



Executive Summary

This construction management supplement deals directly with evaluation of cost recapture for using Cast in Placement concrete instead of the present Pre-cast system. Over the past 30 years arena construction has used pre-cast installation for time sensitive projects: Note worthy projects which have employed the use of Pre-cast Concrete for building superstructure is listed below.

- | | |
|--|--------------------------|
| 1. Great American Ball Park | <i>Cincinnati, OH</i> |
| 2. Jacobs Field | <i>Cleveland, OH</i> |
| 3. Quicken Loans Arena (Gund Arena) | <i>Cleveland, OH</i> |
| 4. Pacific Bell Park | <i>San Francisco, CA</i> |
| 5. Palace of Auburn Hills | <i>Detroit, MI</i> |
| 6. Erickson Stadium | <i>Charlotte, NC</i> |

According to industry sources, the costs of pre-cast installation is less expensive than a cast-in-place concrete method when Chicago, labor rates are factored in costs. An evaluation was completed to determine the costs and time analysis for constructing the Sears Centre concrete superstructure from CIP instead of Pre-cast concrete. The overall cost differences between the two methods, assuming comparable crew sizes were computed to be:

<u>Concrete Placement Method</u>		<u>Associated Costs</u>
	→	
<i>Pre-cast</i>		\$ 989,966
(less) <i>Cast-in-Place</i>	→	(less) \$ 615,947
<i>Cost Difference</i>		\$ 373,919

Unfortunately the saving presented for using a CIP alternative cannot be realized as benefit due to a conservative project overrun of 35 Days beyond the negotiated, penalty enforce turn over date. If time were not an issue with the fixed turnover date, Cast-in-place concrete would be a lucrative method of cost recovery, assuming time frame has at least 1 to 2-months of flexibility.



CIP/ Pre-cast Costs Comparison

An analysis was performed to determine the cost and time associated with using a CIP method for the Sears Centre superstructure, in lieu of the current Pre-cast concrete placement. Due to inherent project constraints, the Sears Centre project is mandated to adhere to all implications specified by Chicago-land unions. One of the dominate entities of Chicago unions is the Carpenter's local. This will have an apparent effect on the constructability of the Sears Center. Nearly 70% of the building superstructure is composed of pre-cast concrete. The decision to pursue cost recapturing via CIP analysis will be based on three determinants:

Pre-cast → CIP Determinants:

- ❖ Union Factored Labor Costs
- ❖ Formwork Costs (Bent Raker Form Costs)
- ❖ Time Durations

The purpose of the analysis is to determine the magnitude of the costs which can be recaptured via a CIP installation system. If the desired trade off is substantial, condition will warrant further evaluation. The current pre-cast system was chosen for the specific purpose of obtaining the negotiated deadline between Ryan Companies (Design-Builder and CCO Entertainment, September 18, 2006. In order to efficiently compare the two concrete placement method a trade of costs benefit analysis will have to be determined to calculated the costs/ day of overrun will have to be computed.

Superstructure Systems comparisons:

Benefits of Pre-cast construction (Chicago Market)

- ❖ Benefits of Pre-cast
- ❖ Ease of physical procurement
- ❖ Erection can take place in any temperature climate ("All weather erection")
- ❖ Curing time eliminated
- ❖ Union Labor Manufacturing Costs Eliminated
- ❖ Reliability of Pre-cast suppliers
- ❖ Industry movement in resent years has employed the use of pre-cast concrete for arena and stadium superstructure
- ❖ Bent Form costs eliminated
- ❖ Less labor intensive

Drawbacks of CIP (Chicago Market)

- ❖ Increase Labor prices due to union locals
- ❖ Longer Cure times and project durations
- ❖ Weather dependent/ Project duration delays can only be estimated "At best scenarios"



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- ❖ Steel pricing for rebar also affected by labor installation costs, as opposed to mat'l costs

Key Labor Constraints for CIP Construction

Carpenter Hourly Rates:

- ❖ *R.S. Means* \$ 35.55/ HR
- ❖ *Chi Labor Factor Costs* \$ **47.52/ HR**

Δ (Hourly Cost Difference) = (\$ 11.97/ HR)

Structural Steel Workers:

