

---

# A Contractor's Perspective on the Use of High Fly Ash Concrete

---

Anne Graham



CONSTRUCTION LEADERS

---

## Bison Courtyard



CONSTRUCTION LEADERS

## Bison Courtyard

- Commercial/residential development with underground parkade
- CIP concrete structure with some structural steel and glulam
- Designed for a 100 year lifespan



## Bison Courtyard



## Bison Courtyard

- Meets LEED Silver requirements
- PCL is construction manager and general contractor
- Over 3 years for design and development processes



## Bison Courtyard



## Bison Courtyard

- Winter construction
- 35%, 45% & 50% fly ash content used
- Over 3,000m<sup>3</sup> of concrete



## Bearspaw Water Treatment Plant



## High Fly Ash Concrete – Main Differences

- Slower set times
- More difficult to finish slabs
- Higher strengths at 28 to 56 days
- Less cracking



CONSTRUCTION LEADERS

## Slower Set Times

- Formwork can't be cycled as quickly
- Schedule and/or cost implications
- Choice is either more formwork or use additives
- One-sided formwork at Bison Courtyard

## Slower Set Times

- Formwork design “beefed up”



## Slower Set Times

- Experimented on the footings



## Slower Set Times

- One sided wall formwork



## Slower Set Times

- Coordination between formwork sub, formwork supplier and concrete supplier

## Slower Set Times

- Planning in preparation of forms and rebar



## Slower Set Times

- Temperature carefully monitored



### COURTYARD ON BEAR - 0420282 CONCRETE TEMPERATURE AND HEATING RECORD

POUR ITEM: Cistern Pad  
 POUR LOCATION: NW  
 POUR DATE: Feb 5/04  
 PROBE LOCATIONS: H-7 150mm Dep  
 H-6 150mm Deep

AREA OF POUR: 128m<sup>2</sup>  
 HEIGHT OF ENCLOSURE: 1.2m  
 VOLUME OF HEATED AREA: 154m<sup>3</sup>  
 TYPE OF ENCLOSURE: Turf Cables, and Insulated Tarps

Date	Time	Temperatures			Concrete	Location of Concrete	# of Heaters & Type	Total BTU	BTU / CU. Ft.	COMMENTS
		Outside Air	Inside Air	Concrete						
Feb 5/04		High	-3	High	21	NW	4X400 000	1 600 000	10 390	
		Low	-16	Low						
		Present	Present							
Feb 6/04	9:00 AM	High	-3	High	15.6	H-7	4X400 000	1 600 000	10 390	
		Low	-12	Low	17.7	H-6				
		Present	Present							
Feb 7/04	11:00 AM	High	1	High	7.3	H-7	Glycol			Insulated Tarps
		Low	-6	Low	7.8	H-6	Glycol			Insulated Tarps
		Present	Present							
Feb 9/04	11:00 AM	High	-1	High	10	H-7	Glycol			Insulated Tarps
		Low	-11	Low	8.5	H-6	Glycol			Insulated Tarps
		Present	Present							
Feb 10/04	9:00 AM	High	0	High	5.6	H-7	Glycol			Insulated Tarps
		Low	-15	Low	5.3	H-6	Glycol			Insulated Tarps
		Present	Present							
Feb 11/04	9:00 AM	High	-3	High	Obstructed	H-7	Glycol			Insulated Tarps
		Low	-17	Low	4.5	H-6	Glycol			Insulated Tarps
		Present	Present							
		High		High						
		Low		Low						
		Present		Present						

## Slower Set Times

- Curing Times
- Strengths



CONSTRUCTION LEADERS

## Finishing Considerations

- Slower set times means finishers start trowelling later



CONSTRUCTION LEADERS

## Finishing Considerations

- Stickier texture



## Finishing Considerations

- Slumps controlled with plasticizer
- Bearspaw mostly pumped; Bison mostly by crane bucket

## Additional Comments

- Strengths – good strength with proper preparation and curing
- Less cracking – especially good for water retaining structures



CONSTRUCTION LEADERS

## Summary

- Schedule and budget impact
- Formwork design
- Planning is critical
- Communication to subcontractors



CONSTRUCTION LEADERS