Weight Matrix					
Description	Research	Value Engineering	Construction Review	Schedule Compression	Total
DBOM	15%	5%	N/A	10%	30%
Pre-cast vs. CIP	5%	5%	10%	N/A	20%
Building Enclosures	5%	15%	10%	N/A	30%
Sequencing Impact on ice-floor construction	N/A	N/A	10%	10%	20%
Total	25%	25%	30%	20%	100%

Proposal Structure:

Analysis (1): Design-Build-Operate-Maintain Project Delivery System

Background/ Problem Statement

New technologies in design and construction methods have lead to aggressive approaches to project development. Owners now require construction entities to fulfill additional task beyond the scope of construction. As the complexity of projects increases, so does the demand for financially accountable project participants. Construction entities are now required to produce an array of services that provide the best possible financial alternatives and building systems management to clients'

- Critical Functions and Building Uses
- Time intensive design implementation, *(typically the date is the driving force behind project development and every thing associated with the schedule and construction process)*
- Liquidated Damages clause accessed to critical time frames

Analysis Goal(s)

The goal of this research is to determine the collective view of construction entity for integrated delivery systems on large scale projects.

Proposed Solution(s)

The proposed solution will detail the selection criteria for this project delivery system. A (PDSS) selection tree will be generated documenting the project constraints associated with large scale projects of similar types and use. Information to be analyzed will be focused on three categories:

- Bonding Capacities (Limitation of obtaining financial sources for first time implementation/ "barrier of entry")
- Validity of Internal Checks and Balances – (Financial Accounting Practices)
- Profit Protection or Quality Satisfaction!

Project selection will be exclusively focused on arenas, convention centers and other public revenue generating projects. (5) to (7) projects will be evaluated to determine:

- Current project delivery system *(How precise were deliverables to owner's request)*
- The current contract structure vs. revised contract structure via project autopsy
- Project Cost
- GC level of experience
- GC Role in preconstruction services and project design
- Opportunities for VE and fast-tracking/ schedule compression offered in current PDS vs. (constructed entity directed/ client focused PDS)

Expected Results

When specific contract types are matched with project constraints, contractors and owners will select the system which minimizes up front owner obligation and maximizes contractor freedom. The expected results will summarize that the best PDS for expensive, complex projects with highly stringent turnover dates is DBOM.

Analysis (2): The effects of union labor on material selection and installation for primary structural elements (Pre-cast vs. CIP)

Background/ Problem Statement

The local union market can have an effect on the various materials selected for construction. Arena construction is a lucrative market for concrete subcontractors. In addition to quality and procurement time, pre-cast/ CIP concrete is selected based on manufacturing and installation cost in the local market. Is it less expensive to hire a non-union pre-cast manufacturer and union erector or a union CIP concrete subcontractor?

(Union Pre-cast Erector & Non-union manufacturer) cost vs. Union CIP cost

How valid are the formwork cost differences with union labor installation against non-union pre-cast concrete manufacturing cost?

Analysis Goal(s)

This analysis will included evaluation of the form work cost associated with cast in place concrete construction for the Sears Centre main structural elements. Union Laborer rates and non-union labor rates will be collected to determine the cost difference. Attention will be given to associated form work cost for bent beams, raker beams and columns. Although the Sears Centre is in the Midwest region, it will be interesting to compare regional pre-cast/ CIP concrete construction cost between regions with heavy arena construction to gather a broader consensus on this issue.

Proposed Solution(s)

The proposal will be focused on recapturing the procurement and manufacturing cost associated with pre-cast construction. Since a re-evaluated delivery system grants the opportunity of fast tracking in design-build entities, a re-calculated start date could be used to stretch the schedule without affecting turnover.

Solution Methodology

1. Investigate specific projects where the benefits of pre-cast elements exceeded the use of CIP members, even with the emphasis of time sensitive delivery.
2. Evaluate the labor market and location for projects similar to the Sears Centre. This will be conducted via surveys and direct interviews of industry professionals and actual labor shop managers.