- ❖ *R.S. Means* \$ 39.95/ HR
- ❖ *Chi Labor Factor Costs* \$ **49.45/ HR**

Δ (Hourly Cost Difference) = (\$ 9.50/ HR)

Concrete Workers:

- ❖ *R.S. Means* \$ 34.40/ HR
- ❖ *Chi Labor Factor Costs* \$ **47.86/ HR**

Δ (Hourly Cost Difference) = (\$ 13.46/ HR)

Machine Operator:

- ❖ *R.S. Means* \$ 38.10/ HR
- ❖ *Chi Labor Factor Costs* \$ **53.78/ HR**

Δ (Hourly Cost Difference) = (\$ 15.68/ HR)

- ❖ Increase completion time duration (attributed to concrete installation and curing time)

Drawbacks of Pre-cast construction (Chicago Market)

- ❖ More expense up front costs
- ❖ Lengthier procurement cycle
- ❖ Requires increase time for logistical analysis “Shake down” Area similar to steel construction

Benefits of CIP (Chicago Market)

- ❖ Less expensive to install
- ❖ Elimination of “Shake down” Area

Cost Recapture Strategy:

- “What is the cost difference between a CIP and Pre-cast Installation?”
- “How valid is the upfront decision to use pre-cast over CIP for this project?”
- “What is the cost vs. time duration pay off?”

Identify Member(s) under CIP Evaluation:

- ❖ Please reference accompanying appendix section

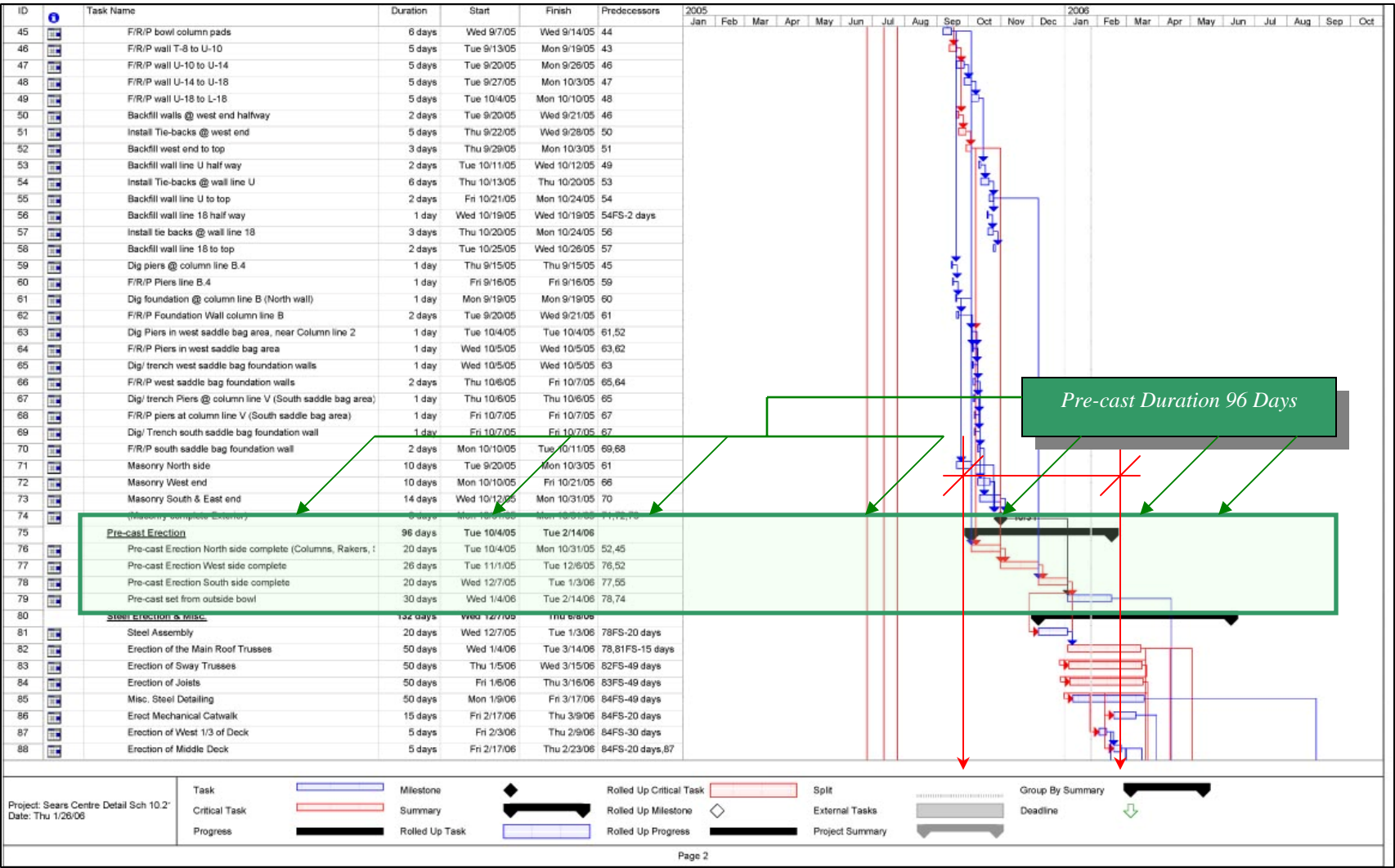


SEARS CENTRE

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Time Impacts: (Current method – Pre-cast Concrete Superstructure)



