materials (Material Take-Off's)**
- **Reports**
 - **(Clash Check, Line Lists, I/O, Valves, Devices, etc)**

Operations and Maintenance

- **More effective data transfer**
 - (turnover packages)
- **Interface to operation systems**
 - Electronic Data Management Systems - EDMS
 - ERPs (SAP, Oracle), 'Smart' Drawings (PDS database, INTools)/EDMS
- **Ongoing modifications**
 - See CA/IFM, CMMS, EAM
- **On-line visualization**
- **Communicate Design Intent**
 - Maintain design integrity – consistency of approach thru life of the project.