As a project safe guard gather pricing information for the price of pre-cast elements constructed as CIP members

1. Pre-cast vs. CIP
2. Material Cost Differences
3. Labor Cost Differences
4. Equipment Cost Differences
5. Procurement/ Erection Time Differences
6. Spatial and Coordination Requirements
7. Market Flexibility

Expected Results

- CIP w/ form work purchase and rental cost > Pre-cast w/ union installation cost
- CIP Erection time ≤ Pre-cast procurement cycle

Analysis (3): Revised Building Enclosure system composed of pre-manufactured masonry panels

Background/ Problem Statement

Envelope and cladding systems are composed of metal panels and concrete panels. Early evaluation has also identified overturning issues attributed to light building weights. A masonry panel assembly should be analyzed to provide a cost affective alternative to the multi-component envelope system, in effect adding necessary weight to the overall structure, counteracting overturning and uplift forces on the foundation. Masonry assemblies may provide the additional load to supplement the existing building weight.

Analysis Goal(s)

Facets of design and constructability will be evaluated for this topic. Pre-manufactured masonry panel assemblies will be analyzed to reduce the complexity of the envelope system. The current envelope is composed 2" thick x 3'0" wide VERSAWALL and FOAMWALL cored insulated panels. Hollow cored panels are composed of 26 gauge G90 galvanized steel (0.73023 lb/sf^2) and insulation with a 2.0 to 2.4 lb/ft^3 density. Since

the majority of the panel assembly is composed of foamed cored insulation the envelope assembly has virtually no effect on the building weight. Panels range in height from 8'-0" to 24'-0".

Unit cost calculation for cladding system:
[(2) (3sf) (0.73023 lb/sf^2) (typical sheet thickness)] + [(2/12) (1sf) (2.4 lb/ft^3)] = 4.78 lb/ft^3

Cored Insulated Panel Designation:	*Per Square Foot $ Cost*
Type (1)	*$ 9.00/ SF*
Type (3)	*$ 12.00/ SF*

Proposed Solution(s)
This proposal will consist of an evaluation to the current enclosure section between the building base veneer and the high walls supporting the arena roof system. Type (1) and Type (3) panels compose the exterior envelope for this section. Pre-manufactured masonry assemblies will be analyzed to provide the required building insulation and bearing values with the goal of adding supplemental weight to the building.

Solution Methodology
1. Evaluate masonry block panel assemblies to include the following:
   - Comparable Architectural Finishes
   - Insulation Requirements
   - Structural Capacities
   - Unit Weights > than current metal assemblies
2. Determine Unit Cost/ SF Cost for masonry assemblies (Cost guidelines ± 10 % of Current Unit)
3. Determine installation time frame to compare with current time allotted to previous system
4. Compare and Contrast procurement and coordination process of the two systems
5. Analyze installation paths and available suppliers

Expected Results
- The challenge will be finding an architectural finished masonry units within 10% of the per square foot cost for the standard sandwich panel
- Increased Building Weights will have an affect on reducing the occurrence of building uplift in the foundation system
- Possible reduction in the number of 100 kip tie-backs
- Possible reduction in tie-back diameter size

Analysis (4): Ice floor construction/ Waste Recovery

Background/ Problem Statement

Aside from the 42'-0" high slopped curtain wall system, the ice floor is the most interesting aspect of this project. The rink will be used for minor league hockey affiliation. Part of standards and practices will include installation procedures typically used in NHL facilities management. Ice-rink/ refrigeration subcontractors will be required to adhere to all submittal requirements. As a preface to this analysis, information will need to be collected on standard procedures for ice-rink installation and system testing. Major consultation will be required of this topic, since systems of this nature are used for specific functions.

