

More Efficient Project Delivery by Integration Risk Management and Innovative Project Delivery



**Mine Design, Operations,
and Closure Conference**

Martin Carlson, P.E.

April 30, 2014

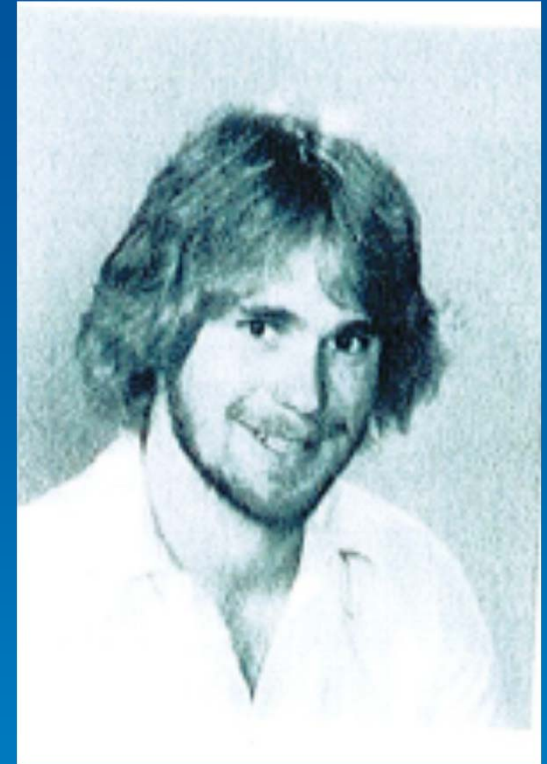
**CDM
Smith®**

Introduction

- Integrated Project Delivery
- My Background
- Traditional Approach
- Risk Management
- Innovative Contracting
- Project Examples

My Background

- Education in environmental and geotech/civil engineering - MT Tech
- Started work in both fields – diverse background with construction
- Design build at young age – hard bid
- Many technical and construction mentors
- Forced to learn integration or lose money



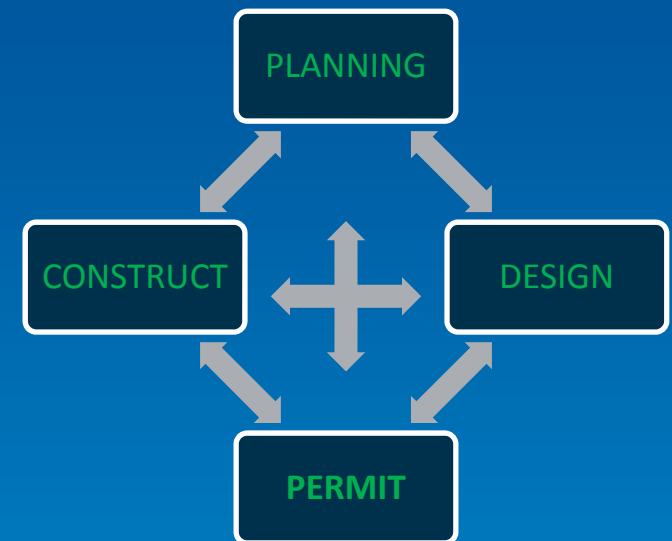
Standard Practice – Clients and Consultants Siloed

- Most Client's, consultants, and contractors do not operate in an integrated world
- Most major service areas separate entities (Silos)
 - Planning/permitting
 - Data collection, characterization, BA, NEPA, ESA, etc.
 - Design
 - Construction
 - Maintenance
 - Operations
- Most do not understand project integration because they don't understand all the other silos



What is an Integrated Solution?

- Integration – difficult, inefficient, most individuals do not understand other silos
- Need broad based individuals trained to understand all project elements or great team facilitators
- When we get it right it's a beautiful thing
 - All components from start to finish consider other components – efficient and save \$



Why Integrate?

- Non-integration = lost \$
- Integration of Data Collection / Design / Permit / Construction Practices
 - Reduces data collection (i.e., only get what is needed)
 - Increased project efficiency & speed
 - Construction flexibility
 - Reduce construction change orders and issue's
 - Find lowest cost highest value solution
- Many great projects lose opportunity savings

Integration Starts Early

- Site Characterization/Data Collection
 - Understand design / construction data needs
 - Only collect data needed to plan and support design and reduce construction risk
 - Money wasted on data for the sake of science rather than to support design / construction



Design / Permitting / Construction Integration

- Design / Permitting
 - Permitting should be completed or at least considered during design
 - Can permitting be avoided
 - Design to minimize permit impacts
 - Maximize construction flexibility to reduce construction costs
 - Permitting time-frame
 - Constructability of design
 - Cost of construction
 - Risk Management

Risk Management

- Improper risk management drives up costs makes integration difficult
- Too much risk on engineer - conservative design greater construction cost
- Too much risk on contractor - greater cost
- Must find right balance between risk transfer and cost

Innovative Construction Contracting

- Traditional Design-Bid-Build
 - Works well in many cases
- Design Build
 - Flexible & can facilitate integration
- Design Build Contracts
 - Lump sum
 - Cost plus a fee, GMP
- Time & Materials with trusted Partner

Mine Subsidence Closure Montana

Design Phase

- Subsidence open to ground surface
- Voids into hundreds of 1000's of yards under vent raise
- Backfill not feasible
- Developed conceptual design for steel reinforced foam plug, placed on competent rock collar



Mine Subsidence Closure Montana

Construction Phase

- Developed design-build approach based on concept design
- Major field change when rock collar not as competent as thought
- Identified Early - Redesigned over weekend = no delays
- Met concept design and no change order
- Must have right engineer working with construction



5/16/2013

**CDM
Smith**

Mine Closure Near Blythe, California

- Two abandoned Gypsum Mines
- Over 150 openings to surface
 - Room and Pillar stoping to surface
 - Vent raises
 - Adits
 - Open cut to underground
- Public Safety Risk Nightmare
- Openings Scattered over 6 square miles



Mine Closure Near Blythe, California

Phase 1 – Not Integrated

- Design Engineer – Plans to close 30 easiest of the 150 openings
- Hard Bid traditional approval
- Cost - \$750,000
- Indicated most difficult openings should be fenced off
- Estimated \$3.5 million to close all openings



Mine Closure Near Blythe, California

Phase 2 – Total Closure – Integrated

- Developed Integrated DB approach with Client – TRUST
- Cost plus a fee-risk management
- Detailed field reconnaissance
- \$25,000 conceptual design
 - Super Flexible
- Backfill, drill & blast, foam, bat gates
- Closed 130 openings in 8 weeks
- Plan changed often during construction
- Cost \$975,000



Mine Closure Near Blythe, California



Sediment Plugged - Rail Bridge in CA

- Phase 1 (no integration)
 - Bridge plugged
 - Permit, design, construction a disaster



Sediment Plugged - Rail Bridge in CA

- Phase 2 (integrated)
 - 6' bridge raise with mile of track raise
 - Needed 120,000 CY of fill
 - Designed and Permitted in 3 months
 - Saved \$3M in fill cost
 - Improved bridge function



Questions

Martin E. Carlson
Vice President
CDM Smith Inc.
(406) 441-1404
carlsonme@cdmsmith.com



5/16/2013

**CDM
Smith**