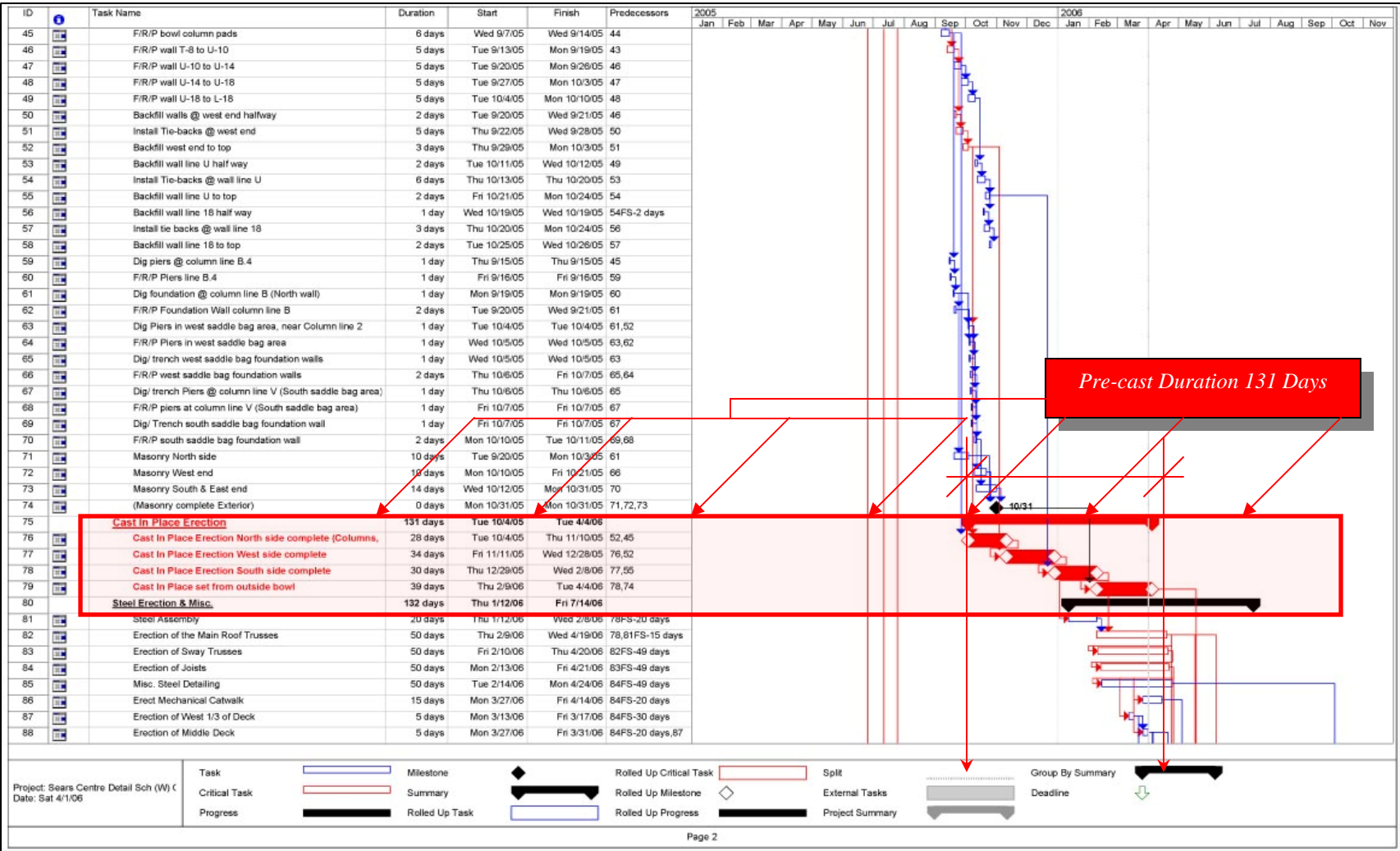


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Time Impacts: (Alternative Method Cast-In-Place Concrete Placement)





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The time assessment analysis has yielded a project duration overrun of 35 crew days for CIP construction of major structural elements. As a result the original project turnover date of **9/18/06** will have to be re-adjusted to **10/24/06**. Since inherent project conditions specify “Liquidated” damages beyond the negotiated completion date, CIP may not be a viable solution used on the Sears Centre. This condition will be evaluated further to determine the costs impacts versus Pre-cast installation.

Cost and Installation Comparison

Pre-cast Concrete Construction Cost:

The current production rate of Spancrete (Current project pre-caster is 20 pieces of pre-cast per day). As a cost comparative analysis, one additional pre-caster (High Concrete) was asked to provide installation production rates for critical columns, beams and rakers. Based on current project information conveyed, realistic durations for pre-cast assemblies were 15 pieces/ day.

Pre-caster	Daily Production	Project Duration	Project Costs
Spancrete	20 Pieces / Day	96 Days	\$ 989,866
High Concrete	15 Pieces / Day	107 Days	\$ 921,022

High Concrete/ Spancrete Costs Difference  = \$ 68,844 (Savings for :)
 High Concrete/ Spancrete Time Difference  = (11) day deficit
Deficit Time/ Costs Trade off = \$ 6,259 per day

CIP Construction Cost:

Aside from labor costs, the most crucial cost encountered for Cast-In-Place construction is formwork rental costs. Standard Beams and Columns can easily be determined from RS. Means or ICE MC² software, however bent form work rental costs can escalate the price of cast-in-place concrete installation. Two leading formwork contractors whom specialize in raker bent form rental are Symons and Shockey Brothers Concrete. Bent raker form rental costs were obtained from Symons Baltimore office. Raker form rental costs for this project were determined by applying a location factor to a MD cost quote.

Standard 18 Riser/ Raker Bent Form Cost Quote [Baltimore, MD] = \$ 3,500 / 28 Day Rental
 Baltimore, MD $CPI_{Index} = 126.3$
 Chicago, IL $CPI_{Index} = 198$
 Adjusted Raker Bent Form Cost Quote:
 $[CPI_{Chicago} / CPI_{Baltimore}] \times \$ 3,500 = \$ 5,464.90 / 28 Day Rental$



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CPI Cost Break Down:

Material & Equipment	46 %	of Total CIP Costs
Formwork Costs	37 %	of Total CIP Costs
Labor	17 %	of Total CIP Costs
Total (Percentage)	100 %	of Total CIP Costs

Concrete Method	Daily Production	Project Duration	Project Costs
Pre-cast	20 Pieces / Day	96 Days	\$ 989,866
CIP	8.40 CY / Day	131 Days	\$ 615,947

CIP / Pre-cast Costs Difference ➔ = \$ 373,939 (Savings for :)

High Concrete/ Spancrete Time Difference ➔ = (35) day deficit

Deficit Time/ Costs Trade off = \$ 17,598 per day

Conclusion:

Although selecting pre-cast generates a costs trade off of \$ 17,598 per day, the resulting reduction in duration, coupled with the elimination of any penalties assessed via liquidated damage clauses is enough refute any costs benefits with using a cast-in-place concrete method.