Analysis Goal(s)

Once the overview for system installation has been produce, an evaluation of the process will be completed to determine if rink construction can be either accelerated or compressed by utilizing SIPS for mechanical/ plumbing predecessors. It is assumed that the current ice distribution drainage system doesn't account for waste recovery. One interesting aspect to analyze from a broad view is the addition of waste recovery measures for this system. Is it possible to salvage any component of brine waste?

Proposed Solution(s)

Using Short Interval Production Schedules for similar event floor plumbing rough-in could possibly accelerate the start date of ice-rink construction. Main even floor air distribution should be installed on the same "SIPS" premise as under slab plumbing and drainage sequences. The schedule impacts will generate additional time for system evaluation and testing. If a waste recovery system could be utilized, new water usage would be minimized as a by product of this efficiency.

Solution Methodology

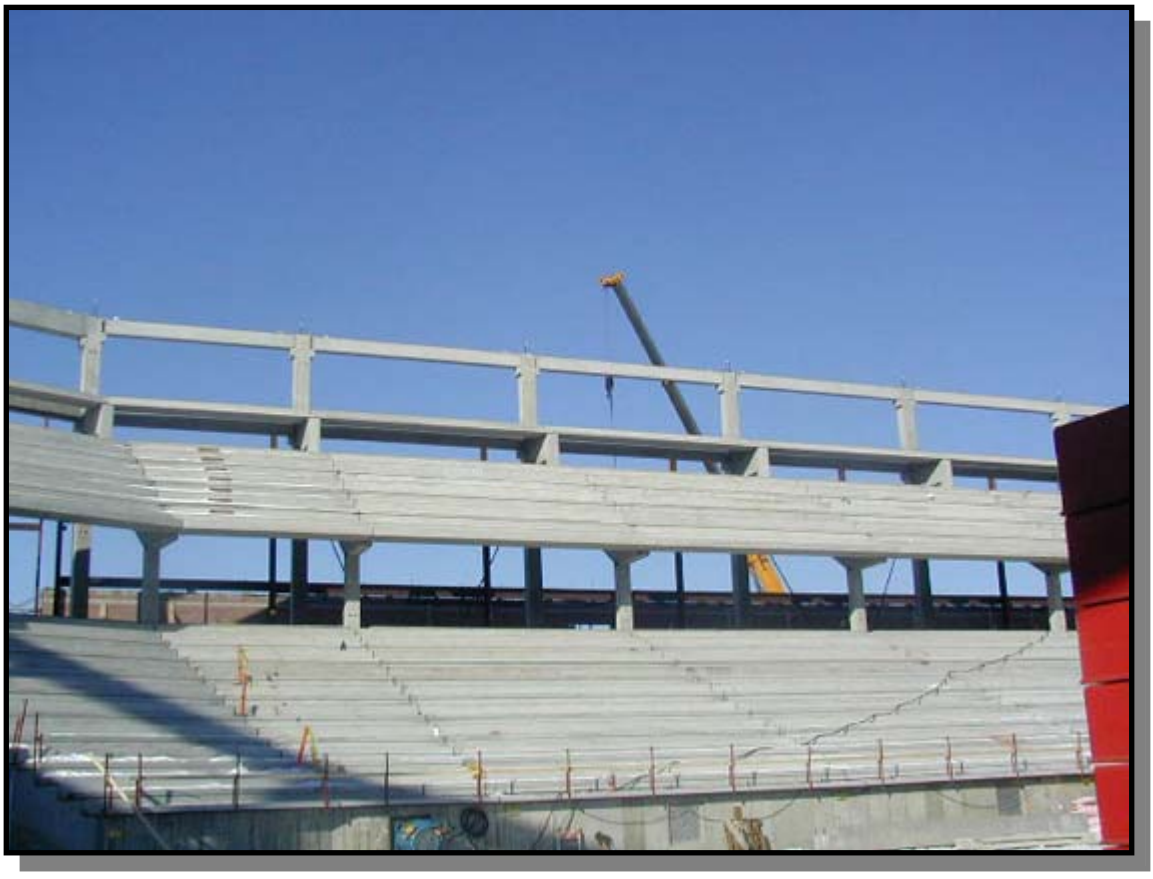
- Contact "CIMCO" Refrigeration, "CIC-Center Ice Consultants & Customer Ice Rink Inc. for project portfolios and products literature regarding ice rink construction.
- Participate in a brief overview of ice-distribution systems, their composition and typical installation practices.
- Re-evaluate and re-draft budget for "best practice" procedures
- Evaluate the project stage for typical rink installation, i.e. how far in the construction project should procurement and floor slab preparation occur.
- Identify all cross coordination and depended design guidelines applicable to system implementation and testing. *(Two areas that will affect the coordination process of rink construction are (1) HVAC Arena Floor Dry and Wet Bulb Temperature Requirements and (2) Plumbing Rough-In slab penetrations.)*

- Determine the minimum potable H_2O condition for system operation. Lower potable water may have the potential to be used in the process after distilling prior to being introduced to the system. If any component from previous brine solution can be salvage the system will have a lower operational cost.
- The cost of water softeners will be evaluated to preserve filter efficiency and extend the life span of the system.

Expected Results

- Established standard practices will reduce installation time frames
- System will operate on % re-used sources
- Installation of waste recovery and water softeners will offset repair and replacement cost for filter system by reducing calcium, etc. build up in piping system

Appendix



(Main Concourse, Bridge & Suite Levels)

Appended Survey Questions pertaining to the level of interest in (DBOM) for GC(s) & DB(s):

"GIT"- General Information Template			
GC Contracting Entity Background			
GC/ Contracting Entity	*TBD*	*TBD*	*TBD*
Geographic Location	*TBD*	*TBD*	*TBD*
Primary Market Focus	*TBD*	*TBD*	*TBD*
Exposed Values and Strategic Plan	*TBD*	*TBD*	*TBD*
Project Delivery Management			
Preferred PDS	*TBD*	*TBD*	*TBD*
(3) Recent PDS(s) selected – Survey will provide description of Traditional PDS(s)	*TBD*	*TBD*	*TBD*
Nature of Owner for Repetitive Business – (Aggressiveness of Project Strategy)	*TBD*	*TBD*	*TBD*
# of Sports Recreational Facilities/ Convention Centers Developed/ Built	*TBD*	*TBD*	*TBD*
(3)Landmark Project Types w/ Project Cost Range (Preferably most complex projects)	*TBD*	*TBD*	*TBD*
(3) Lessons Learned	*TBD*	*TBD*	*TBD*
(3) Changes GC would make if selected PDS was rejected	*TBD*	*TBD*	*TBD*
Level of interest for Increase Project Responsibility in Design and Delivery Phases	*TBD*	*TBD*	*TBD*
Status of Strategic Plan after Project Completion, has it changed	*TBD*	*TBD*	*TBD*
Level of Interest for Development of "Niche-Market"	*TBD*	*TBD*	*TBD*
Level of Interest in pursuing Design build and Facilities Management Projects	*TBD*	*TBD*	*TBD*
Internal Checks & Balancing and In-house Fiscal Capabilities			
Largest Bonding Capacity	*TBD*	*TBD*	*TBD*
Preferred Cost Reporting Function	*TBD*	*TBD*	*TBD*
Overall need for Internal Audit Function beyond Estimating/ Cost Controls	*TBD*	*TBD*	*TBD*
"E"-Submittal Management Process			
Level of Familiarity with "PM-Suite/ Prolog" or compatible software packages	*TBD*	*TBD*	*TBD*
# of projects completed which software was used	*TBD*	*TBD*	*TBD*
(3) Benefits of the Process	*TBD*	*TBD*	*TBD*
(3) Changes you would like to see implemented	*TBD*	*TBD*	*TBD*

Research Timetable: