

COAA BEST PRACTICES CONFERENCE XXIII Driving to Excellence, Thriving Amid Challenge: Twice as Safe, Twice as Productive by 2020 Shaw Conference Centre

9797 Jasper Avenue, Edmonton, Alberta

May 12th & 13th, 2015

WELCOME TO COAA BEST PRACTICES XXIII

Tuesday -	- May 12 th 4:00 – 9:30 pm	Wednesda	ay – May 13 th 8:00 am – 4:00 pm
11:30 am	Preconference Short Courses AWP Implementation: Creating Your Recipe for Success – Lloyd Rankin / ASI Group 11:30 am – 3:00 pm. To attend, please register at: http://www.groupasi.com/sitemap		
11:00 am	Lean Construction 101 – GO Productivity 11:00 am – 3:00 pm. To attend, please register at http://bit.ly/1Mty1zS		
	Best Practices Conference		Best Practices Conference
3:00 pm	Registration Desk opens (coffee & juice available)	7:00 am	Registration Desk opens (coffee, juice, muffins & fruit available)
4:00 pm	 Welcome, safety moment and productivity moment report from the COAA Board report from Industry Leaders Roundtable 	8:00 am	 Welcome, safety moment and productivity moment Plenary Session Driving to Excellence – reports of the Best Practices committees Workforce Forecast & Demand Projection
4:30 pm	Panel Discussion – Safety and Productivity by the Numbers	10:15 am - 4:00 pm	Workshops - 17 topics presented in three tracks
5:45 pm	Supper Buffet	11:45 am – 12:45 pm	Lunch Buffet
7:00 pm	COAA Award Presentations	12.45 pm	
7:30 pm	Keynote Speaker – Ed Merrow – Safety and Productivity – Leadership from the Top		
8:15 - 9:30 pm	Reception & Networking		

Tuesday Highlights

- Get the straight goods from industry leaders with the benchmarking panel discussion: **Safety and Productivity by the Numbers**. Moderated by COAA President Ernie Tromposch, the panel features benchmarking experts Keith Mayo of Independent Project Analysis, Larry Sondrol of Suncor, and Dr. Stephen Mulva of the Construction Industry Institute
- Catch up with colleagues from across our industry at supper and an evening reception
- Applaud workforce development excellence at the COAA Awards presentation
- Broaden your knowledge base: listen to **keynote speaker Ed Merrow** on what the numbers are telling us about leadership as it relates to safety and productivity
- Discover a million-dollar idea at one of the information booths and R&D poster presentations

Wednesday Highlights

- Best practices available and in the pipeline tools to achieve "Twice as Safe, Twice as Productive"
- Look into the future with the ever-popular presentation on the **BuildForce Canada Workforce Forecast** and the **COAA Demand Projection**.
- Tap into the heart of BP XXIII by making your pick from 17 great workshops in three tracks



COAA BEST PRACTICES CONFERENCE XXIII Driving to Excellence, Thriving Amid Challenge: Twice as Safe, Twice as Productive by 2020

Safety Committee Workshops	Track A 10:15 – 11:45	Track B 12:45 – 2:15	Track C 2:30 – 4:00
Moving from Safety 2000 to Safety 2020 Significant progress was made in safety from 2000 to 2010. That decade saw organizations gain a better understanding of safety management systems plus the development of new approaches and tools for addressing safety. We are halfway through the next decade and safety improvement has slowed and in some cases even plateaued. It is time for a refresher on the safety fundamentals that lead to the improvements and time to explore the new approaches that will allow us to build off those fundamentals and make progress toward being ' <i>Twice as Safe by 2020</i> '. This presentation will provide both this refresher of the fundamentals and exploration of what needs to be done in the next five years.	~	~	
Winter Works Best Practice This Best Practice received initial feedback at the 2014 Conference and through the past year it is now ready for formal rollout. Learn about the best thinking on the topics of site preparation, equipment readiness plus PPE and crew preparedness. Ensure your company is aware of leading practices to deal with the chilly realities of Canadian winter and be ready when the thermometer starts to drop!	~		
Canadian Model 5.0 – Initial Implementation and Experiences Version 5.0 was launched in October 2014; learn from industry leaders and peers about how they are implementing updated procedures, e.g. for risk assessment, for voluntary disclosures about prescription medications. Ask questions which could turn into FAQ's on the web site! This will be a workshop dialogue between committee experts and the community of practice in Alberta heavy industrial construction.		~	¥
Online Perception Survey and Employer Analytics Tool Perception surveys are a critical component of any HSE program. Injury Alberta is an online perception survey tool that organizations can distribute to its workers, then analyze anonymous, aggregated results to identify problems or trends and take appropriate action where needed most. From actionable worker scorecards to industry benchmarking, learn how your organization can get started today!		~	



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Workforce Development Committee Workshops	Track A 10:15 – 11:45	Track B 12:45 – 2:15	Track C 2:30 - 4:00
Industrial Construction Crew Supervisor ICCS (Industrial Construction Crew Supervisor) is a designated Occupation with Alberta Industry and Trade and can help make front- line leaders safer and more productive. Learn about the implementation challenges and successes first hand from members of the ICCS Industry Steering Committee: Owners, Contractors, and Labour.	~		~
Get the Canada-Alberta Job Grant Working for You Now could be the right time to train your employees and increase workforce efficiency. The Canada-Alberta Job Grant can offset your investment, by providing up to \$10,000 per trainee. Many Alberta employers are already taking advantage of the grant on a wide variety of training programs that are benefiting their staff and their bottom line. Learn about the eligibility requirements, the application and reimbursement process, and find out how others in the construction industry are using the Canada-Alberta Job Grant to train workers. Presented by the Government of Alberta, Jobs, Skills, Training and Labour. <u>www.AlbertaCanada.com/jobgrant</u>		~	

Construction Performance Committee Workshops	Track A 10:15 – 11:45	Track B 12:45 – 2:15	Track C 2:30 – 4:00
Benchmarking 10-10 Program: From Lagging to Leading The new Construction Industry Institute 10-10 benchmarking uses more frequent, shorter questionnaires which focus on team effectiveness. 10-10 works in conjunction with the existing benchmarking program. Benchmarking Phase 3 has recently kicked off; an overview of initial progress will be provided. Workshop attendees will leave with an understanding as to how project performance can be improved and an appreciation of the power of COAA benchmarking tools and how they can add value to Alberta projects.	✓		•
Managers – Listen to Your Workers The workers on this panel discussion are the boots on the ground of your projects, who "make it happen" despite management's best efforts. Hear firsthand from front line supervisors as they discuss approaches to project planning, safety culture, productivity in the real world and leadership at the workface. You will walk away with a new appreciation and insights.			~



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Construction Performance Committee Workshops	Track	Track	Track
-	Α	В	С
	10:15 - 11:45	12:45 - 2:15	2:30 - 4:00
Learnings from the Project Productivity Survey			
The COAA Productivity Committee is currently developing a best practice guideline for improving construction productivity throughout the project lifecycle – suddenly a hot topic in the present economic conditions! The intent of the Construction Productivity Best Practice is to provide guidance to project teams on what tools, tactics and techniques can be applied - by whom and when. Reducing effort, waste and defects, and improving collaboration requires input from all contributors, so an industry survey has been circulated to capture learnings to be incorporated into the development of the best practice. Building on those learnings, this interactive session will allow attendees the opportunity to contribute to Alberta's future by increasing our ability to deliver on time, on budget and without harm.		~	
Advanced Work Packaging and WorkFace Planning 101 Do you keep hearing the names Advanced Work Packaging or WorkFace Planning? Not sure what they are or what they mean? Have you seen these terms as contractual requirements but have no idea what is being asked? Then please join Robin Mikaelsson and Ben Swan for a presentation on the basics of AWP/WFP. They will take you through an overview of the planning methodology basics and in the Q&A would be happy to answer the burning question of "where do I start"?	~		v
Module Assembly Best Practice – Lower Your Total Installed Cost			
To increase the competitiveness of Alberta's energy sector, a proven strategy of progressive construction owners is to increase modularization of their projects to reduce total installed cost. A Module Assembly Best Practice is being developed with a focus on early engagement of engineering, fabrication and assembly. A dynamic team of construction owners, design engineers, support groups and module assemblers is working hard to create and implement this Best Practice. To find out how your next project can benefit, come and hear what is being developed and how you can participate in shaping the future of this best practice.		~	
Aligning Engineering & Procurement with Construction			
Good project management practices have demonstrated time and again that improved front end deliverables greatly enhance success in the construction phase. To date, however, there have been no best practices, tips or tools to assist with the actual process of doing just that. Come to this workshop to be among the first to see the findings of this CII initiative, which will be formally published this summer. Included is the generic table of contents for a Project Execution Plan, highlighted to show which areas are critical to alignment, plus other new tools and tips to more effectively engage suppliers, to automate your processes, and to audit your progress towards full alignment.	✓		v



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Construction Performance Committee Workshops	Track A 10:15 – 11:45	Track B 12:45 – 2:15	Track C 2:30 – 4:00
Case Studies: Validation of AWP Recommended Practice Are you a "show me" project manager or perhaps you have a "show me" boss – if so, this is the workshop for you. We will be presenting more evidence, demonstrating that the Advanced Work Packaging best practice yields successful projects. New evidence shows that as AWP maturity improves, predictability of project performance increases. Listen to Owner testimonials that show that AWP is effective not only on oil and gas megaprojects, but is just as effective in other industries and on midsize or small projects as well. Gain the knowledge and the confidence needed to implement AWP on your projects.		~	
Engineering Work Packages – the Owner's Perspective If you are part of the Owner's team managing the engineering / procurement phases during FEED, this workshop is focussed on you. Accurately forecasting the progress and expected completion dates of each Engineering Work Package and Procurement Work Package are critical to meet the approved Path of Construction and to meet the intent of your AWP implementation. Which KPI's need focus to ensure that engineering and procurement packages are aligned? This workshop will explore decisions and actions within Owner control that help or hinder FEED progress. Owner feedback on these observations and suggestions will be valued. We expect this to be a very active workshop - roll up your sleeves and sign up!		~	
COAA Partner: UAlberta Hole School of Construction Engineering Connecting Real World Challenges with R&D Solutions Dr. Aminah Robinson Fayek and her research team invite interested companies to attend this session and explore how ongoing R&D research can provide practical solutions to real world problems facing the Alberta construction industry. The session will highlight a combination of practice-ready research, preliminary findings from ongoing research, and new research that offers opportunities for participation. Findings, based on several years of data collection, will identify the most significant factors and practices affecting labour productivity. Additionally, initial results on the level of both owner and contractor organizational competencies and their links to project performance will be presented. This workshop provides both an overview of potential R&D solutions and structured, interactive conversations with the researchers, with an emphasis on putting the research deliverables to work to improve project performance and increase competitiveness.	✓		



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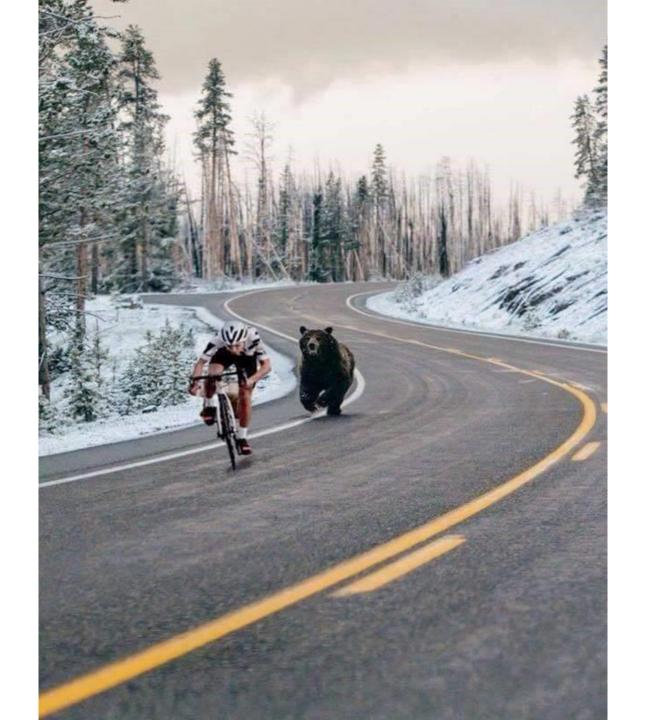
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Construction Performance Committee Workshops	Track A	Track B	Track C
	10:15 - 11:45	12:45 - 2:15	2:30 - 4:00
COAA Partner: GO Productivity			
Never Waste a Perfectly Good Crisis: Improving Productivity When Uncertainty is High			
The sky is falling! The sky is falling! It's easy to believe that the economy is collapsing and there's not a bright spot to be found for any company. It can be a self-fulfilling prophecy if you see only the problem, not the opportunity. Now is a good time to take new looks at ongoing challenges, to ask hard questions, and to find new, innovative solutions. Join GO Productivity for an overview of what companies and project teams are doing right now to address their productivity challenges - including supply chain collaboration, roll-out of integrated project delivery (IPD), and internal business and process improvements. GO Productivity will provide implementable ideas for your team as you look for innovative solutions and tools to apply to your projects, <i>en route</i> to a more profitable and productive future in Alberta and Canada.	~		~

Scope of Work Best Practice – Standardize and Structure for SuccessCOAA believes that development and implementation of a fit-for- purpose Scope of Work template will facilitate successful project outcomes. A standard approach will lead to increased visibility into the scope responsibility splits, reduce project costs, assist in prioritizing schedules and mitigate contract extras, through clarity of obligations for both the Owner and Contractor. This Best Practice will provide project management professionals with standardized templates and supporting documents to assist cross-functional project			
purpose Scope of Work template will facilitate successful project outcomes. A standard approach will lead to increased visibility into the scope responsibility splits, reduce project costs, assist in prioritizing schedules and mitigate contract extras, through clarity of obligations for both the Owner and Contractor. This Best Practice will provide project management professionals with standardized			
teams to develop a fit-for -purpose Scopes of Work for their specific projects. The workshop will present an outline of the Best Practice, report on deliverables completed to date, and seek interactive feedback between the attendees and committee.	~	v	

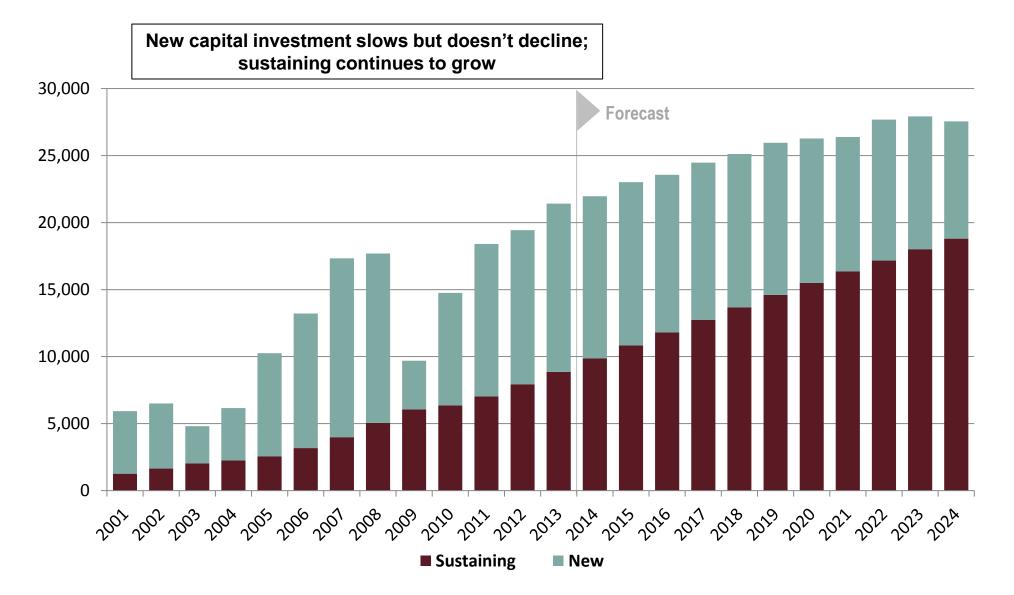
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Construction Best Practices Conference Forecast 2015

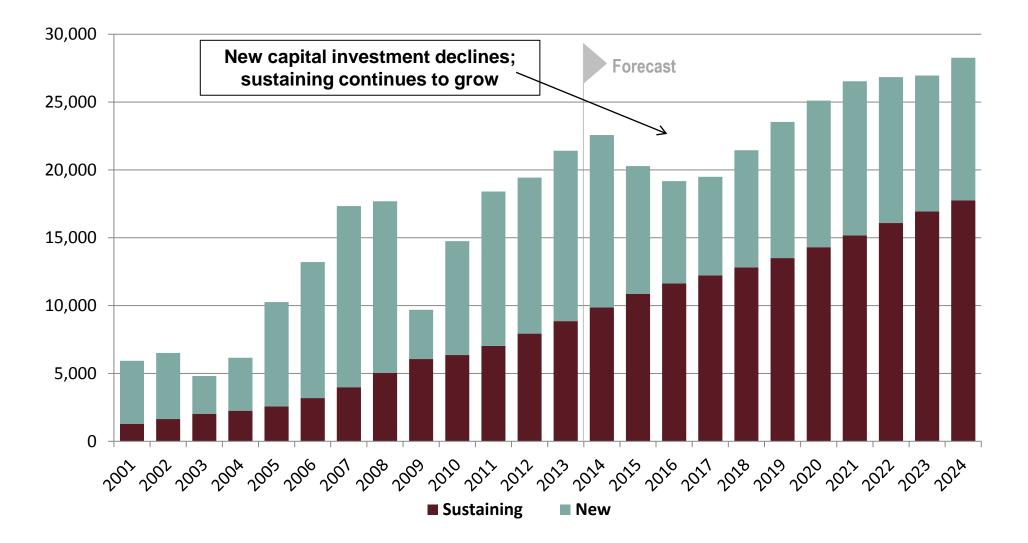
What's Coming Down the Pipe?



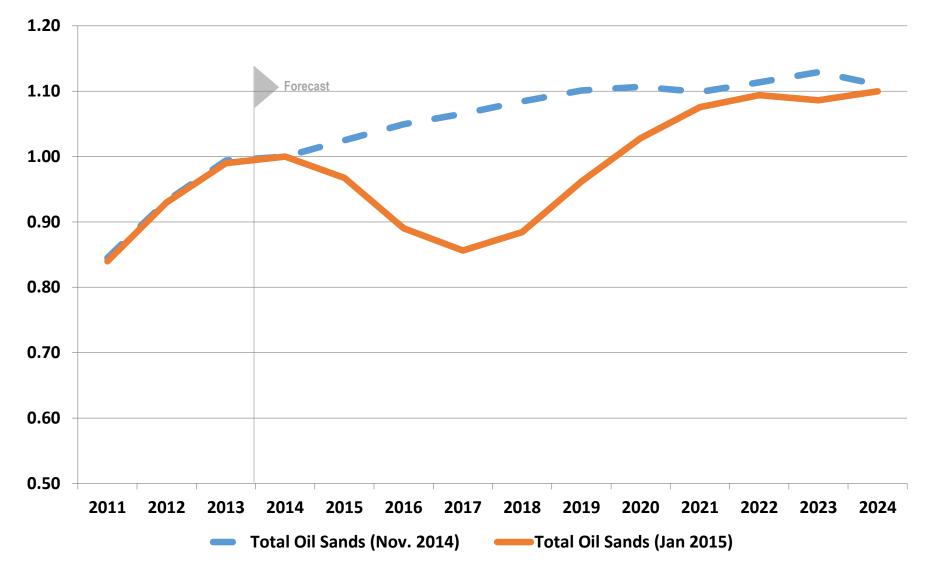
Oil Sands – November 2014 (\$2007 Millions)



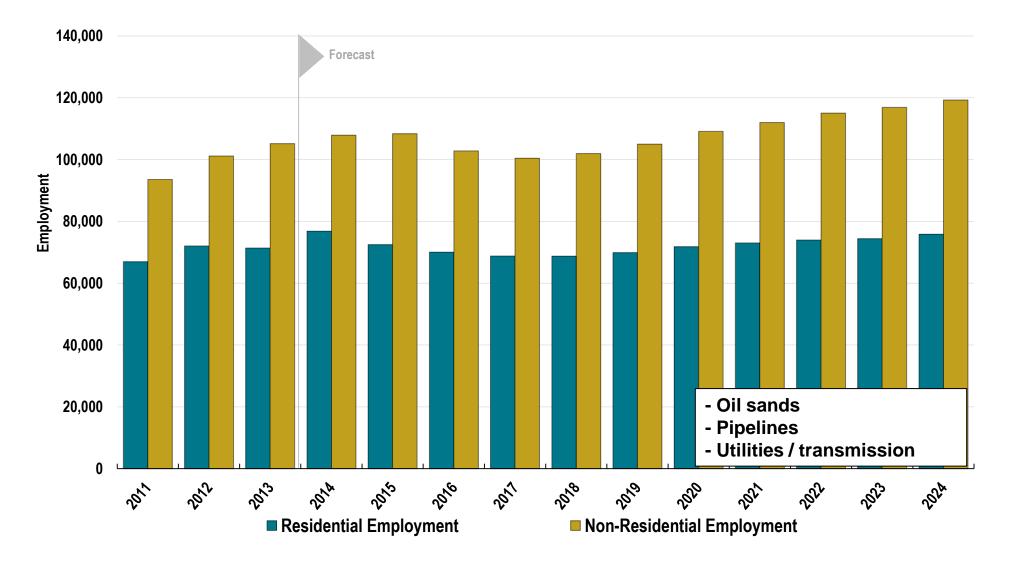
Oil Sands – January 2015 (\$2007 Millions)



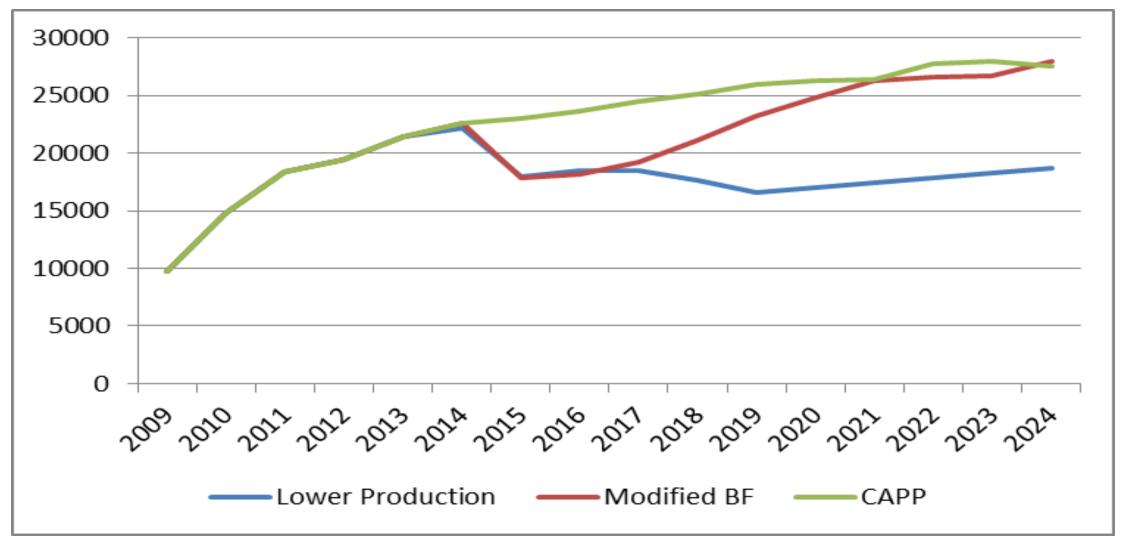
Oil sands construction employment (2014 = 1.0)

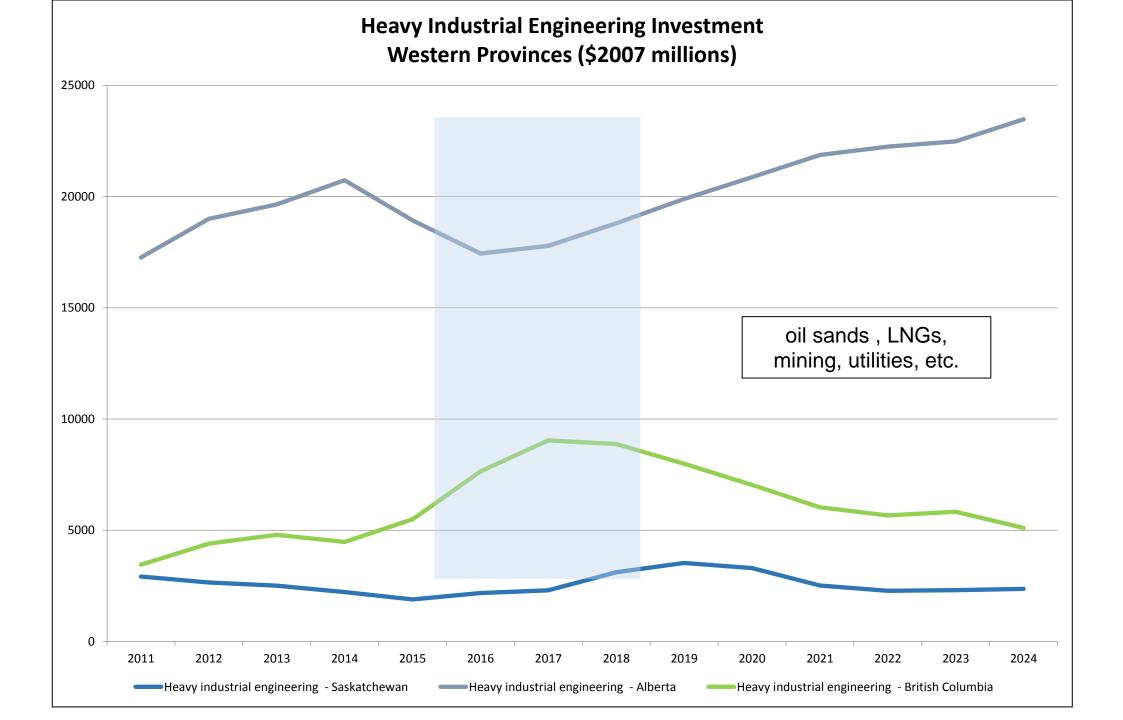


Construction Employment Alberta



Forecast Oilsands Investment if CAPP Production Forecast Reduced (2007 \$millions)



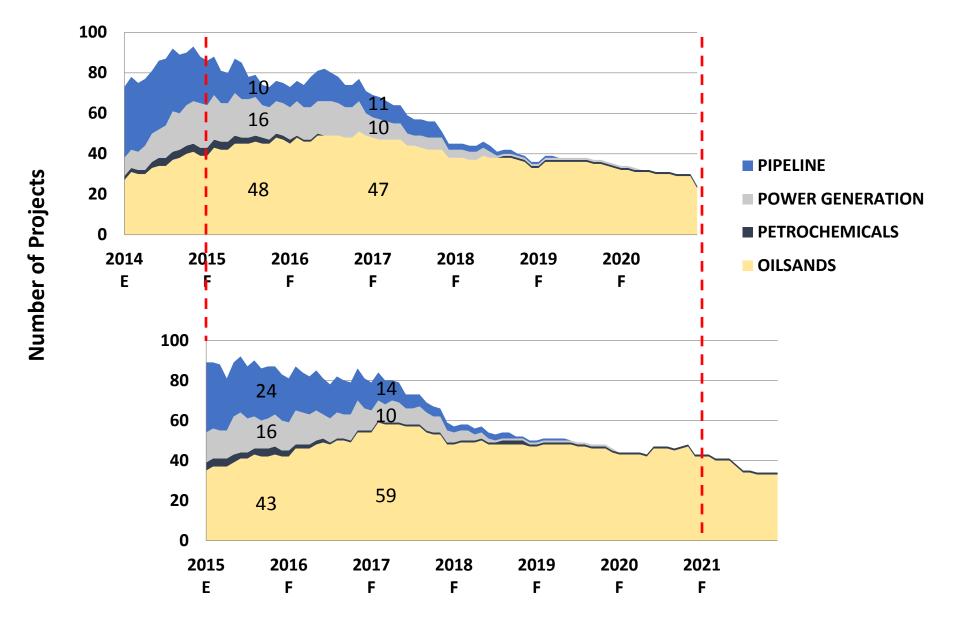


36,000* construction workers are expected to retire over the next years The province's Alberta will need labour force grows by to attract about workers following the new construction workers 2015-2017 slowdown. over the next 10 years.

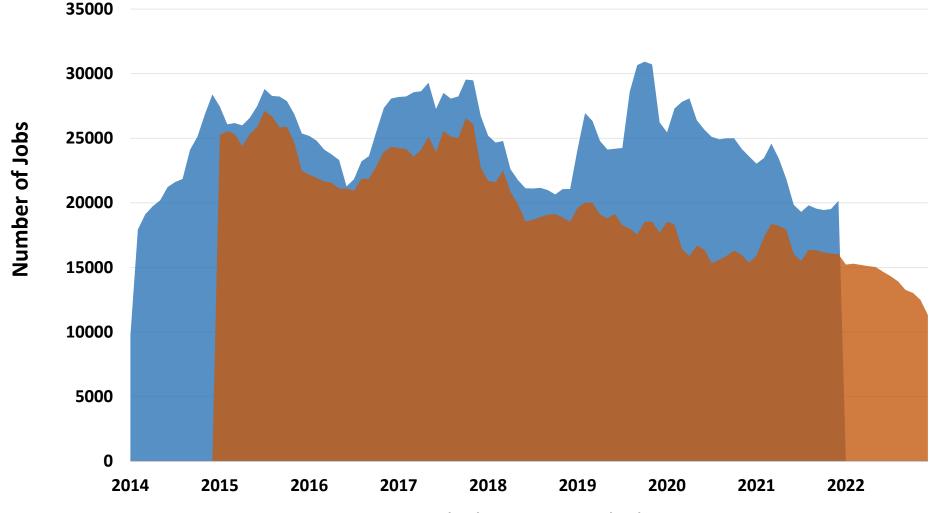
WHAT'S CHANGING IN THE ALBERTA CONSTRUCTION INDUSTRY?

* 18% of the current labour force Source: BuildForce Canada (data as of February 2015)

TIMING OF PLANNED NEW CONSTRUCTION

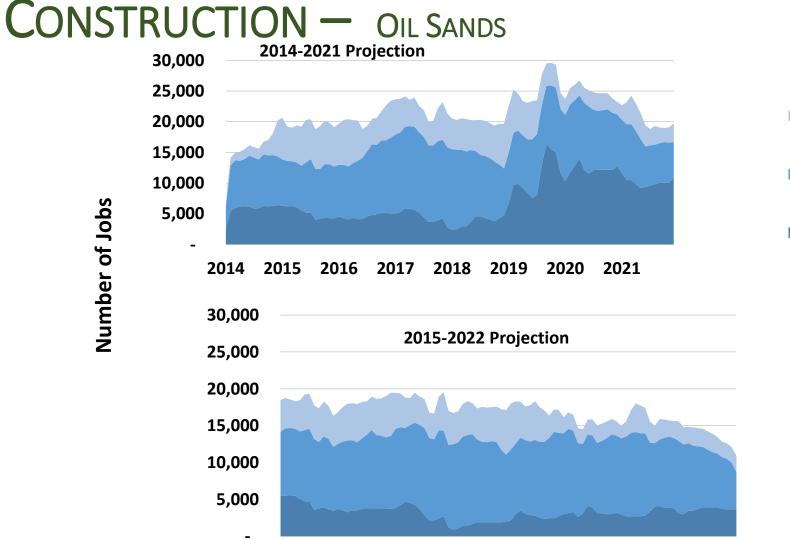


ON-SITE WORKFORCE NUMBERS FOR PLANNED NEW CONSTRUCTION



2014 projection 2015 projection

ON-SITE WORKFORCE NUMBERS FOR PLANNED NEW

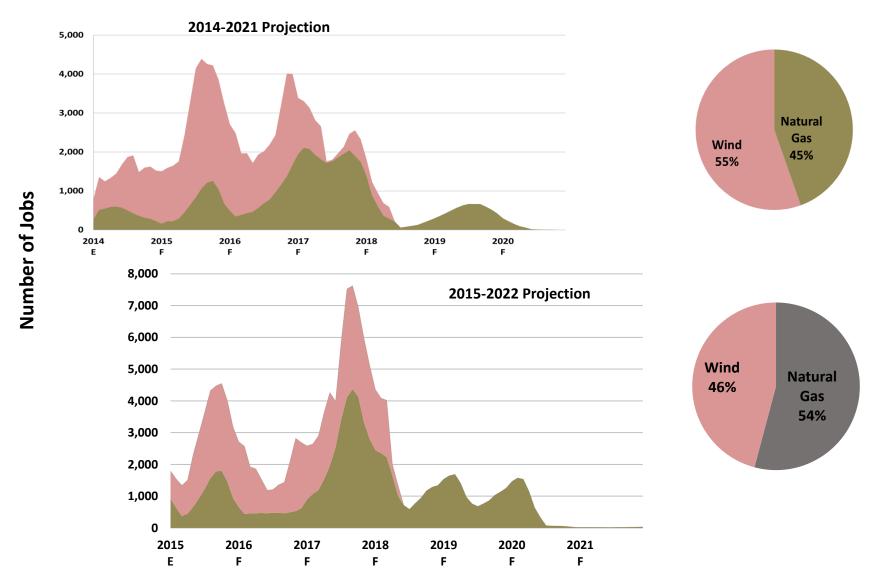


2015 2016 2017 2018 2019 2020 2021 2022

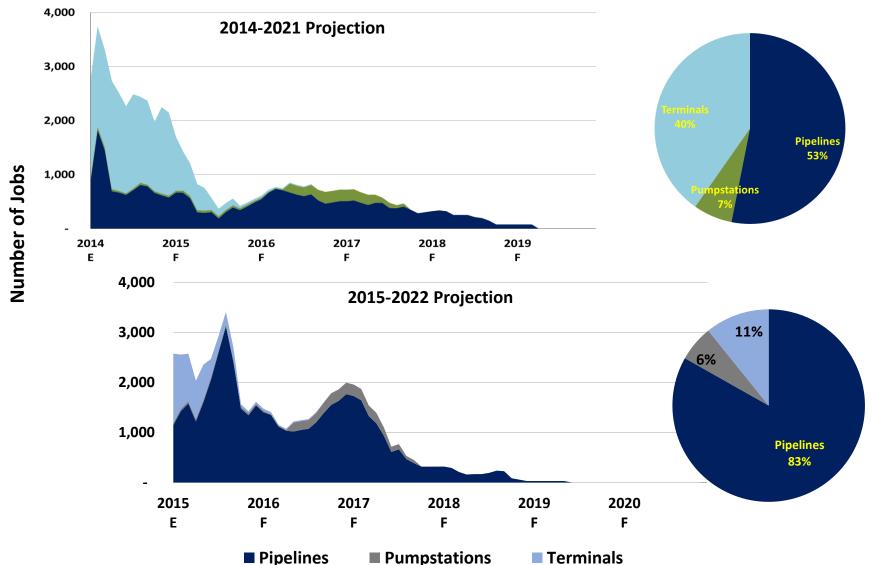
On-site upgrader construction

- On-site in-situ construction
- On-site mining construction

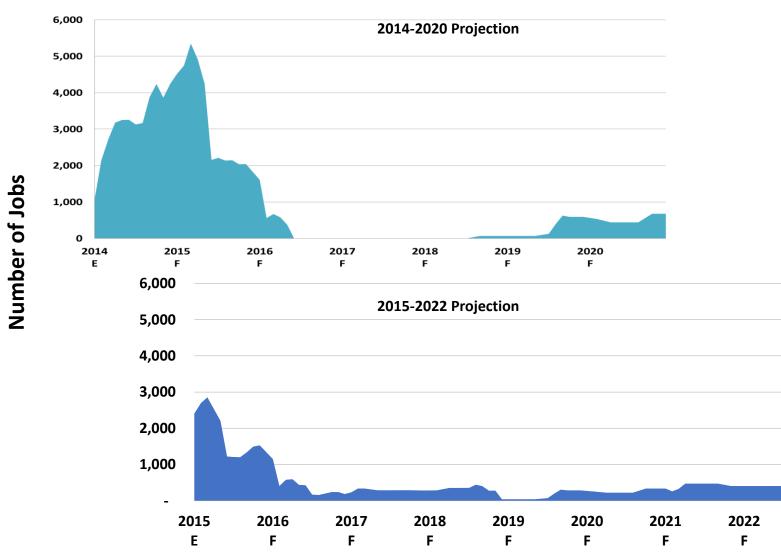
ON-SITE WORKFORCE NUMBERS FOR PLANNED NEW CONSTRUCTION - POWER GENERATION



ON-SITE WORKFORCE NUMBERS FOR PLANNED NEW CONSTRUCTION - PIPELINE

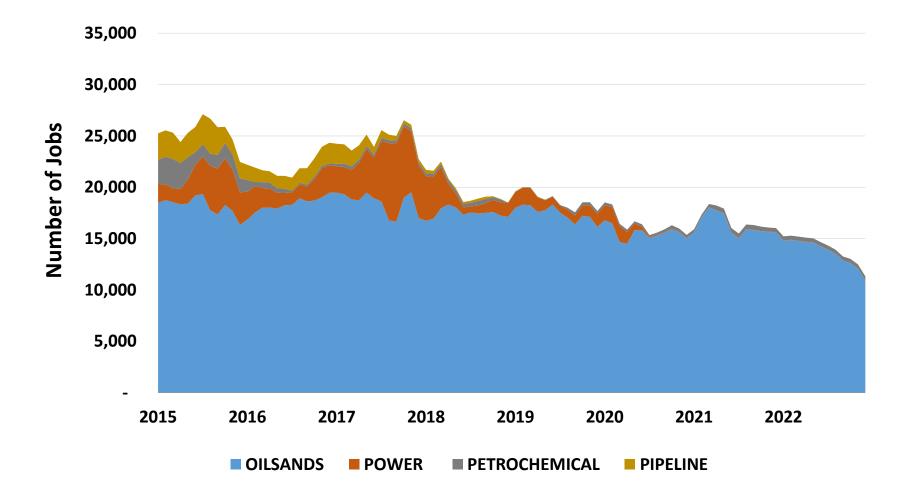


ON-SITE WORKFORCE NUMBERS FOR PLANNED NEW CONSTRUCTION - PETROCHEMICALS

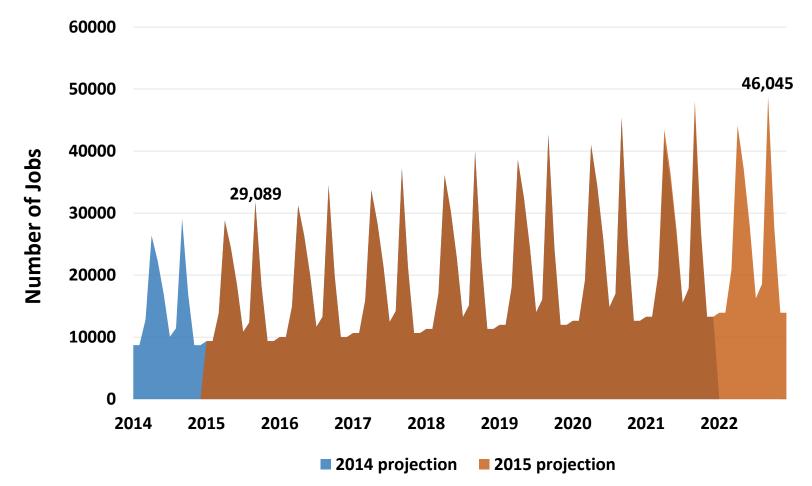


ON-SITE NEW CONSTRUCTION EMPLOYMENT

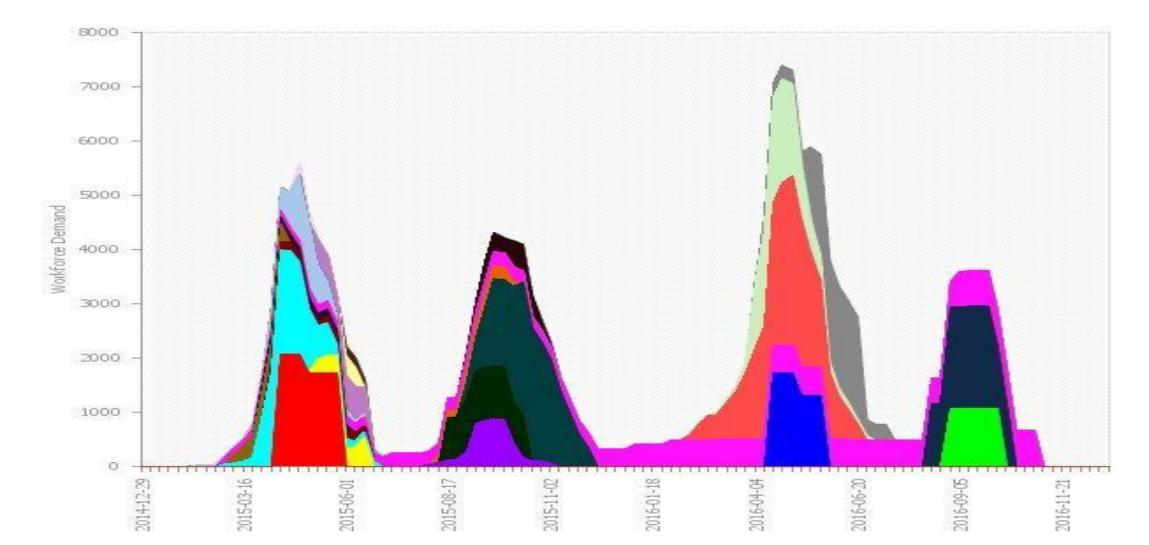
(OIL SANDS, POWER, PIPELINE & PETROCHEMICALS)



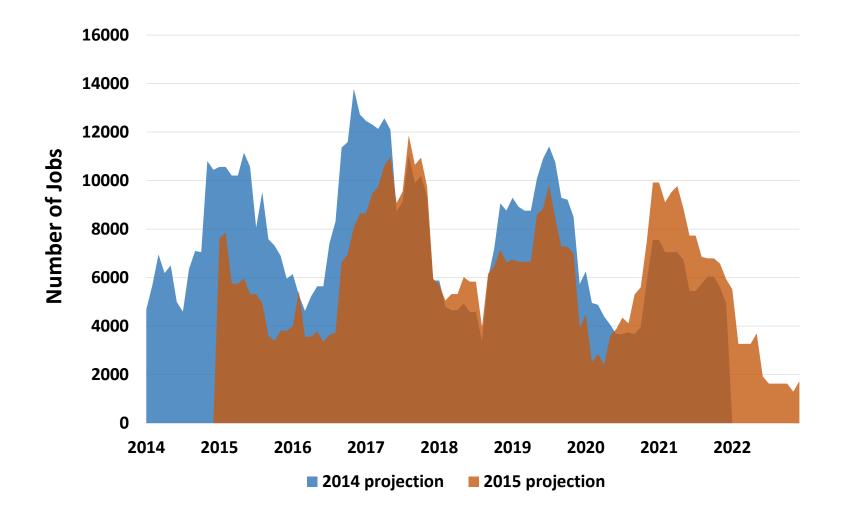
ON-SITE TURNAROUND AND ONGOING MAINTENANCE



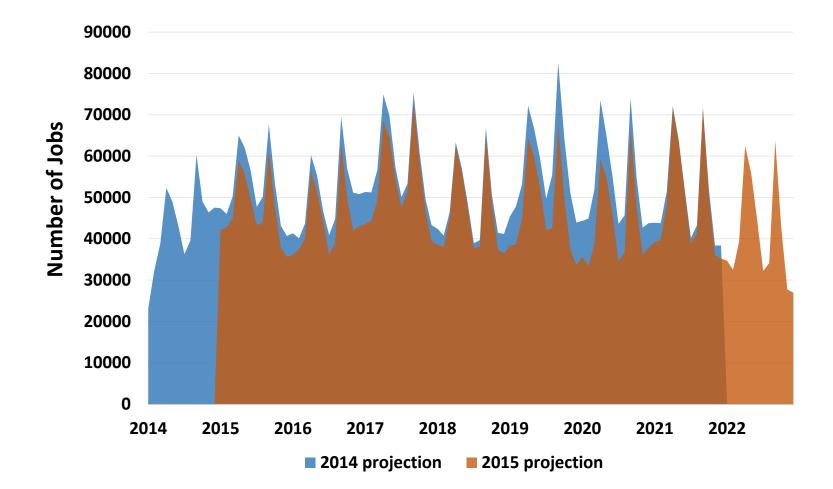
Estimated Shutdown Workforce Demand 2015-16



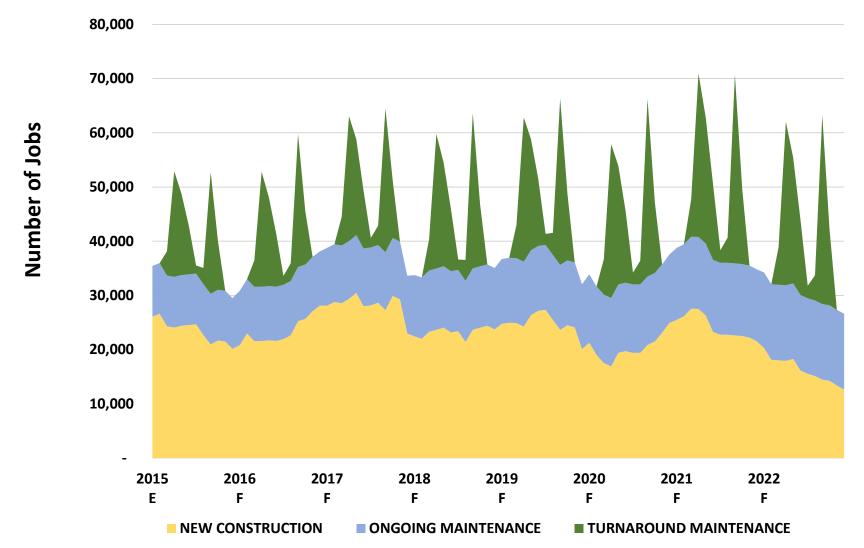
OFF-SITE MODULE FABRICATION



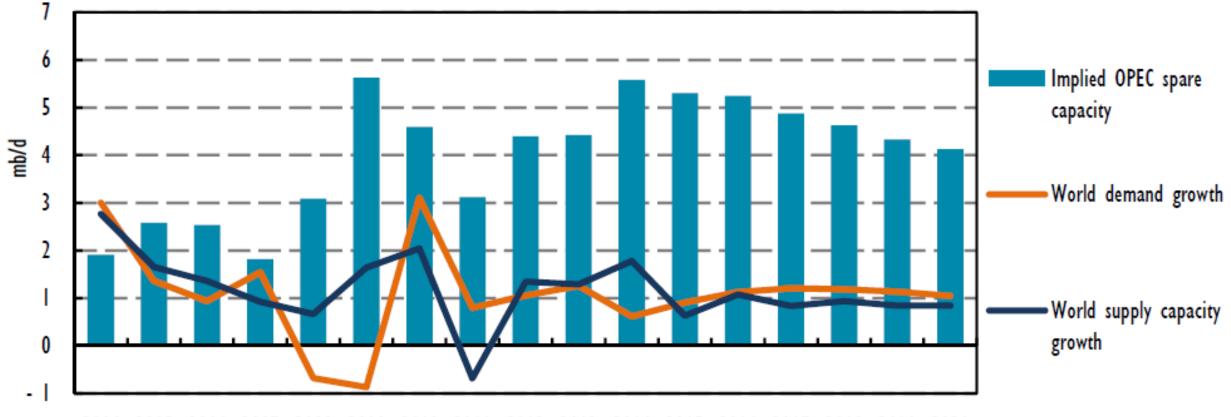
ON-SITE CONSTRUCTION, OFF-SITE MODULE FABRICATION, MAINTENANCE



ON-SITE CONSTRUCTION WORKFORCE REQUIREMENTS BY CONSTRUCTION TYPE

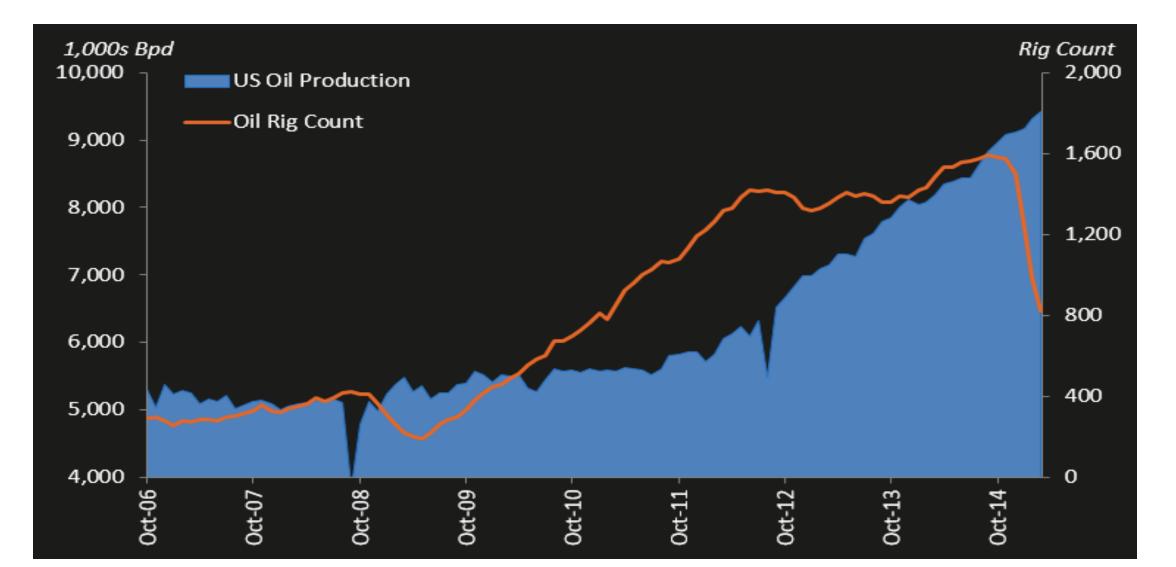


Oil Supply/Demand Loses Synchronicity



2019 2020

US adds four mm/Bpd since January 2010



How OPEC Supports the Price of Oil

- In 2008 as oil prices fell OPEC cut production
- OPEC increases production 2009 through 2012 to control price increases
- 2012 to 2014 OPEC regulates production to maintain avg. \$110 Brent oil price
- Brent price drops in 2014 in response to Saudi Arabia dropping price to Japan and certain other customers
- Price drops precipitously through latter 2014 yet OPEC maintains very high production levels

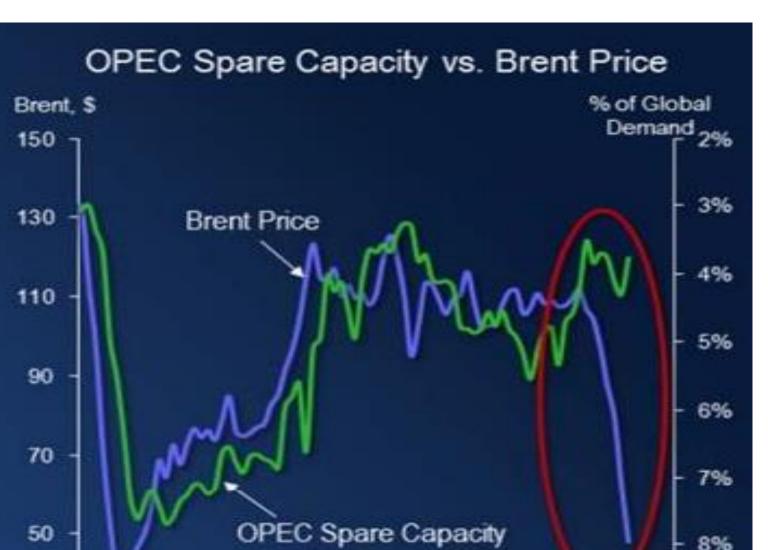
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2008

2009

2010

• Not all of OPEC supports these production levels



2012

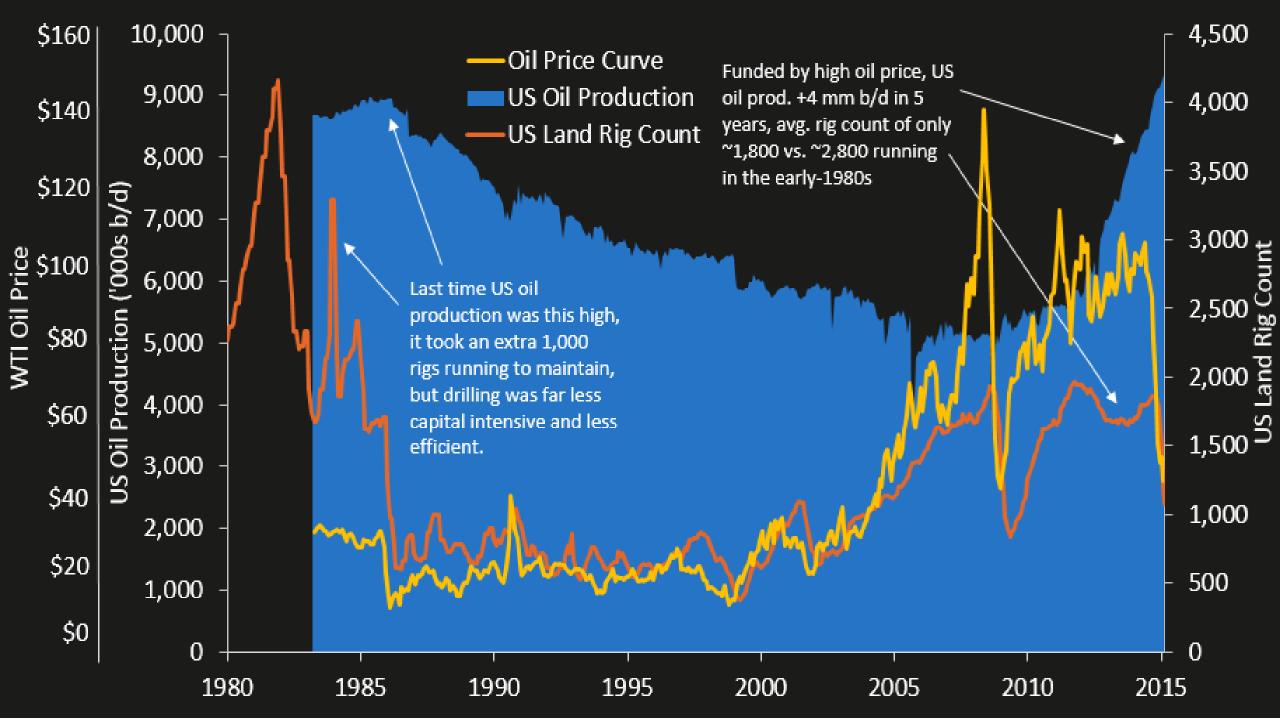
2011

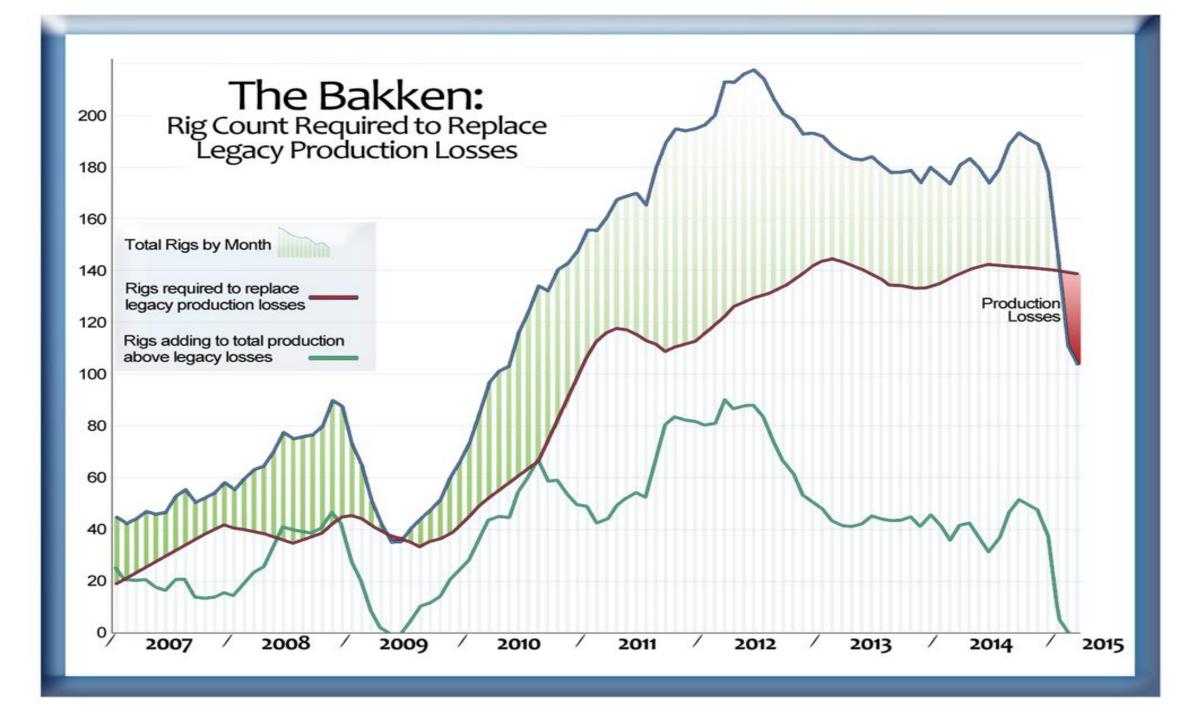
2013

2014

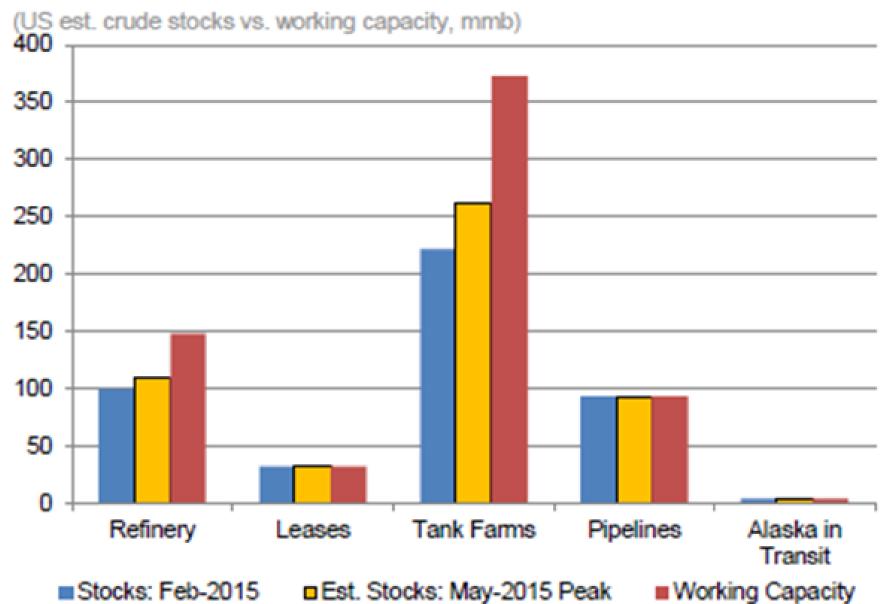
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2015





Plenty of Storage To Absorb Record US Crude Inventories in 2015



• "Further, it's our view that North America will continue to be the most adaptable market in terms of addressing well economics through both efficiency models and technology uptake. One way to look at it is that the U.S. unconventional business is now the lowest-cost, fastest-tomarket incremental barrel of oil available in the world today." Jeff **Miller, President at Halliburton**



Cushing, OK Crude Oil Future Contract 1

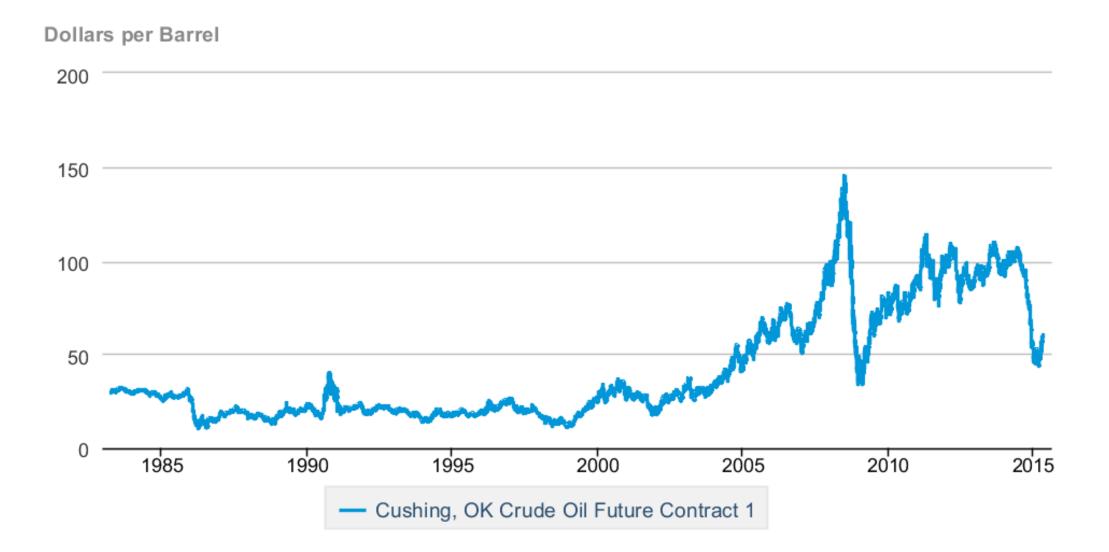




Figure ES1. North Sea Brent crude oil spot prices in four cases, 2005-40

2013 dollars per barrel

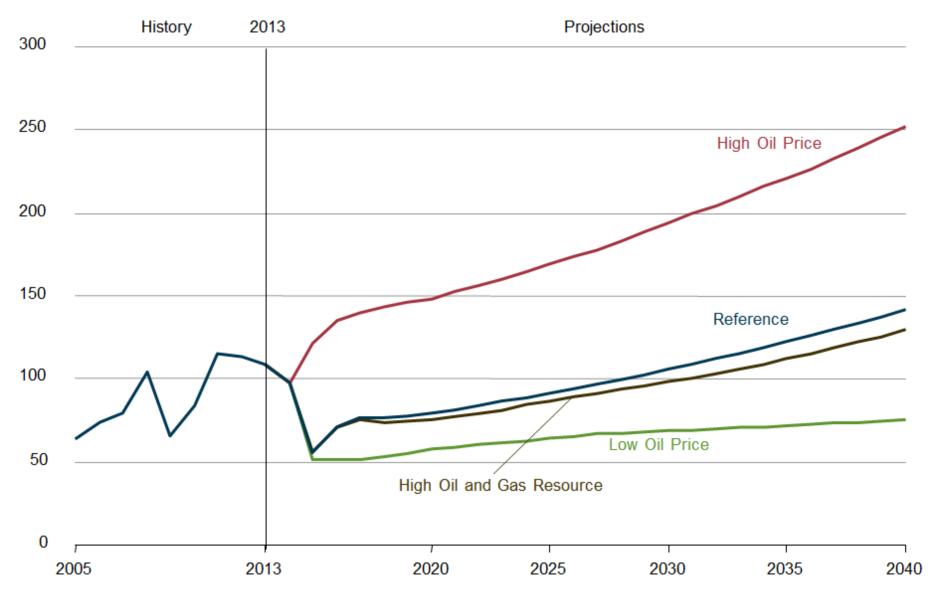
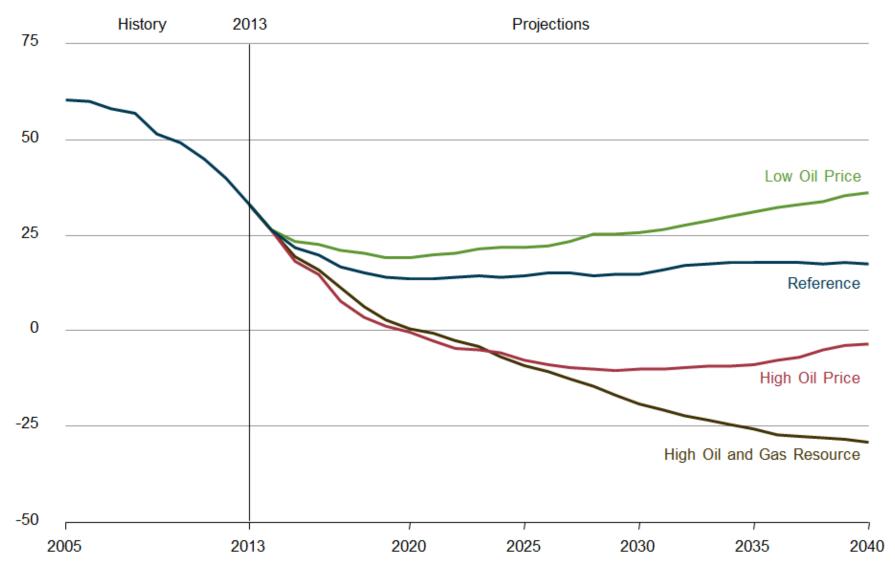


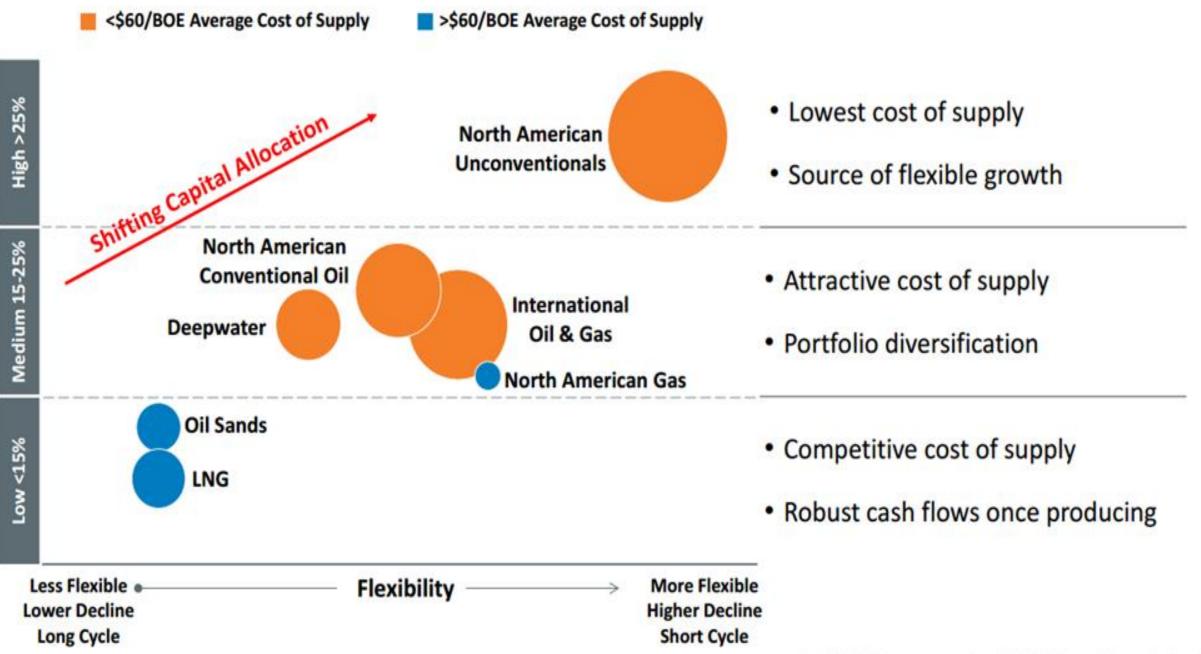


Figure ES4. Net crude oil and petroleum product imports as a percentage of U.S. product supplied in four cases, 2005-40

percent







Full-Cycle Project Returns

Size of the bubble represents planned 2015-2017 cumulative capital spend.

Figure ES5. U.S. total net natural gas imports in four cases, 2005-40

trillion cubic feet

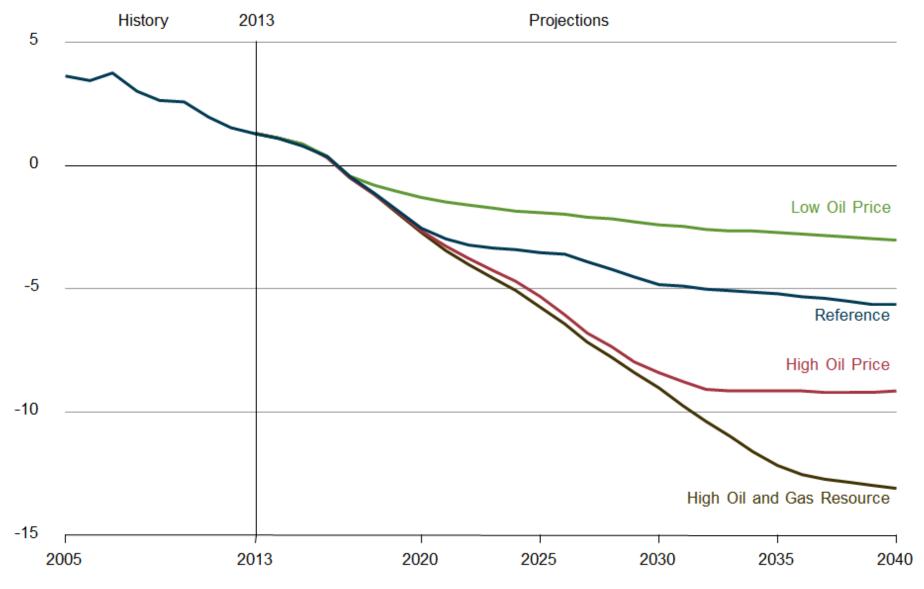
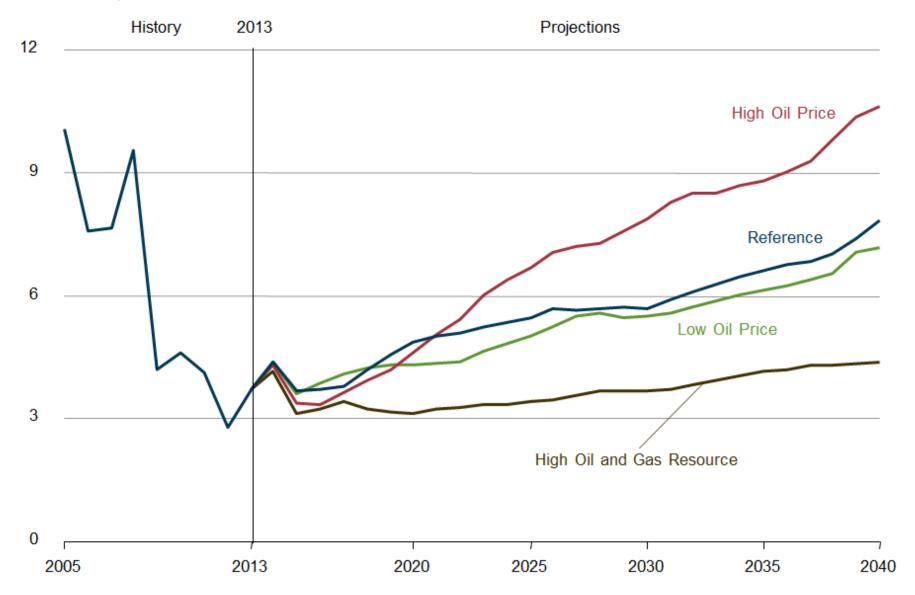




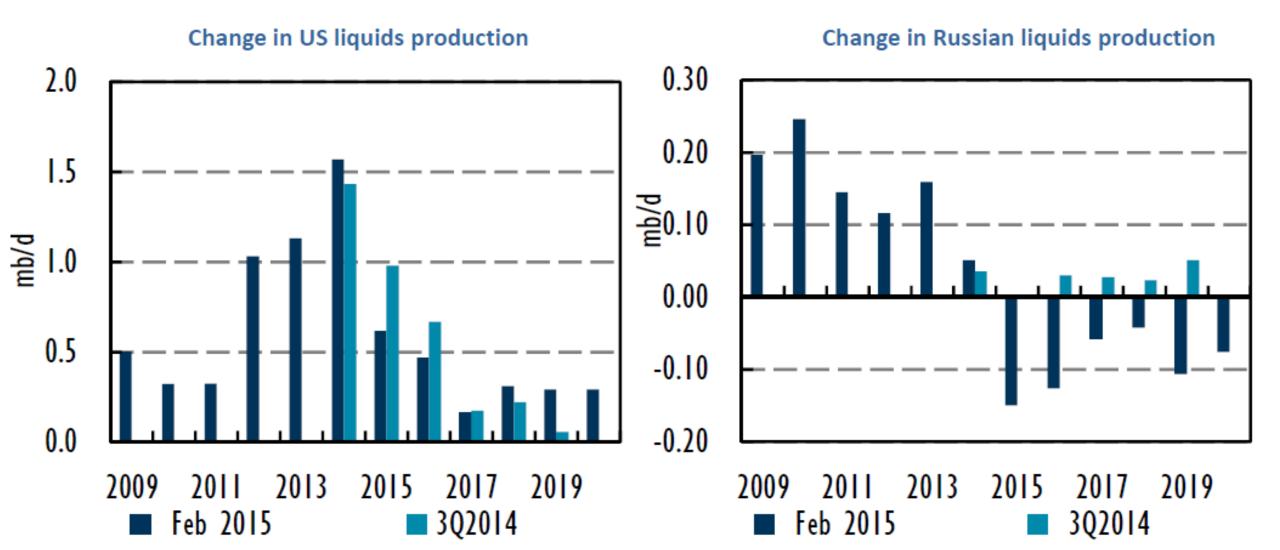
Figure ES2. Average Henry Hub spot prices for natural gas in four cases, 2005-40

2013 dollars per million Btu





US & Russia on Diverging Production Paths







The Knowledge Leader for Project Success

Owners • Contractors • Academics

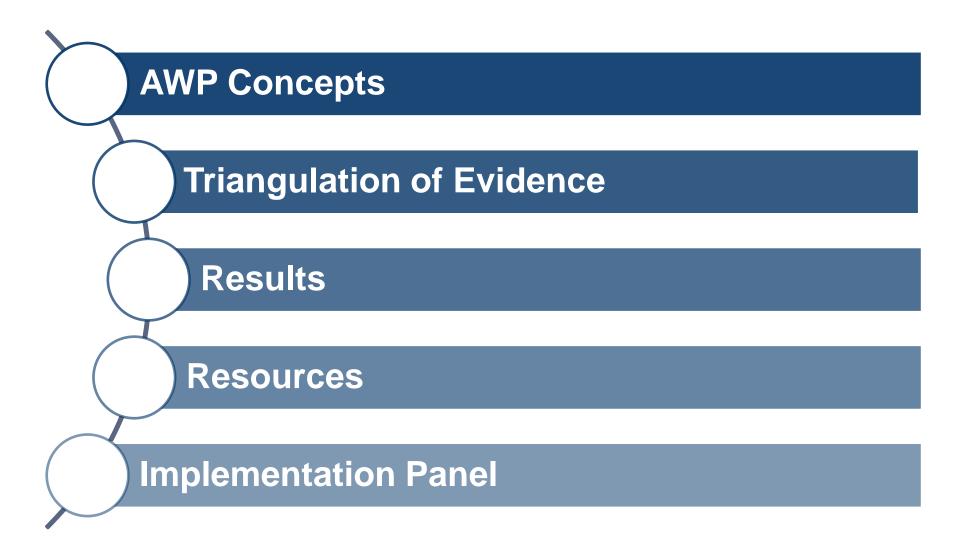




RT319 Validating Advanced Work Packaging as a Best Practice – A Game Changer

Michael Bankes, Fluor Joel Gray, Coreworx William O'Brien, University of Texas at Austin Jim Rammell, Wood Group Mustang, Inc. Stan Stasek, DTE Energy







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RT 319 – Edmonton, 13May2015

A Long Research Journey!



Steve Autry, ConocoPhillips

Michael Bankes / Hubavalin

Jim Blevins, Pathfinder DoelgCHayu,seoZewloryx Industrial Inc. Roy Burnette, CH2M HILL

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Ken Kohl, GE Power & Water Fernanda Leite, The University of Texas at Austin Jose LaRota, Southern Company

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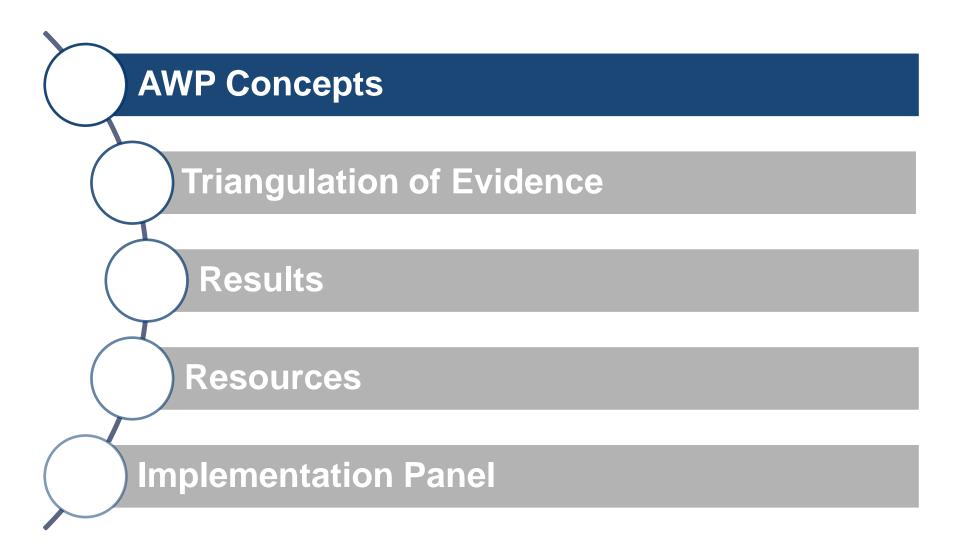
Researching Refinesties Eladegys

Sean Peliegrino, Chevron West Redwater Partnership

Stan Stasek, DTE Energy Jim Rammell, Mustang Jim Vicknair, WorleyParsons

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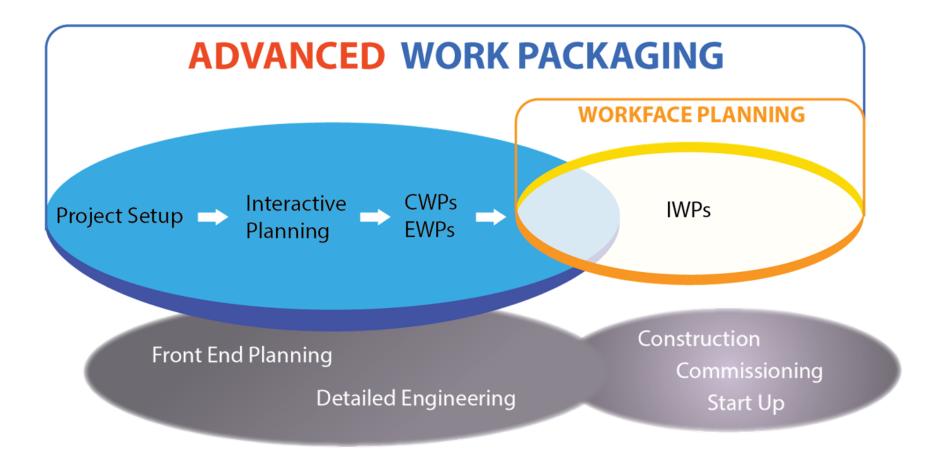




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RT 319 – Edmonton, 13May2015

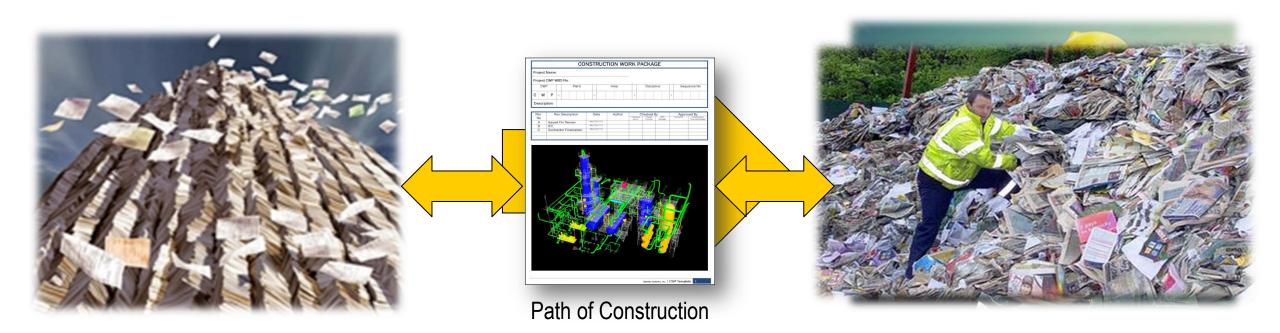
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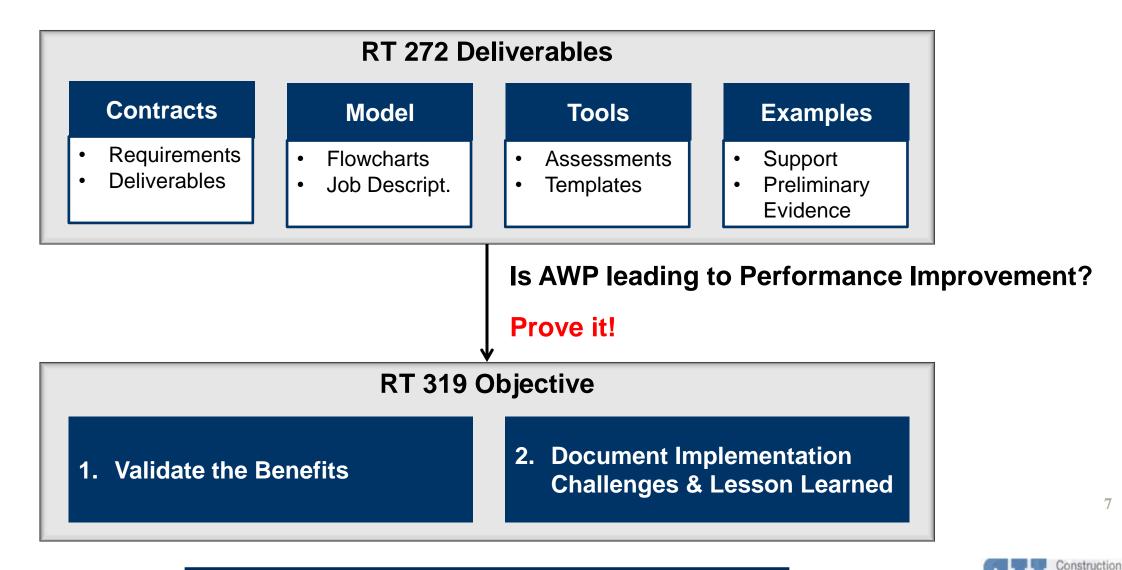


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AWP Work Package Relationships

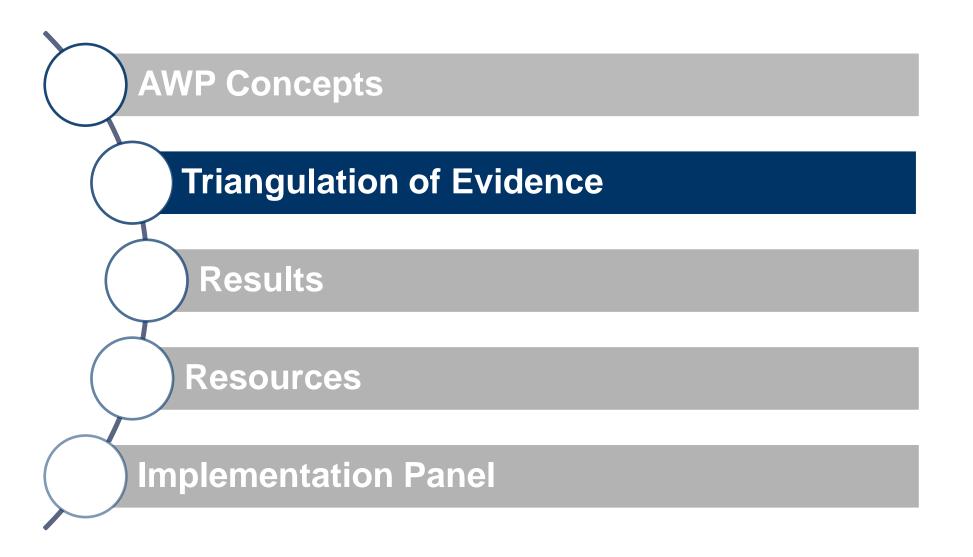








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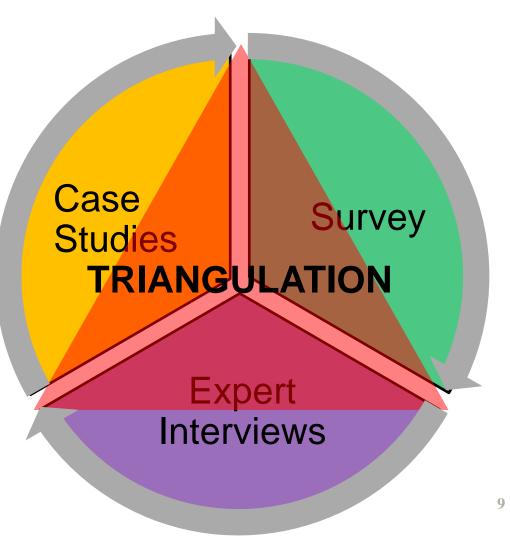
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RT 319 - Edmonton, 13May2015

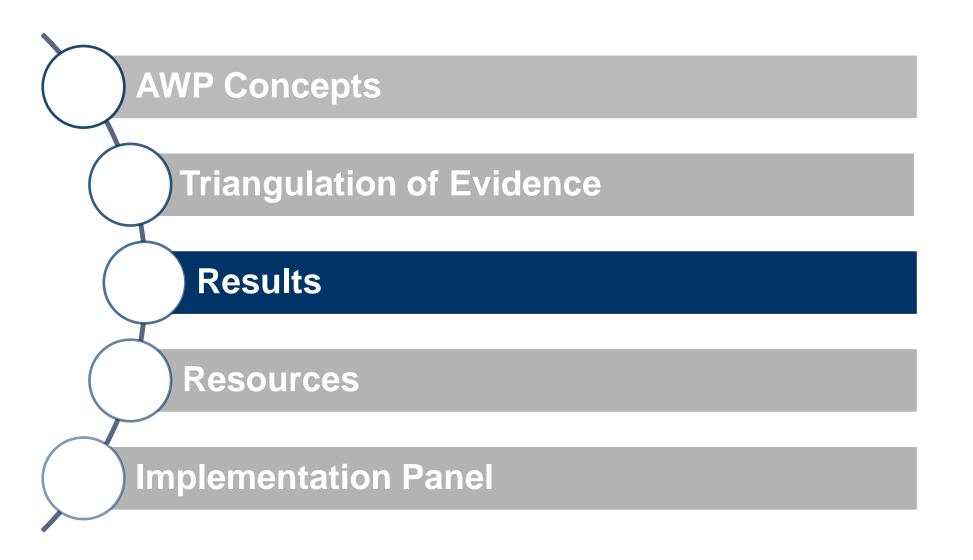
Triangulation of Evidence

Case Studies	 Methods of AWP Implementation Benefits / Challenges / Lessons Learned 17 Case Studies 		
Survey	 Statistical Validation AWP and Project Predictability 92 Surveyed Managers 		
Expert Interviews	 Specific AWP Processes Feedback on Research Findings 22 Direct Interviews 		

Cross-Validated Results!





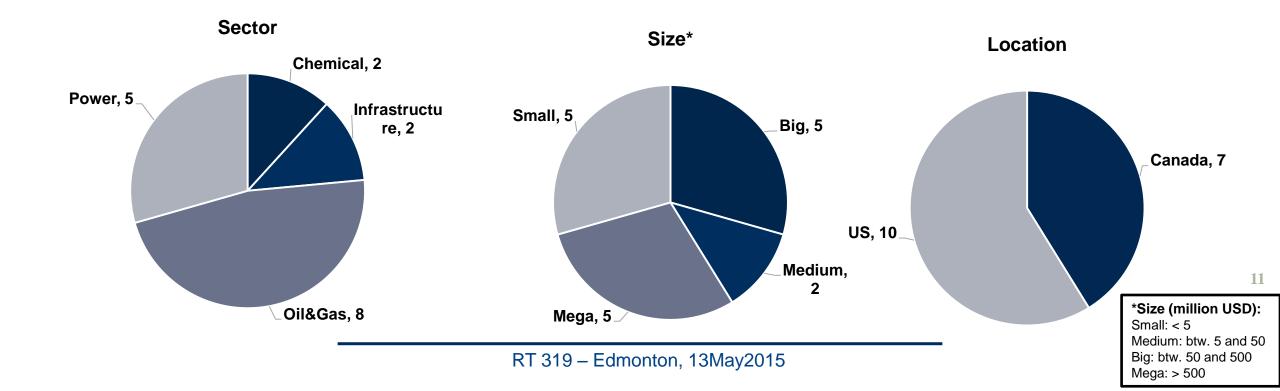


Construction Industry Institute®

Case Studies

In-depth Results on AWP Benefits!

- 17 Case Studies and 46 Interviewees
- Different industrial sectors and project sizes
- Documented AWP benefits, challenges, and lessons learned



Maturity Model

Three AWP Maturity Stages conceptualized within CII IR272 – Volume II

Advanced Work Packaging Implementation Maturity Model

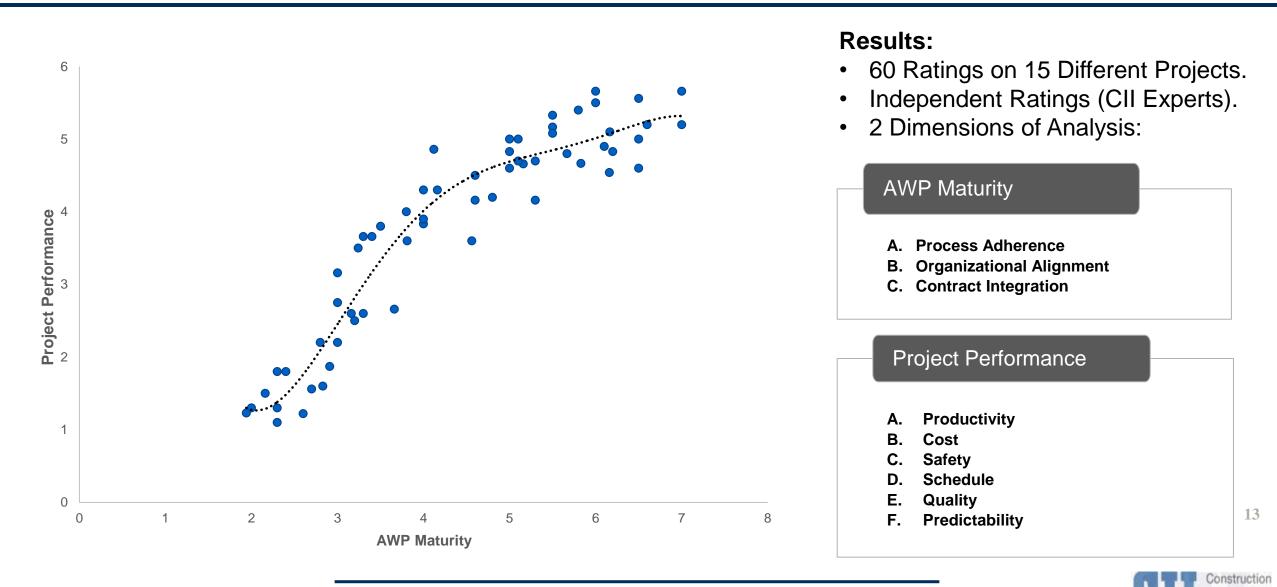
	Level 1: AWP Early Stages	Level 2: AWP Effectiveness	Level 3: AWP Business Transformation
View of AWP	The potential of the implementation of AWP strategy is not understood and has few champions. AWP is not a priority within the corporate vision.	AWP is seen as part of the business solution - being both an opportunity and a challenge.	AWP is fully integrated with the business strategy and is seen as invaluable. It enables true differen- tiation between you and the competition.
Project AWP Strategy	AWP is developed on an ad hoc basis - most often driven by customer demands.	Integration of AWP strategies are routinely developed and updated. These often seek to overcome integration and communication issues across project organizational units (silos). AWP is now included in all contracts.	Barriers to implementation of AWP strategies are minimal and project-specific planning focuses more on advancing strategic business needs and interests. Contracts include AWP language and supported by commercial terms, plans and procedures.
Work Processes & Deliverables	Work process and deliverables are in develop- ment stage. They are not well defined and are not structured for implementation across business units (silos). Inputs and outputs required of stakeholders to support the strategy are not defined and no discipline involved. Most processes support individuals or isolated work groups and not fully integrated.	Work processes and deliverables for individual business functions or departments are mostly well defined and standardized. Integration of these processes are still problematic across functional unit lines. Frustration will be experienced when some functions are progressing towards AWP implementation but are set back by other silos who are not supporting the integration.	Work processes and deliverables are fully integrated across functional units. Each stakeholder under- stands their responsibilities to provide accurate and timely deliverables to support the strategy. This allows more time for productive analysis of deliver- ables and supports flexible, adaptable integrated work processes. Work processes represent best-in- class use of corporate knowledge and AWP practices.
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Training & Support	Some training standards are in place based on job descriptions to support AWP. Team members may take the training but are still not supported within their organization to implement what they have learned.	Training to fully support a successful AWP imple- mentation is fully available, valued and supported within the organization.	Training is continuous and the organization is considered an industry leader.

Objectives:

- 1. Provide empirical evidence of the 3 stages
- 2. Investigate the relationship between AWP Maturity and Project Performance
- 3. Deliver practical recommendations to obtain higher levels of AWP maturity

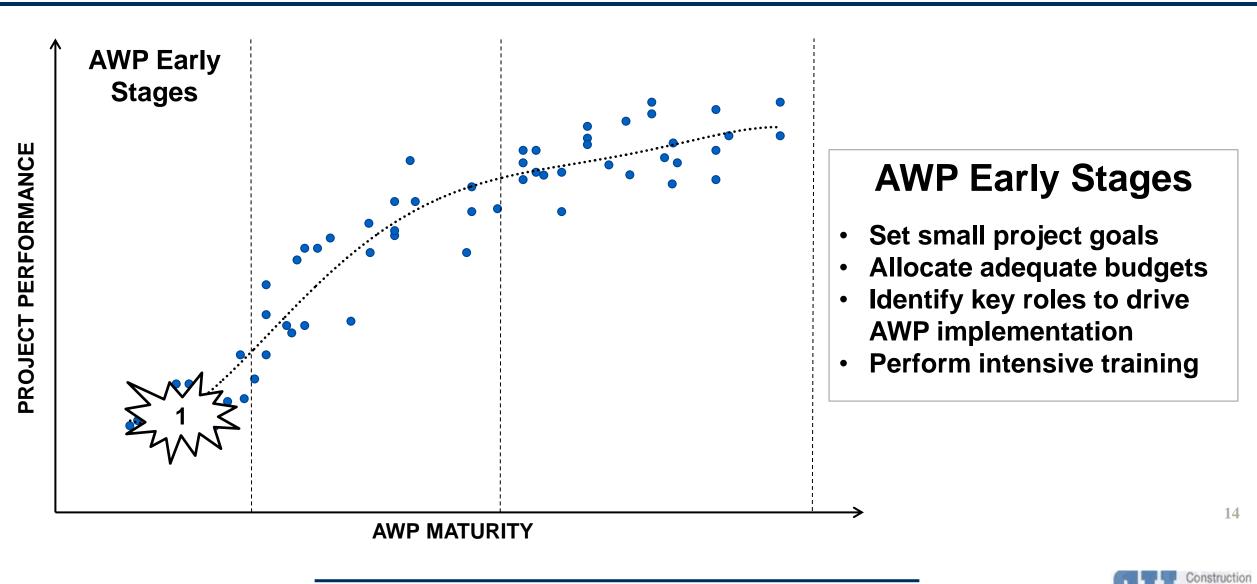


Maturity Model – Case Study Evaluations

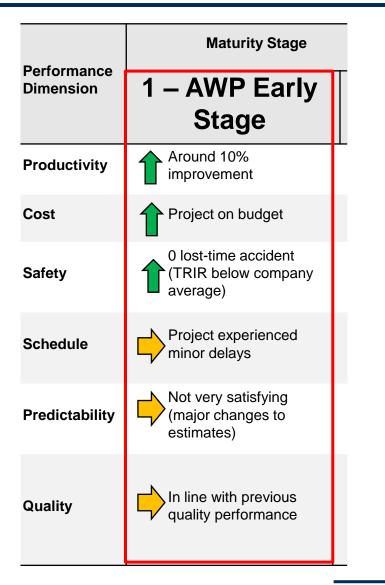


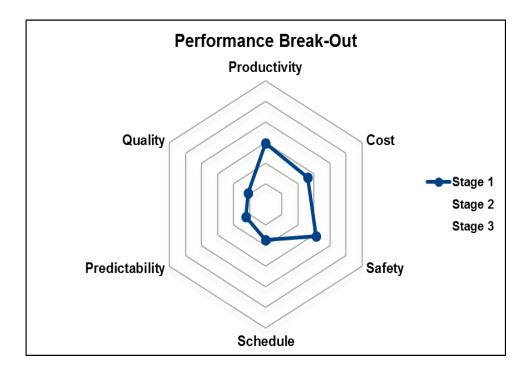
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Maturity Model



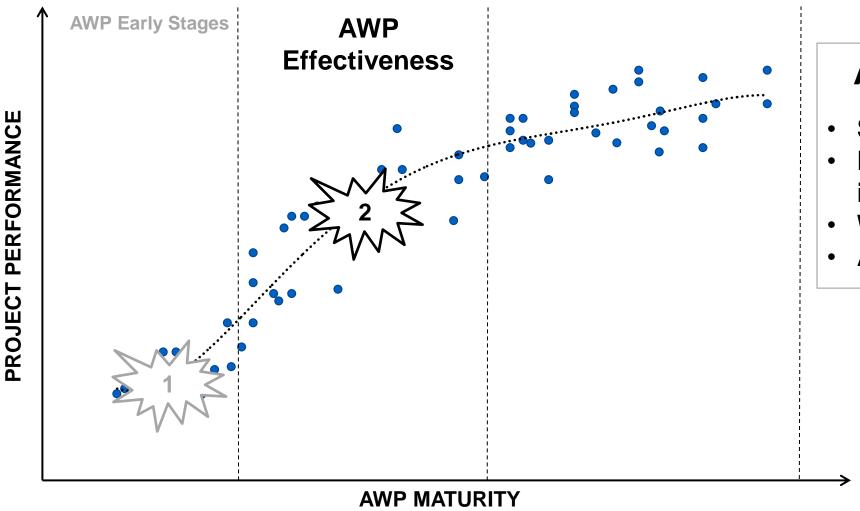
(1) AWP Early Stages







Maturity Model



AWP Effectiveness

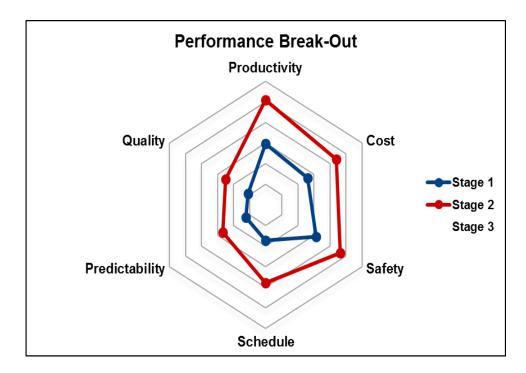
- Set ambitious project goals
- Prioritize incremental improvement projects
- Watch out for complacency
- Attain to AWP guidelines





(2) AWP Effectiveness

	Maturity Stage		
Performance Dimension	1 – AWP Early Stage	2 – AWP Effectiveness	
Productivity	Around 10% improvement	Around 25% improvement	
Cost	Project on budget	Around 10% below TIC	
Safety	0 lost-time accident (TRIR below company average)	0 lost-time accident (sporadic first-aids and near misses)	
Schedule	Project experienced minor delays	Project slightly ahead of schedule during execution	
Predictability	Not very satisfying (major changes to estimates)	Moderately positive (minor changes to estimates)	
Quality	In line with previous quality performance	Reworks slightly below company's average	

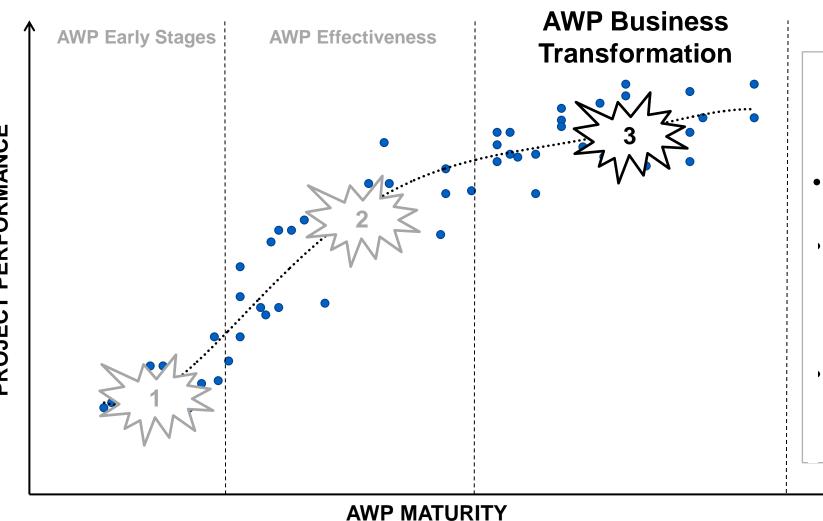




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Maturity Model



AWP Business Transformation

- **Continue investing in AWP** implementation
- Increase the flexibility of **Project Managers to** evolve/adapt AWP processes
- Export the project as "world-class" benchmark



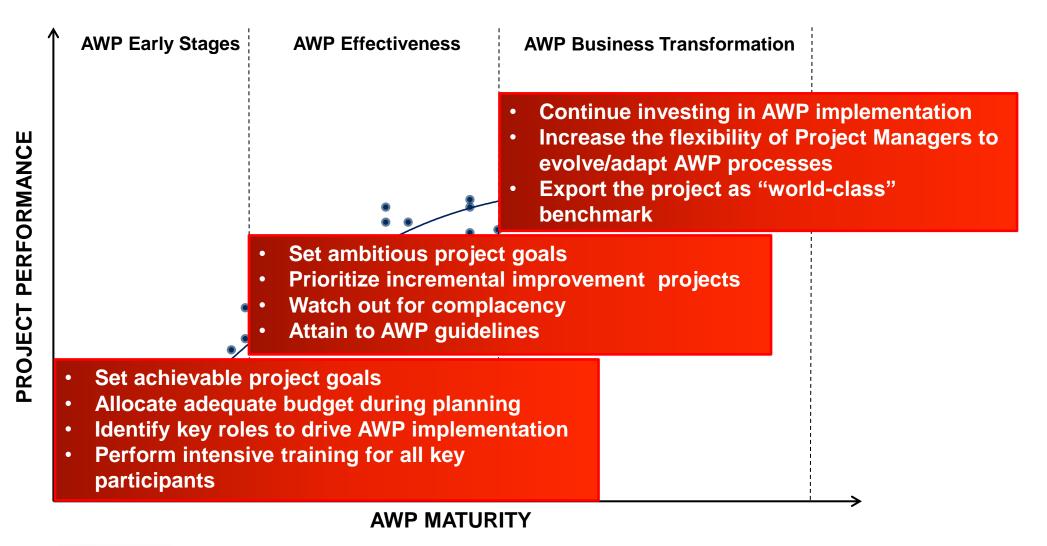
(3) AWP Business Transformation

Performance Dimension	Maturity Stage		
	1 – AWP Early Stage	2 – AWP Effectiveness	3 – AWP Business Transformation
Productivity	Around 10% improvement	Around 25% improvement	Around 25% improvement
Cost	Project on budget	Around 10% below TIC	Around 10% below TIC
Safety	0 lost-time accident (TRIR below company average)	0 lost-time accident (sporadic first-aids and near misses)	0 lost-time accident (sporadic first-aids and near misses)
Schedule	Project experienced minor delays	Project slightly ahead of schedule during execution	Project slightly ahead of schedule during both planning and execution
Predictability	Not very satisfying (major changes to estimates)	Moderately positive (minor changes to estimates)	Completely positive (full alignment to estimates)
Quality	In line with previous quality performance	Reworks slightly below company's average	Reworks and RFIs substantially below company's average (negligible impact on IWP execution)

Construction

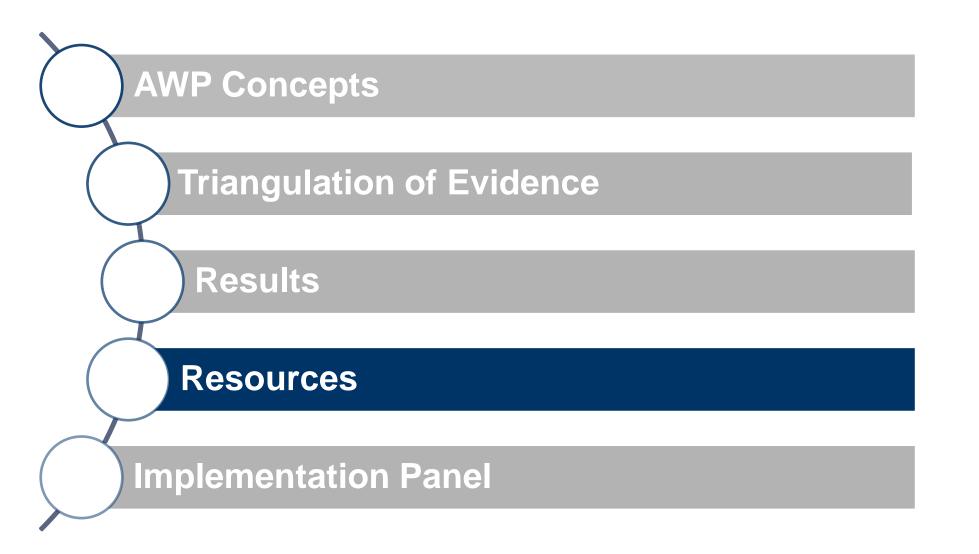
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Managerial Implications

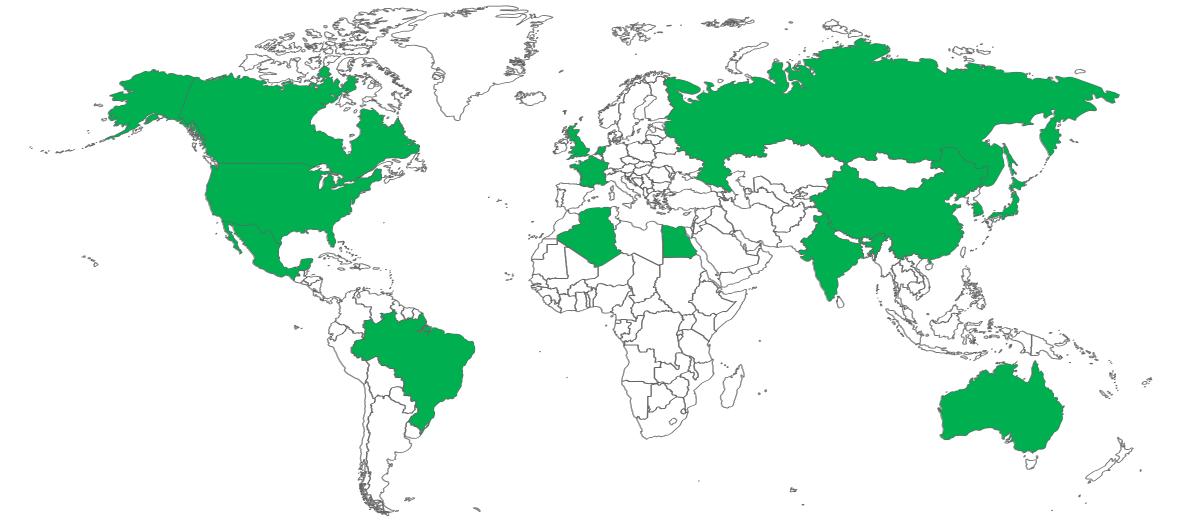








AWP World-Wide Adoption





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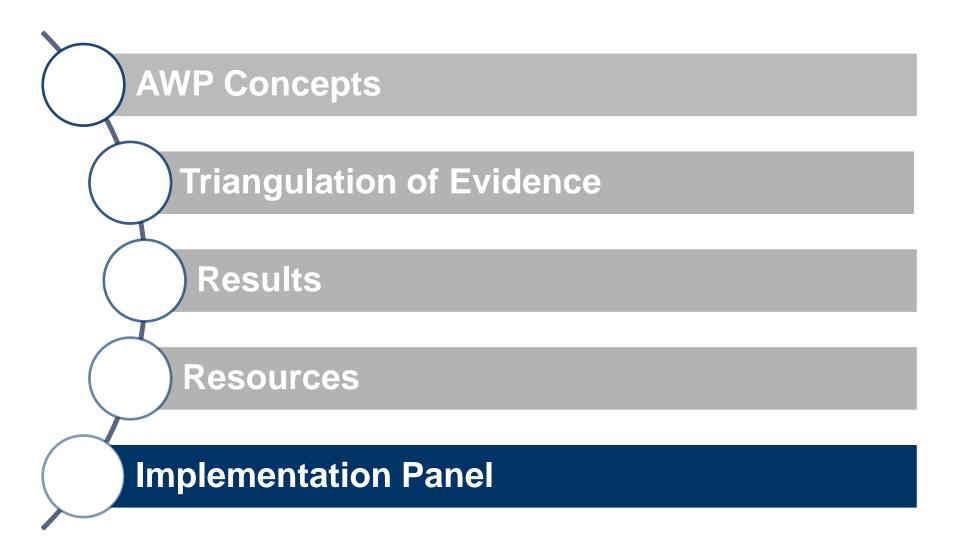
Resources





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IMPLEMENTATION PANEL

MODERATOR: JOEL GRAY, COREWORX

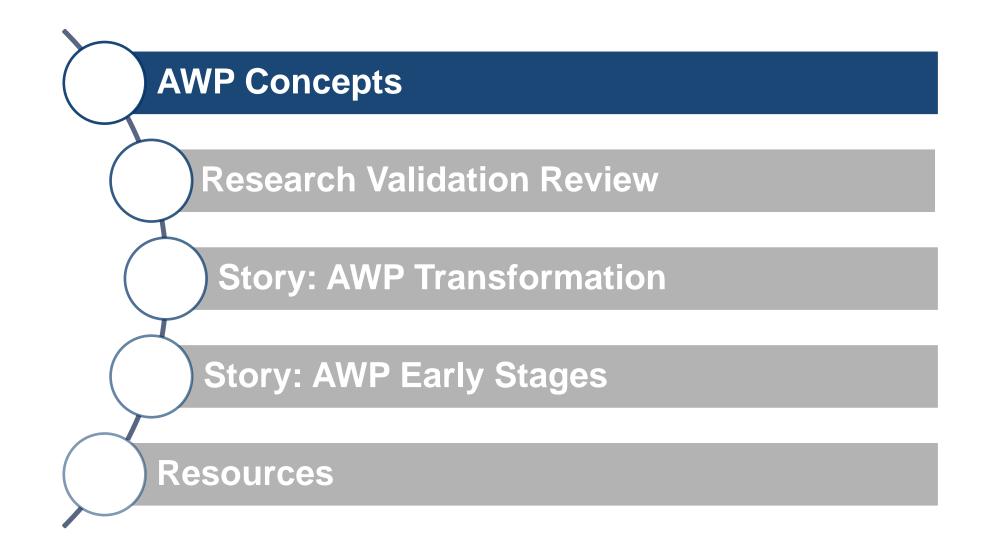
AWP RESEARCH OVERVIEW: WILLIAM O'BRIEN, UNIVERSITY OF TEXAS AT AUSTIN

CONTRACTOR STORY: *MICHAEL BANKES*, FLUOR

OWNER STORY: STAN STASEK, DTE ENERGY

OWNER STORY: *TREVOR POSYLUZNY,* SHELL

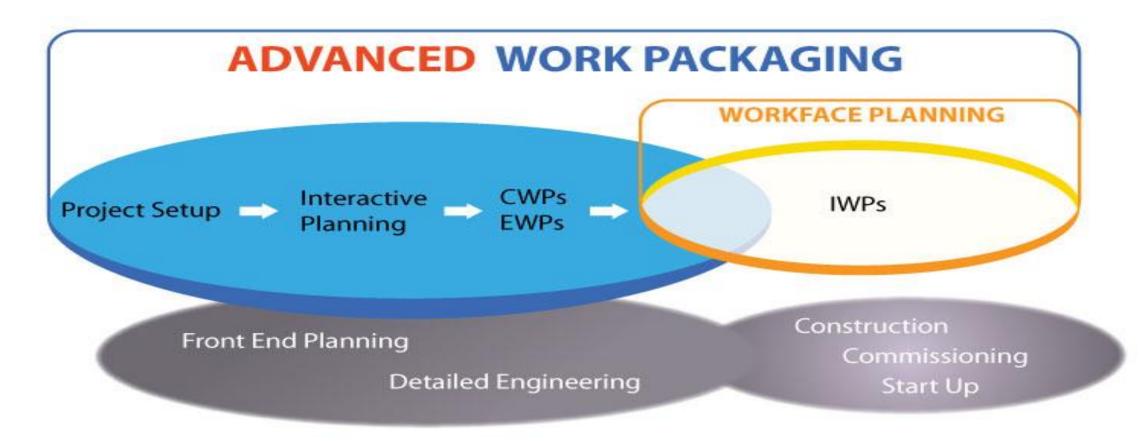
RESOURCES: JOEL GRAY, COREWORX





What is Advanced Work Packaging?

Work planning that emphasizes construction requirements





Sample CWP and EWPs



CWA – Construction Work Area CWP- Construction Work Packages

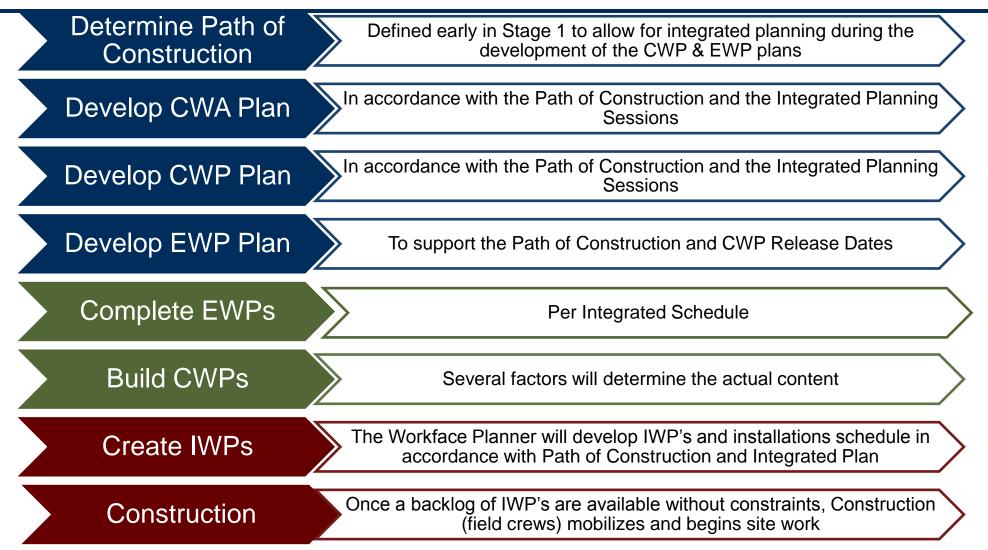
EWP- Engineering Work Packages IWP- Installation Work Packages



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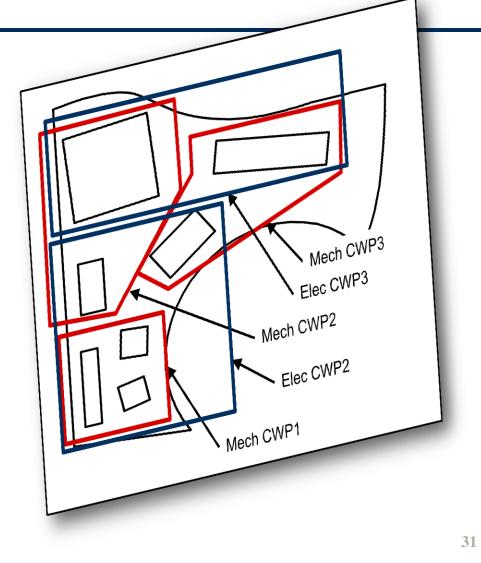
Fundamental Steps to AWP





Inside the CWP Plan

- A CWP Plan considers:
 - Construction constraints
 - Trades being used
 - Contracting plan
 - Modules separate CWPs for fabrication and installation
 - Minimize interfaces to other CWPs
 - Minimize schedule duration

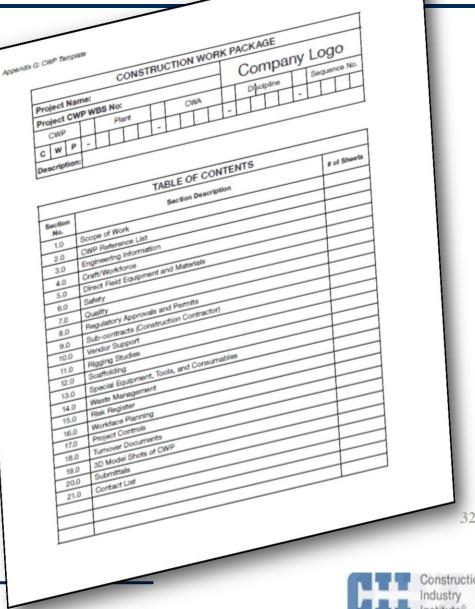




Inside the CWP

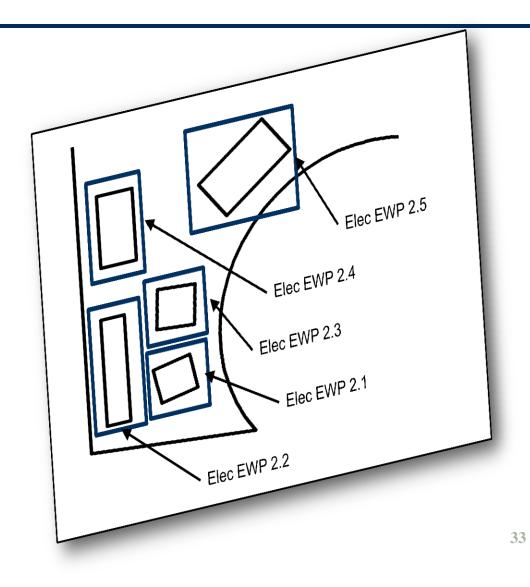
- All information required by Construction Contractor
- Usually compiled by Construction Management (or the party responsible for managing subcontractors)
- Considers construction constraints, trades, contracting plan, module fabrication & installation, minimal interfaces with other CWPs, minimal duration





Inside the EWP Plan

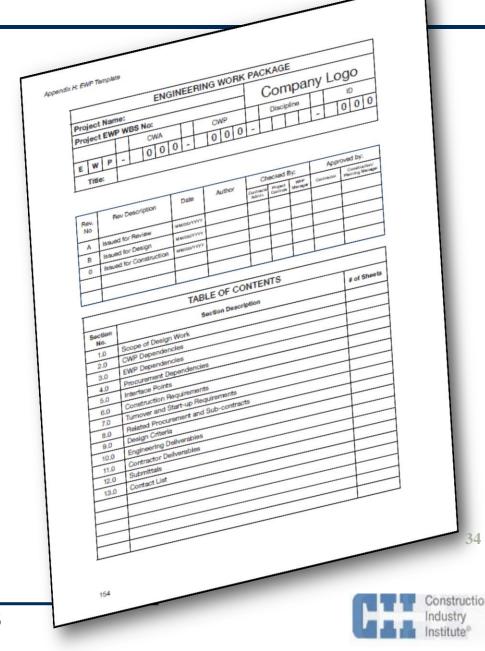
- A EWP Plan considers:
 - Availability of engineers and drafters
 - Availability of design data
 - Dates when needed by construction





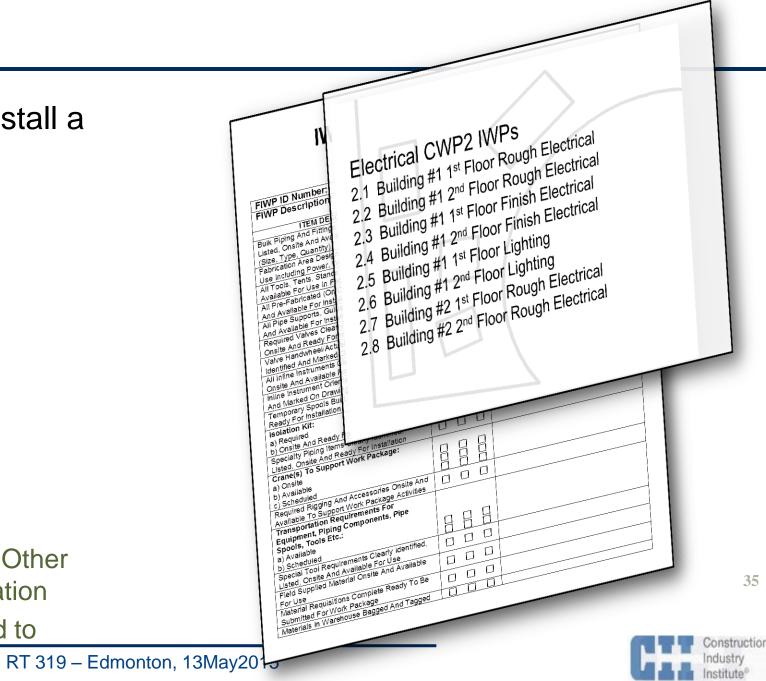
Inside the EWP

- All information required to be developed & transmitted from Engineering
 - Scope of work, drawings and specifications, vendor data, line lists and equipment lists
- Content will vary depending on Engineering's scope of work
 - Is the Engineering Contractor also procuring materials?
 - Is Engineering developing the specifications or are they being provided?
 - Full EPC contract?



Inside the IWP

- All unique requirements to install a portion of work
- Enough work for one "Shift"
- Includes •
 - IWP Constraints
 - Scope of Work
 - Safety Requirements
 - QA/QC Requirements
 - Trade Coordination
 - Material Take Offs & Locations
 - Scaffold Requirements
 - Model Shots, Drawings and All Other **Necessary Engineering Information**
 - Any Other Information Required to Install the Work

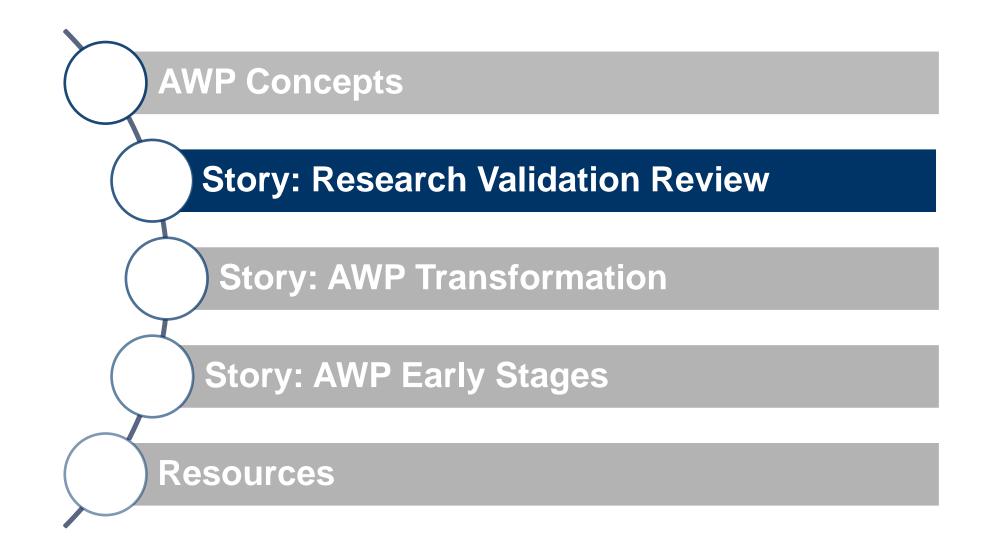


AWP – the Ultimate Payoff

- Brings Construction planning into the early phases of the project
- Provides better visibility to the progress in a given portion of the project
 - Highlights areas that are falling behind plan and allows more efficient recovery planning
 - Allows flexibility in construction execution
- Provides a mechanism to maximize supervision time and tool time in the field



Agenda





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Triangulation of Evidence

R	T 319 Objective		
1. Identify AWP Matu Levels	2. Validate AWP Benefits		
Case Studies	 Methods of AWP Implementation AWP Benefits & Lessons Learned 	Case	Expert
→ Expert Interviews	 Support Case Study Analysis Focus on Specific AWP Processes 		
Survey	Statistical ValidationAWP and Project Predictability	Cross-Validated	38



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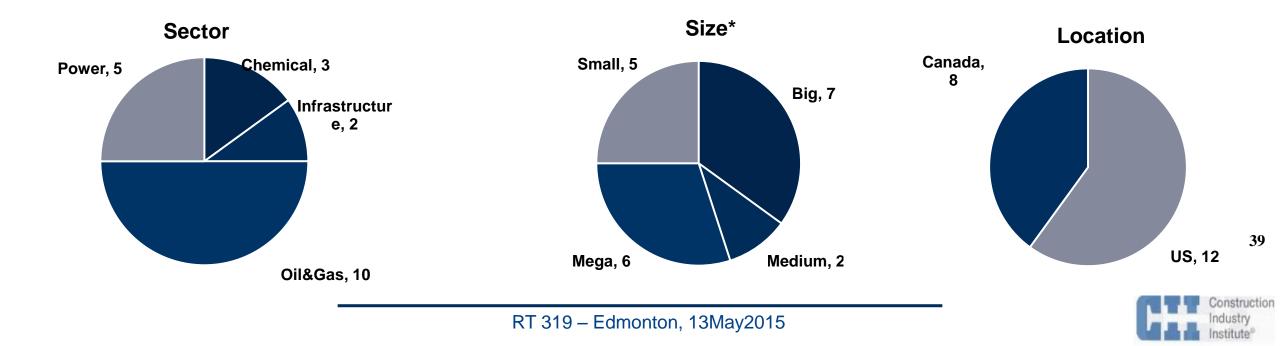
Case Studies

Objective:

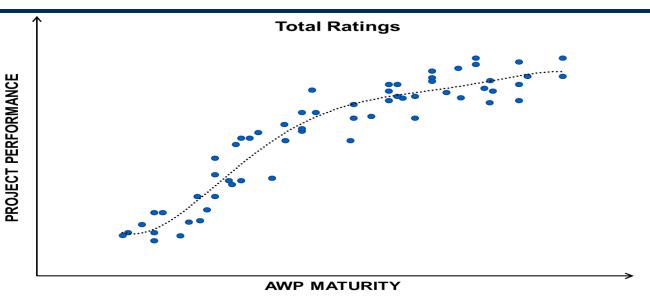
In-depth Results on AWP Benefits

- 20 Case Studies and 52 Interviewees.
- Different industrial sectors and project sizes.
- Documented AWP benefits, challenges, and lessons learned.

***Size (million USD):** Small: < 5 Medium: btw. 5 and 50 Big: btw. 50 and 500 Mega: > 500



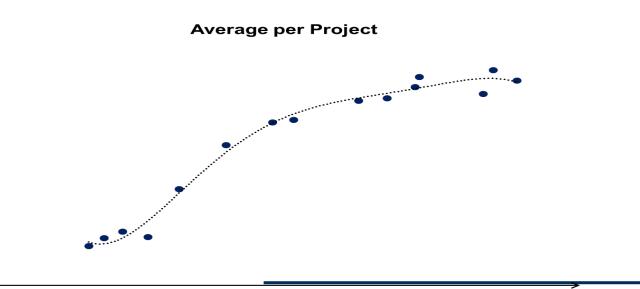
AWP Maturity Model



S-Curve pattern:

- High Correlation between AWP Maturity and Project Performance (Spearman rho = 0.959, significant at 99% confidence level)
- AWP Maturity level can be used to set Project Performance expectations (R² = 0.923, significant at 99% confidence level)







Maturity Model

Three AWP Maturity Stages (CII IR272 – Volume II)

Advanced Work Packaging Implementation Maturity Model

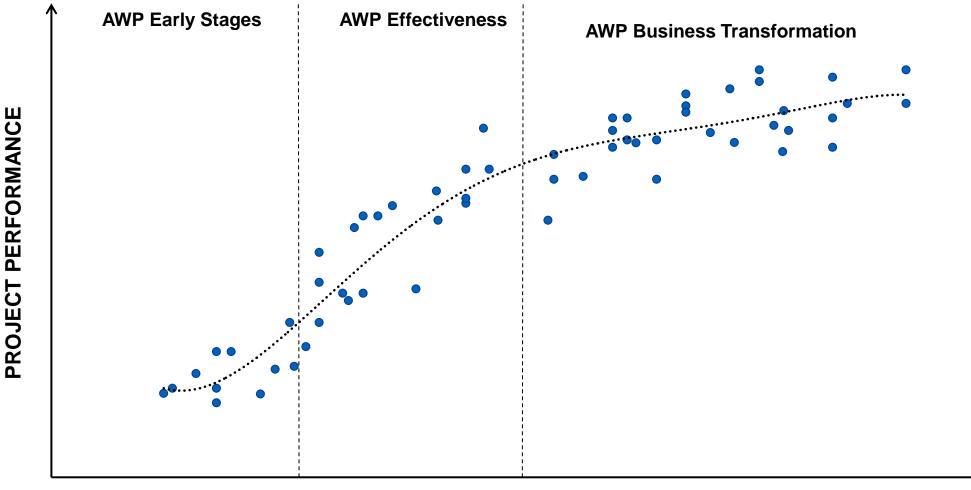
	Level 1: AWP Early Stages	Level 2: AWP Effectiveness	Level 3: AWP Business Transformation
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- 2. Investigate the relationship between AWP Maturity and Project Performance
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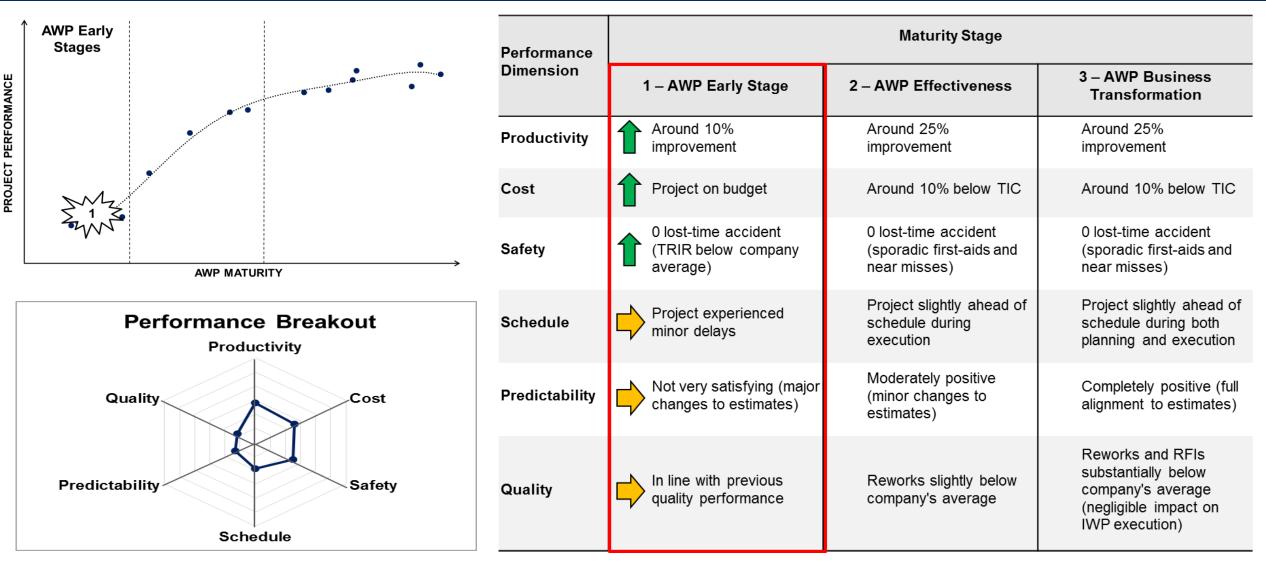
AWP Maturity Model



AWP MATURITY

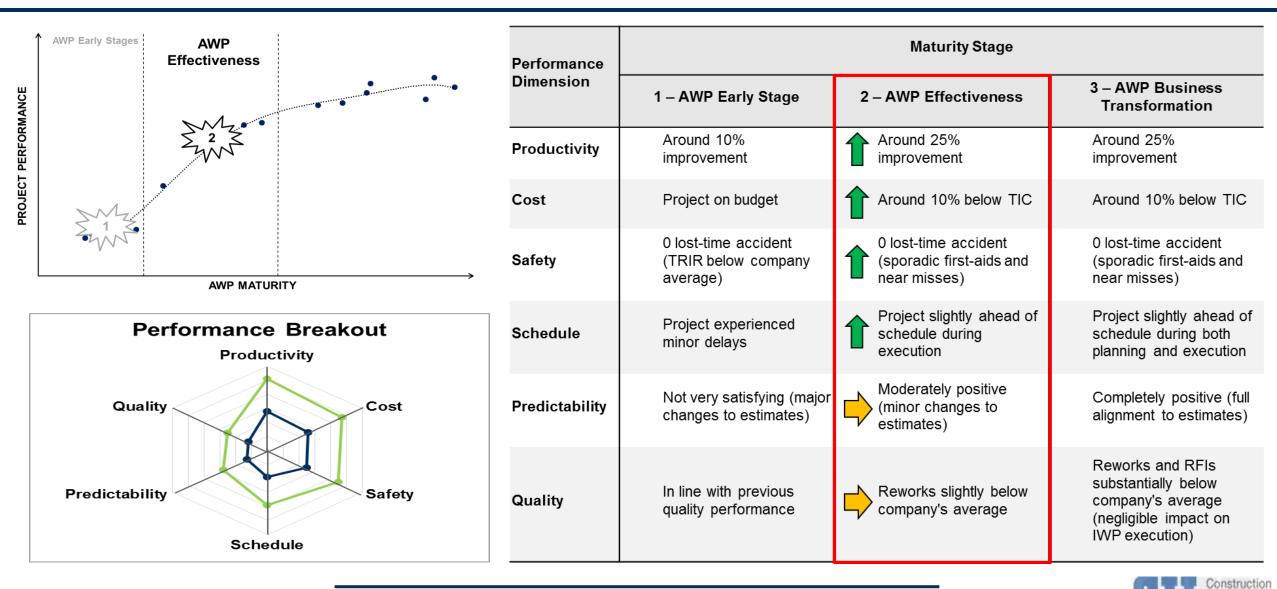


(1) AWP Early Stages





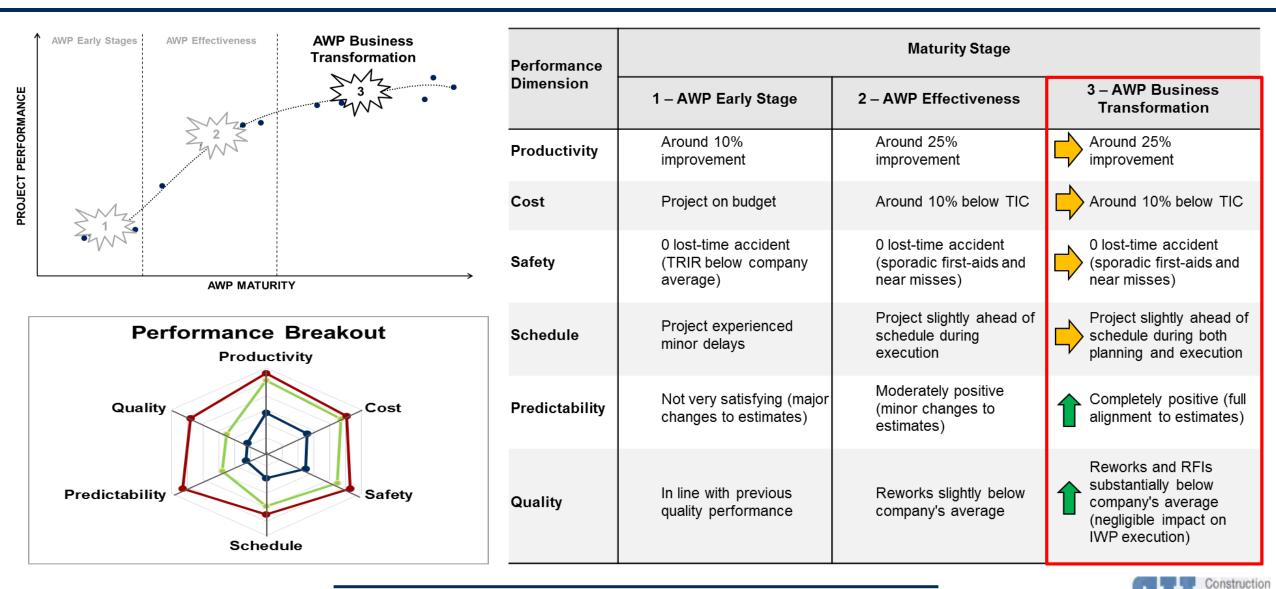
(2) AWP Effectiveness





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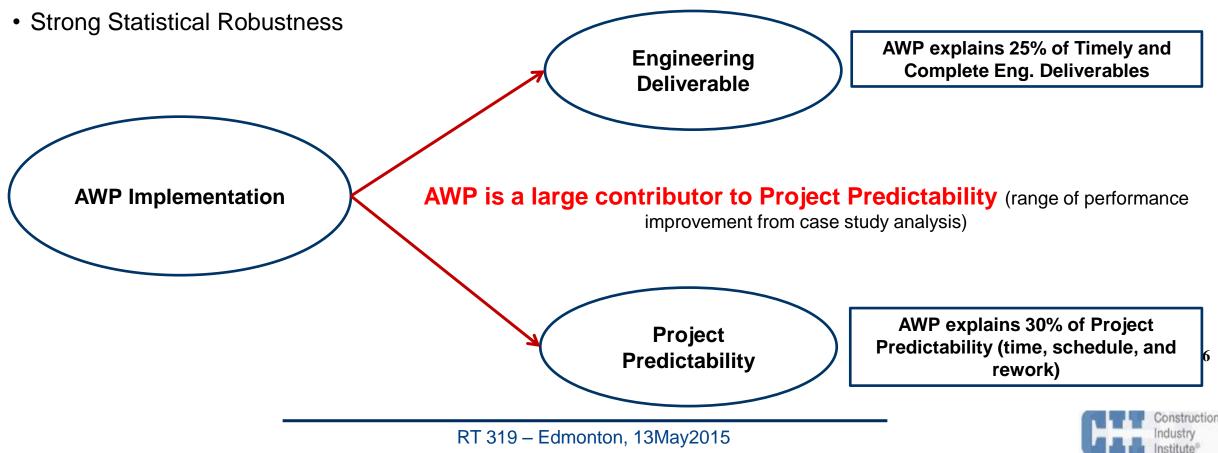
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Survey

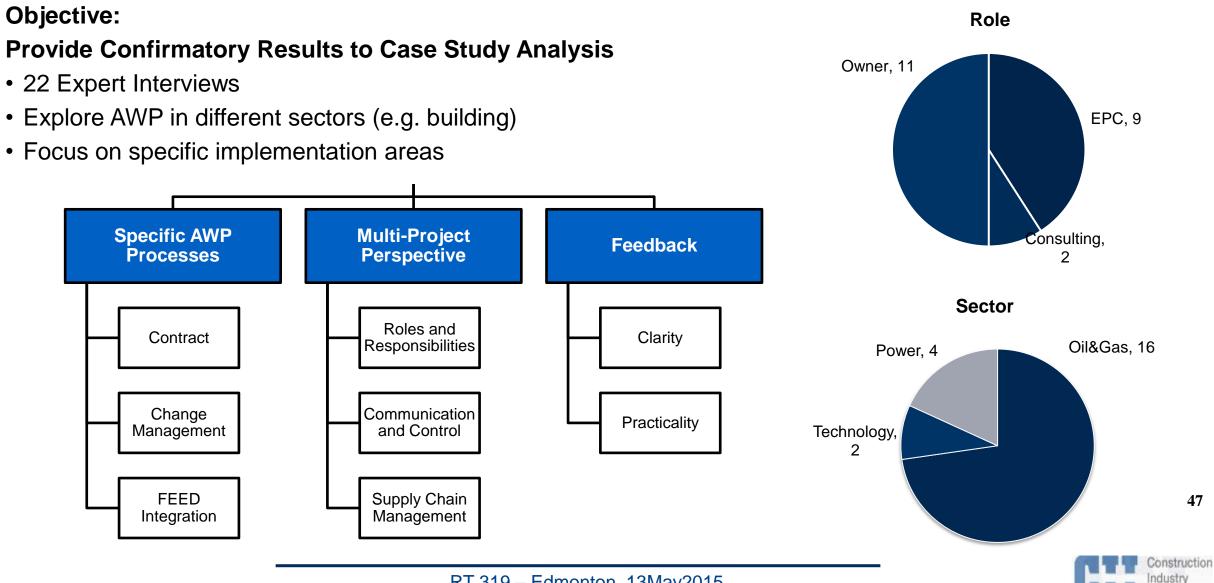
Objective:

Achieve Generalizable Results on AWP Benefits

- 92 Responses (Houston + Alberta Data)
- Unit of Analysis = Project



Expert Interviews

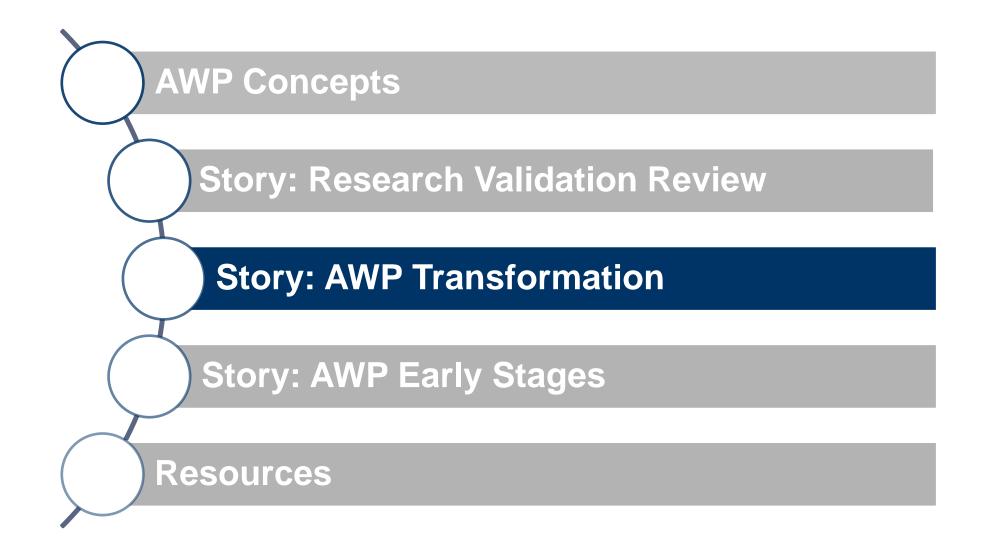


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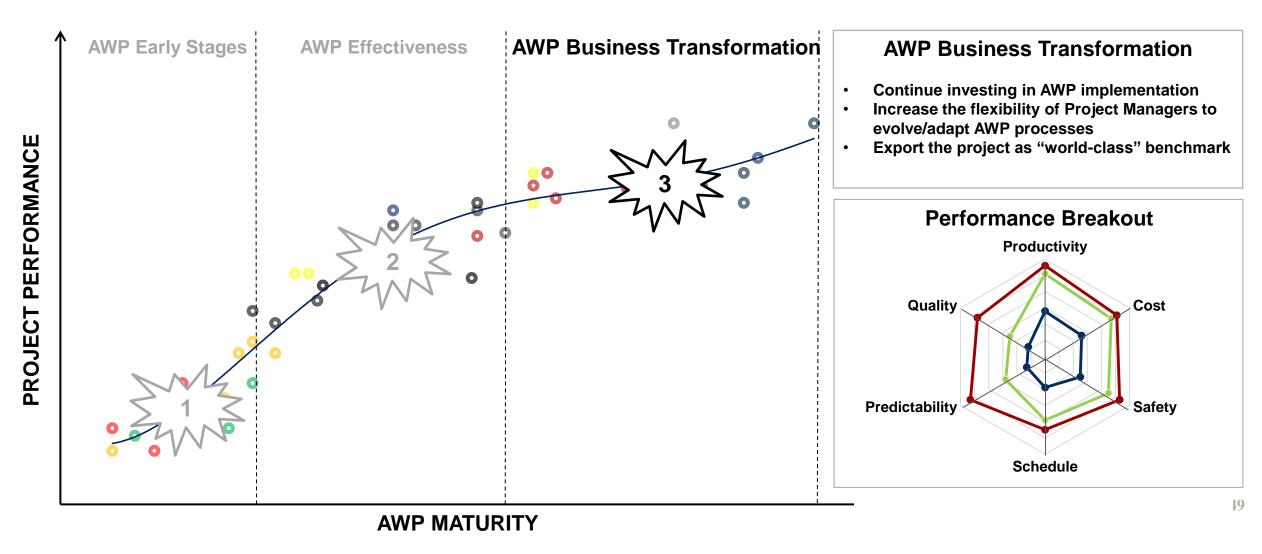
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Agenda





Maturity Model



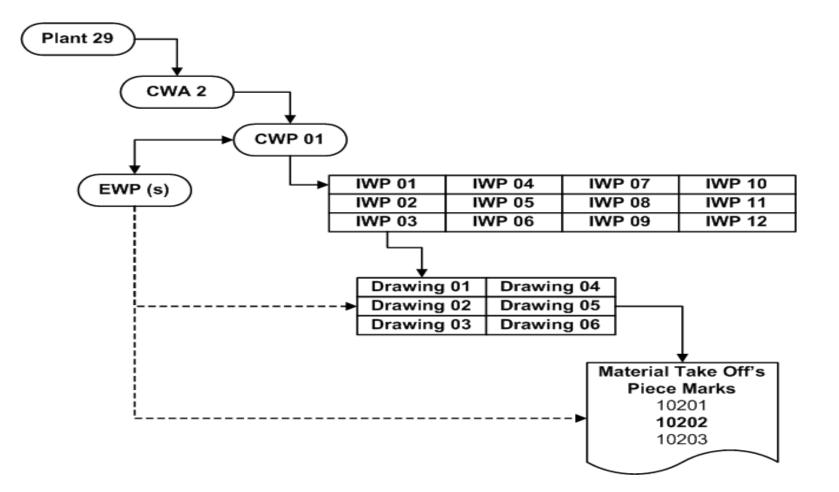


Construction

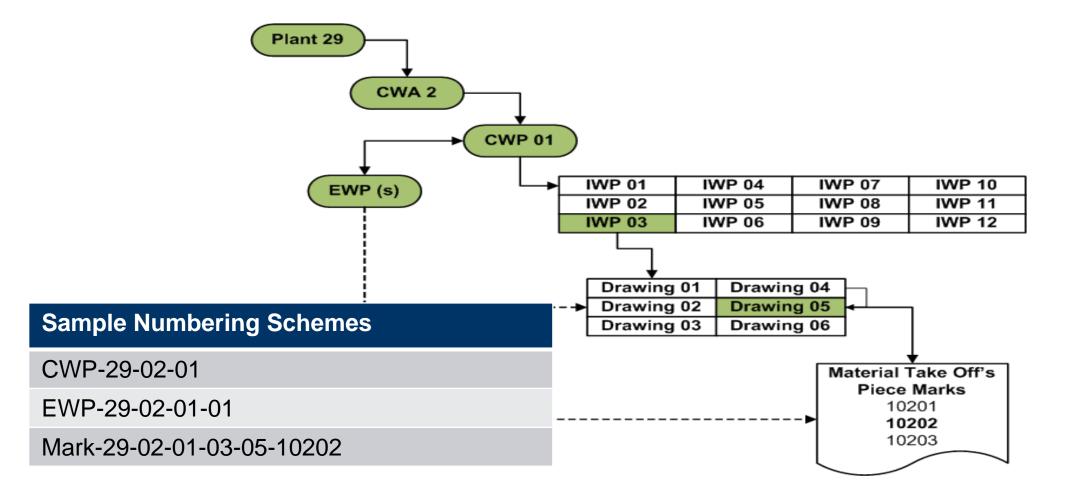
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- Project Setup and Execution
 - Written Practices and Procedures
 - WBS/CBS
 - Engineering and Construction Work Package Plans
 - Scheduling and Progress Measurement by Work Package
 - Change Management Systems
- Construction Focused
 - Effective Construction input early in FEED
 - Well thought out Path of Construction and CWP Plan
 - Material delivery dates integrated into schedule
 - Dedicated and Experienced WorkFace Planners

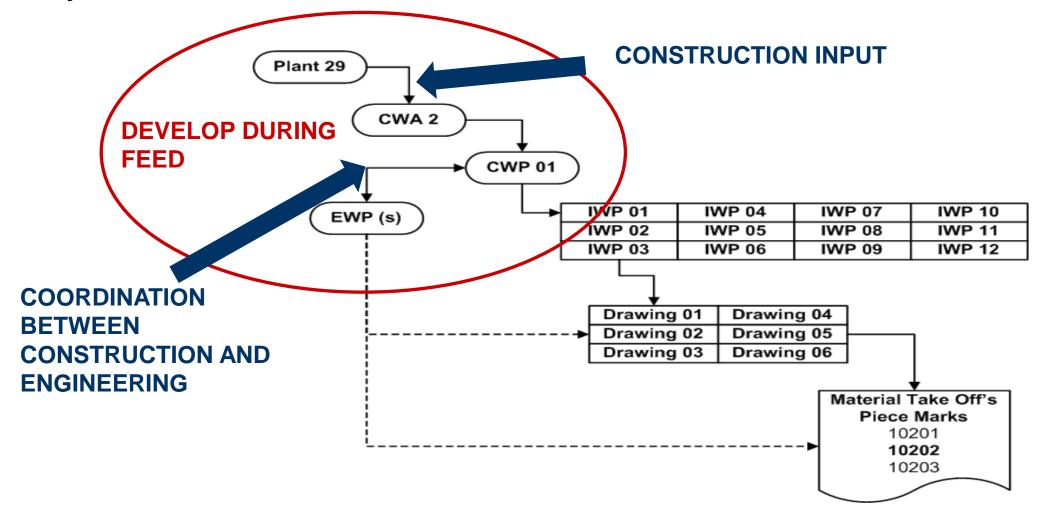
Influence of WBS on AWP



Influence of WBS on AWP

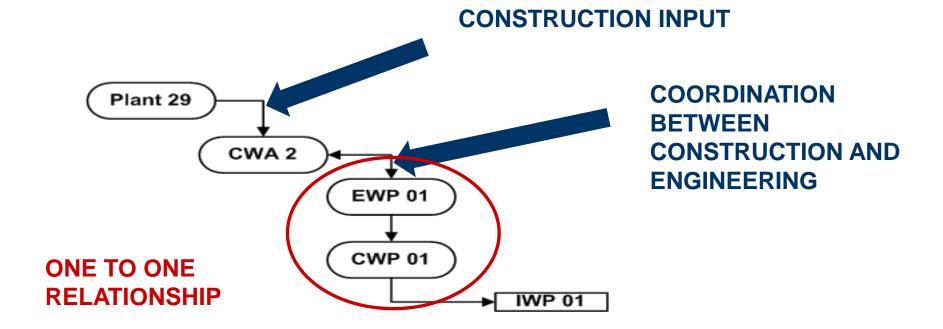


Key Points to Maximize Full Potential



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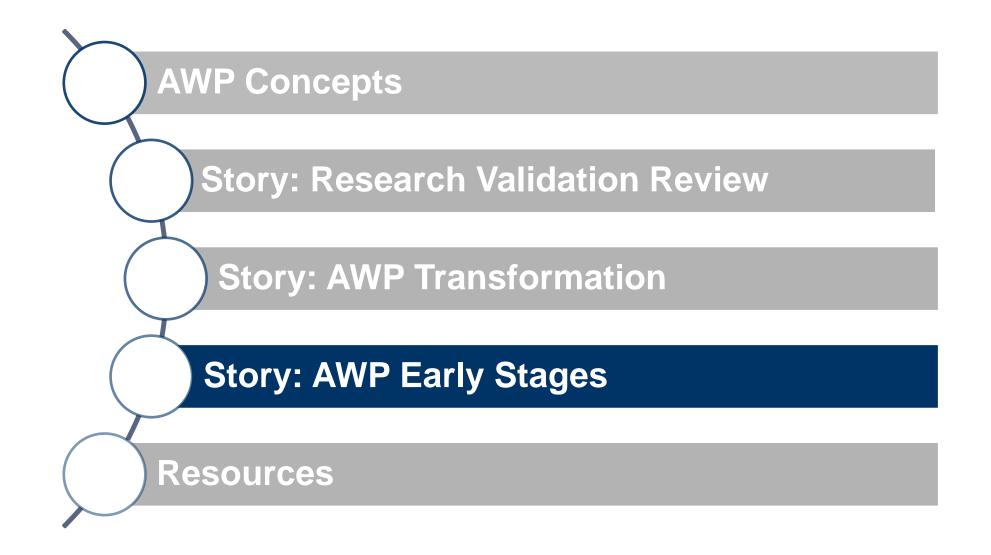
Alternate WBS Structure





- Integrated Data Systems
 - Statusing individual EWP's, CWP's and IWP's
 - Automated constraint analysis
 - Automated IWP creation
 - Effective checkout and start up

Agenda





One Owner's Story – DTE Energy

• **DTE Energy** is a Detroit based diversified energy provider involved in the development and management of energy related businesses and services nationwide.





DTE Energy – Major Enterprise Projects

- Major Enterprise Projects is responsible for managing large capital and strategic projects for DTE Energy
- Portfolio is large and very diverse



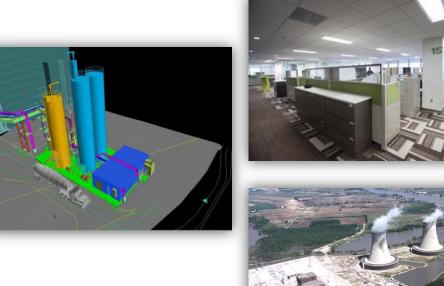
Case for Change – Why Advanced Work Packaging?

- MEP exists to deliver enterprise projects in a predictable and repeatable manner
- Client expectations focus on safety, schedule, cost, quality
 - Sounds like AWP might help achieve
- MEP has experienced variability in productivity, constructability, and rework rates
- Significant contractor variability in using work packaging
 From zero use of work packages to full use of AWP
- MEP has focus on process orientation for all project activities



Approach - Embedding AWP Into MEP Work

- Establish a core team (including an AWP implementation lead with prior experience)
- Benchmark AWP techniques/insights/lessons learned (RT272)
- Plan and execute WP/AWP on targeted pilot projects (large repeating project, small repeating project)
- Conduct After Action Reviews
- Apply lessons learned and "finalize" governance procedure controls
- Roll out to all "new" MEP projects
- Check and adjust, coach and mentor (ongoing)





Benefits Realized So Far

- Early wins
 - Productivity improvements (less crew downtime)
 - Improved tracking of work progress
 - Improved communication between contractor(s) and owner
 - Worker feedback used to improve downstream work
 - Increased contractor ownership of issues and their resolution
 - Better constructability planning embedded into design phase

Early learnings

- Contract language needs to clearly define AWP expectations upfront
- Some contractors were new to AWP wanting to add AWP costs as contingency risk to bids (felt it was potentially added work)
- Need to educate project stakeholders on AWP (owner's staff, contractors, client representatives)
- Very difficult to initially implement AWP on in-flight projects



One Owner's Conclusions

DTE Energy has concluded that:

- AWP improved project **productivity** and **predictability**
- AWP can be scalable, adjusted and applied to smaller projects as well as larger projects
- Contractors will embrace AWP once they gain experience in its use
- The **Owner** needs to drive use of AWP in the early stages
- Early Stages of AWP can see a payback even if their maturity level is low
- Need only use technology/software necessary to do the job



Initial Misperceptions of AWP

- True or False?
 - Costs of AWP implementation outweigh the benefits (FALSE)
 - In the Early Stages, expensive new technology and software are required to implement AWP (FALSE)
 - AWP can only be used on large complex projects (FALSE)
 - AWP requires large additional staffs to implement (FALSE)



AWP IMPLEMENTATION IN SHELL

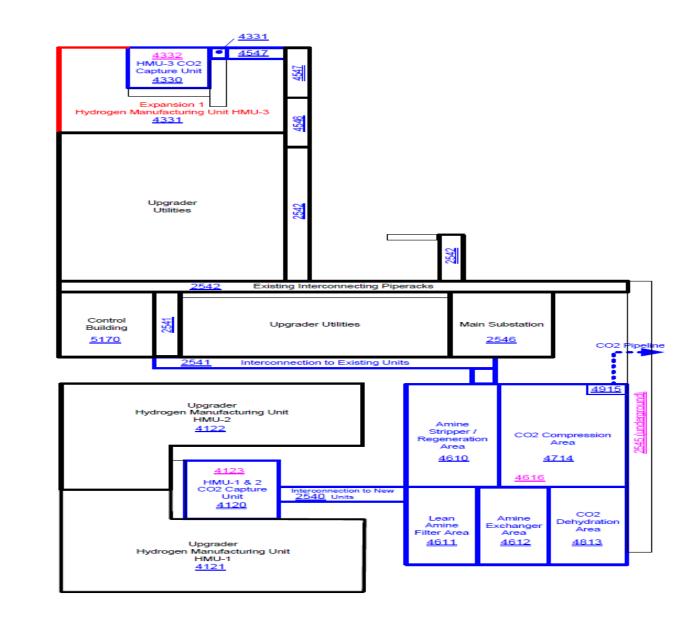
Owners Story



Trevor Posyluzny Global AWP/WFP Subject Matter Expert

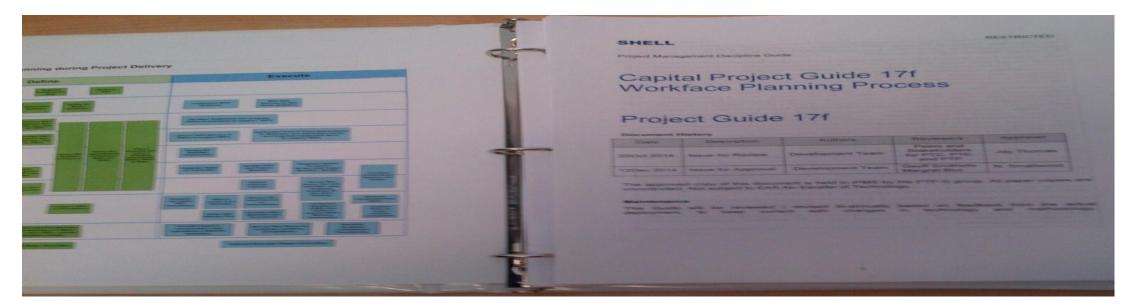
OPTIMAL PATH OF CONSTRUCTION

- Established in Select (very early) and finalized in Define (Preexecution).
- ✓ Utilizes Construction Work Areas (CWAs) as its primary elements
- Drives the sequence and prioritization of the Engineering and Procurement deliverables
- Facility commissioning complexity, start-up sequence and long lead items must be considered and incorporated



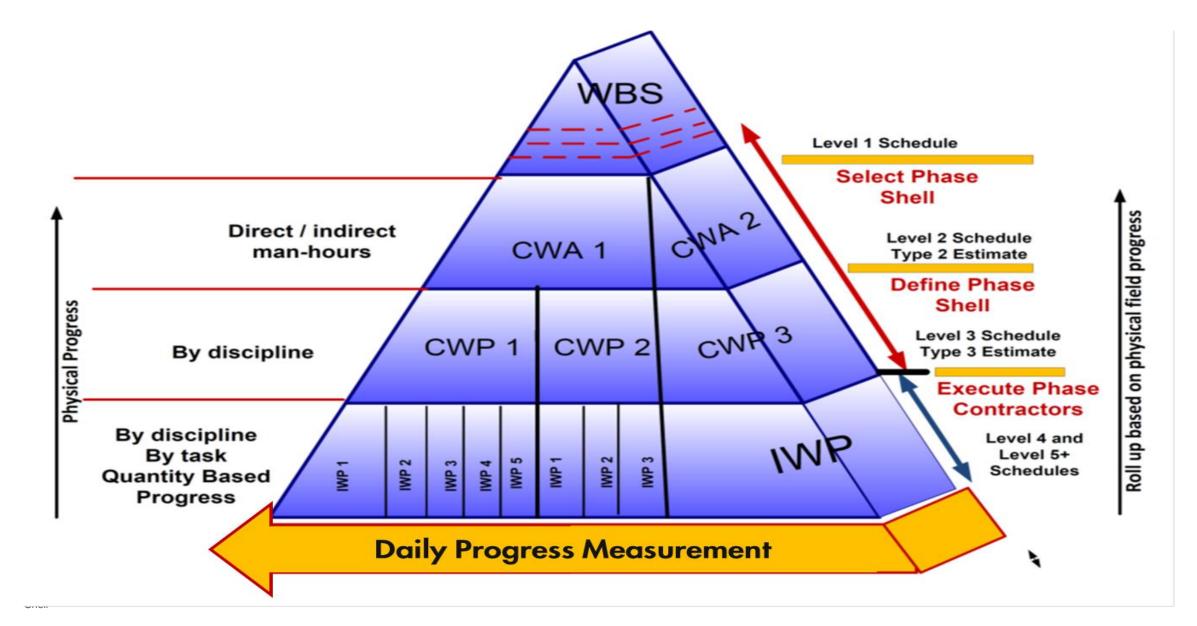
AWP/WFP IN SHELL

Both Shell and its contractors develop Engineering and Procurement packages that are broken down into discrete work packages that align with <u>optimal</u> <u>construction sequencing.</u>



This guide provides the **framework** to implement a **systematic** process to **organize** and deliver all the elements necessary, to enable craft persons to perform quality work in a safe, effective, and efficient manner.

WORK BREAKDOWN STRUCTURES AND REPORTING



GLOBAL IMPLEMENTATION



Projects >\$100M have been identified in all regions and all Business Super Buckets.



KPIs and Reporting Processes include Site reporting and extend up to Regional VP score cards





AWP is an expectation for all projects – It will be one of our major levers to become predicable and efficient in Project delivery.

PERFORMANCE INDICATORS

Leading Indicators

□ IWPs approved by HSSE, QA and Construction Engineering, and ready for issuance to field

- □ vs plan vs total forecast of IWPs; ~ Go/No-Go Status; by discipline and area,
- □ IWPs completed and closed out vs plan vs total forecast of IWPs; by discipline and area,
- □ IWPs issued to field and in progress vs plan; by discipline and area,
- 90 day look-ahead of IWPs ready for release to field for execution (Unit and/or area) vs plan; status of engineering and procurement deliverable constraints

Lagging Indicators

- IWPs returned incomplete (due to constraints), for week and in total; trend analysis of constraints; by discipline and area,
- Simple on Tools # hours on tools working constraint free / duration of work shift, plus list of typical constraints w/ trending analysis,
- Productivity factor based on earned labor man-hours/budgeted labor man-hours, by discipline, by CTR, by IWP or total, 3 week trending,
- □ Average trend of Cost Performance Index of IWP actual costs/budget,
- □ Average trend of Schedule Performance Index of IWP actual duration/approved duration,

COLLABORATION WITH OUR CONTRACTORS

- Project strategy is shared among key project participants to obtain commitment towards a shared vision.
- AWP Language and expectations have been included within the contracts.
- The procedures are prepared by the EPC and then reviewed and approved by the owner.
- Contracts included the specification of major project milestones and serve as a basis for the audits throughout the various project phases.





AWP AND MODULARIZATION



Aligning the delivery sequence of modules with the construction sequence is critical because of the different optimization logics
between the mod-yard and the construction site.

 Identify Module Work Scope and Site executed early in project detailed Planning.

RESULTS – CASE STUDY 2.8M MAN HOURS

Improved safety: significantly better safety statistics (Zero LTIs)

■<u>Under Budget</u>! >\$20M

- On time: Delivered 3 months ahead of schedule!
- Superior Quality: Rework from construction activities was <u>below 1%</u> in comparison to a target of 3% or less rework.
- Not all areas of this project used AWP, those areas used a disproportionate amount of contingency.



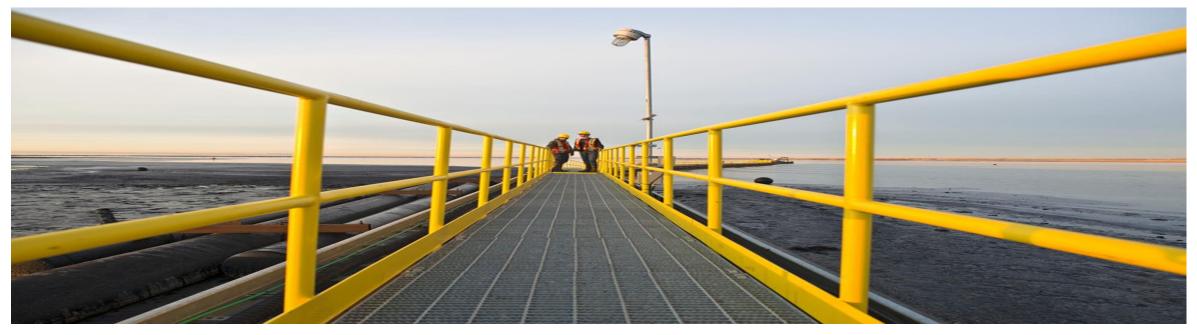
Predictable: minimal change orders (influenced by both the completeness of construction specifications and by the higher level of engineering completion before field mobilization).

LESSONS LEARNED

A global database has been developed with over 120 lessons currently captured – they are shared with all projects implementing AWP/WFP strategies.

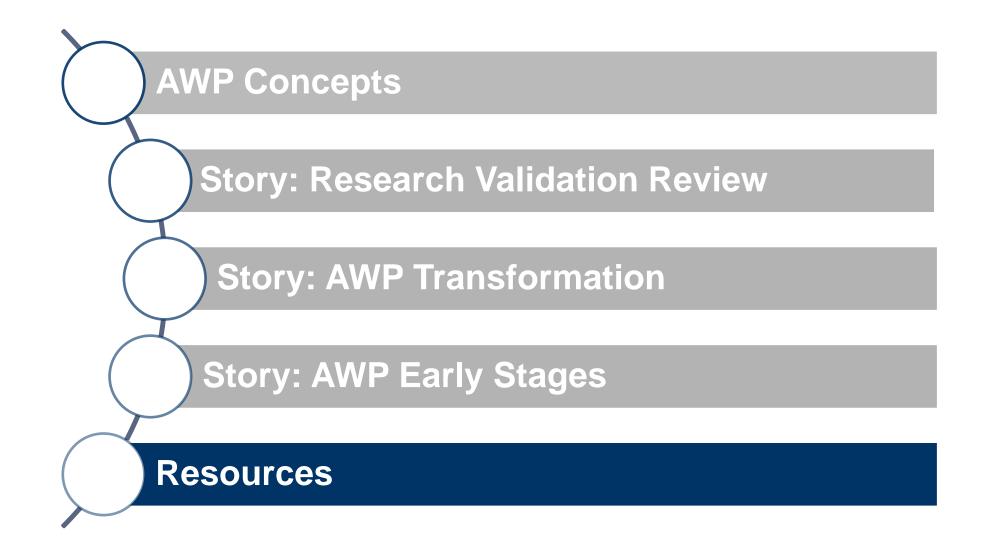
■Top 3 lessons:

- Start AWP planning/execution early
- All home office work must support the optimal Path of construction
- Include support crafts in the design stages early involvement of CM and construction contractors pays dividends.





Agenda



Construction

stitute



RT 272 Publication – IR272-2 rev. 3

Advanced Work Packaging: Design through Workface Execution Construct Industry Institute Volume I: Recommended Process

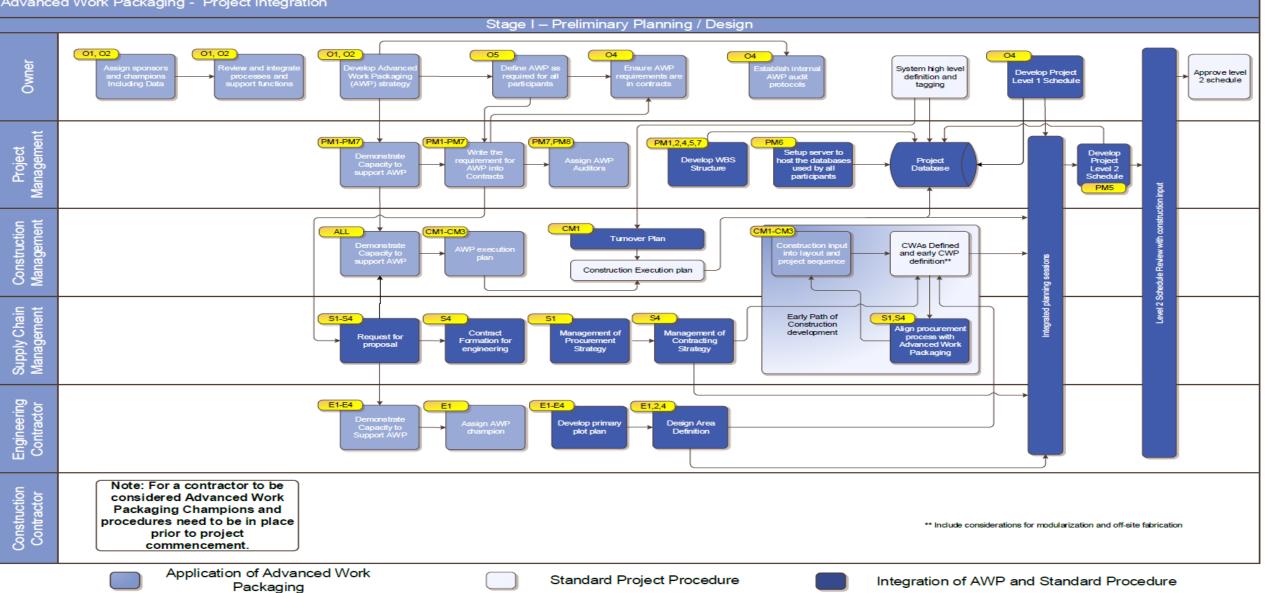
Advanced Work Packaging: Implementation Guidance GEE Construct Industry Institute Volume II: Implementation Guidance

Advanced Work Packaging: Implementation Case Studies and Expert Interviews GII Construe Industry Institute Volume III: **Case Studies** and Expert Interviews



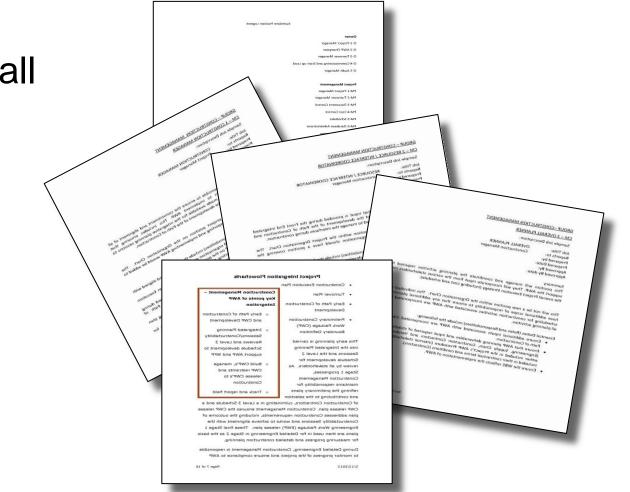
Flow Charts

Advanced Work Packaging - Project Integration

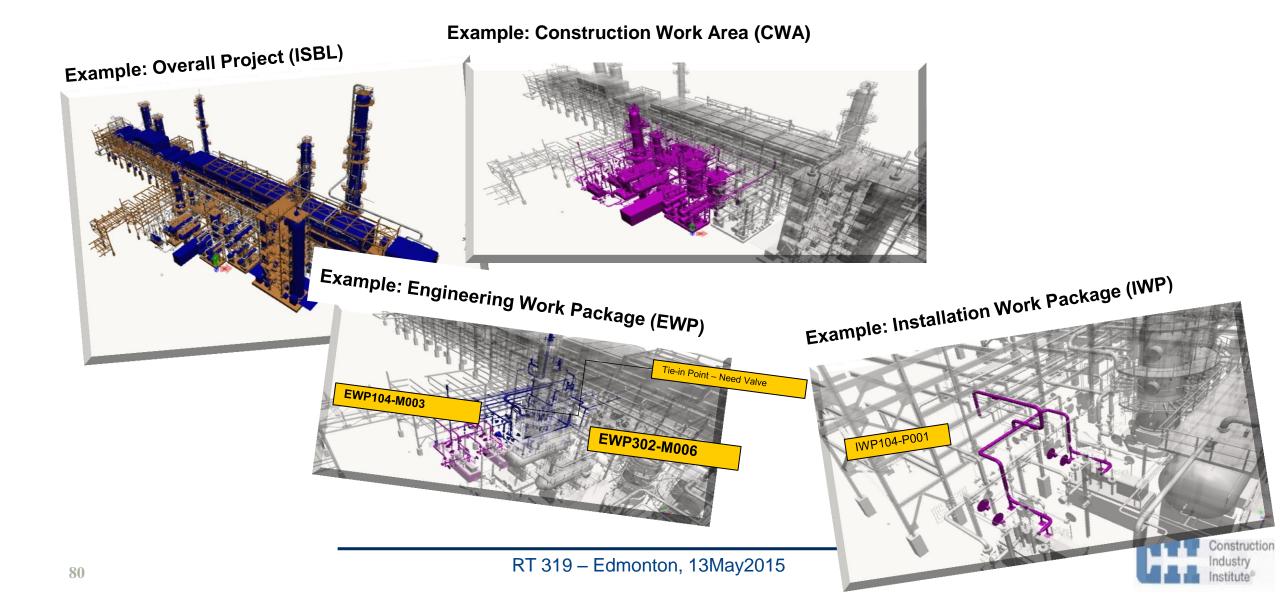


Narrative & Templates

- Narrative description of the overall AWP Process
- CWP, EWP, IWP templates
- Contract considerations
- Functional Roles & Job Descriptions
- Vendor prequalification
- Maturity model
- Audit & assessment tools



Detailed Project Example



Questions & Answers

81

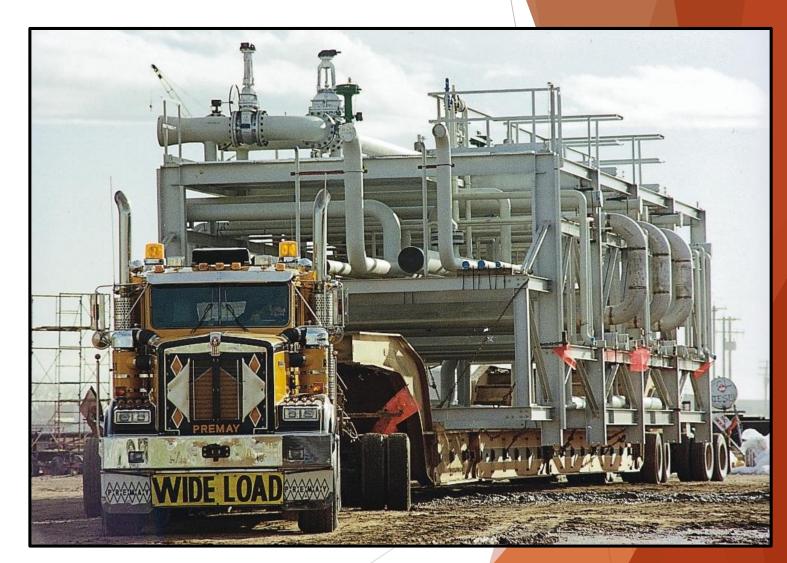
Module Assembly Best Practice Lower your total installed cost

COAA Best Practices Conference XXIII

May 13, 2015

Today's Agenda

- 12:45 1:30 Overview of Module Assembly Best Practice work to date
- 1:30 1:50 Break into working groups, discuss topics
- 1:50 2:05 Table presenters provide feedback to larger group
- 2:05 2:15 Summary & Path Forward
- ▶ 2:15 Wrap-up



Introduction

- Vision: To make optimum use of the already strong Alberta fabrication capabilities to deliver globally competitive modules.
- Goal: Establish and implement an industry accepted Modular Best Practice to improve Total Installed cost, Scheduling, Quality, Transportation and Safety.



Introduction

Committee Chairs

- Greg Prinsen, Williams Energy
- Gary Trigg, PCL Industrial Management Inc.

Committee Members

- Dr. Simaan Abourizk, UofA
- Patricia Armitage, Govt of Alberta
- Martin Clutterbuck, Devon Energy
- Jason Collins, Collins Industries
- ► Kevin Guile, Supreme Modular
- ► Gavin Kerr, Mammoet
- ► Ken McAlpine, Suncor Major Projects

- Rae-Ann McMullen, PCL Industrial Management
- Michael Powell, Enterprise Edmonton
- Darren Starchuk, Enerflex
- Brian Skeoch, Bemac Construction Corp
- Ross Turner, Fluor Canada Ltd.
- Karen Ulmer, PCL Industrial Constructors Inc.

Module Assembly Elements



- 1) Design
- 2) Procurement
- 3) Contracting
- 4) Work packaging
- 5) Fabrication
- 6) Module assembly
- 7) Lifting & shipping preparation
- 8) Transportation & receiving (offload)
- 9) Module installation

Principles vs Best Practices

- Module Assembly Best Practices Sub-Committee is developing a "Principled base Framework" with the intent that it:
 - provides guidance for proper planning and execution
 - ▶ is adaptable and non-prescriptive
 - ▶ is scalable to fit the needs of various project sizes
 - allows contracting flexibility
 - recognizes that organizations within the contracting supply chain have their own specific strengths, weaknesses and risk profiles
 - put ownership at the front end with the decision maker, early involvement in planning

Principles vs Best Practices - what's the difference?

Principle:

"A fundamental truth; a comprehensive law or doctrine, from which others are derived, or on which other are founded; a governing law of conduct" - Definitions.net

Best Practice:

"Commercial or professional procedures that are accepted or prescribed as being correct or most effective." - Oxford Dictionary

Principles vs Best Practices - Modularization

Principle (industry applicable):

5.3 All required materials delivered to fabricator prior to start of fabrication

Best Practice (project specific):

Example:

- Materials arriving from local suppliers are required to arrive a minimum of <u>7 days</u> prior to the start of fabrication.
- Materials arriving from international suppliers are required to arrive a minimum of <u>30 days</u> prior to the start of fabrication.

Focus on 1-2-3 Principles & Practices



- 1) Design
- 2) Procurement
- 3) Contracting
- 4) Work packaging
- 5) Fabrication
- 6) Module assembly
- 7) Lifting & shipping preparation
- 8) Transportation & receiving (offload
- 9) Module installation

Focus on Work Packaging Principles & Practices



- 1) Design
- 2) Procurement
- 3) Contracting
- 4) Work packaging
- 5) Fabrication
- 6) Module assembly
- 7) Lifting & shipping preparation
- 8) Transportation & receiving (offloa
- 9) Module installation

Focus on Work Packaging Principles & Practices

4.0 Work Packaging

- 4.1 Deliverables from buyer to modular supplier
- 4.2 Work package elements
- 4.3 No changes
- 4.4 Scope repetition if possible
- 4.5 Recommended scope review

Focus on Fabrication Principles & Practices



1) Design

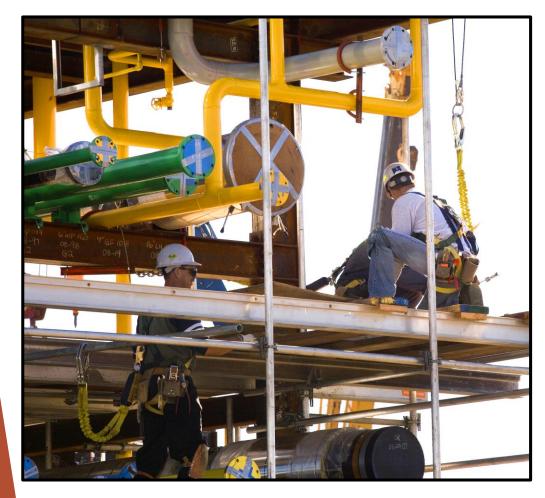
- 2) Procurement
- 3) Contracting
- 4) Work packaging
- 5) Fabrication
- 6) Module assembly
- 7) Lifting & shipping preparation
- 8) Transportation & receiving (offload
- 9) Module installation

Focus on Fabrication Principles & Practices

5.0 Fabrication

- 5.1 Complete IFC drawings required
- 5.2 Engage fabricator at earliest stage of engineering design
- 5.3 All required materials delivered to fabricator prior to start of fabrication
- 5.4 Fabrication to include all required components to avoid design at modular fabrication level (i.e., support for misc piping, electrical, etc.)
- 5.5 Maximize pre-assembly for modular erection efficiency

Focus on Module Assembly Principles & Practices



1) Design

- 2) Procurement
- 3) Contracting
- 4) Work packaging
- 5) Fabrication
- 6) Module assembly
- 7) Lifting & shipping preparation
- 8) Transportation & receiving (offload)
- 9) Module installation

Focus on Module Assembly Principles & Practices

6.0 Module Assembly

- 6.1 MIWP requirements are agreed by stakeholders in advance of module assembly
- 6.2 Issued for construction design model, drawing and cut sheets are available to module contractor
- 6.3 Design is complete before assembly commences
- 6.4 Module assembly materials are shipped with one module per load
- 6.5 Module assembly contractor is engaged as a stakeholder in the engineering, procurement and construction schedule integrated project schedule
- 6.6 Module contractor utilizes work face planning and lean manufacturing principles
- 6.7 Materials are shipped on time
- 6.8 QC/QA requirements are defined up front by stakeholders
- 6.9 Module yard infrastructure supports project goals

Focus on Lifting & Shipping Preparation Principles & Practices



1) Design

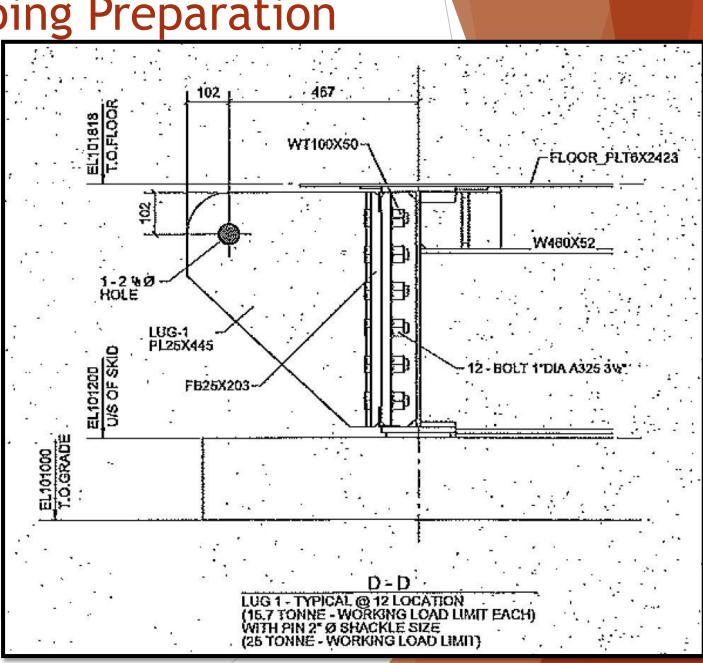
- 2) Procurement
- 3) Contracting
- 4) Work packaging
- 5) Fabrication
- 6) Module assembly
- 7) Lifting & shipping preparation
- 8) Transportation & receiving (offload
- 9) Module installation

Focus on Lifting & Shipping Preparation Principles & Practices

7.0 Lifting & Shipping Preparation

7.1 Lifting

- Standardize the lift points & bay spacing
- Minimize the number of lift points
- Modules with unequal lift lug elevations
- Lift lugs cannot fit shackles



Focus on Lifting & Shipping Preparation Principles & Practices

7.0 Lifting & Shipping Preparation

- 7.1 Shipping Preparation
 - Width & height control
 - Weight certainty & control
 - Shipping season/construction schedule
 - Lashing & tie-downs



Focus on Transportation & Receiving Principles & Practices



1) Design

- 2) Procurement
- 3) Contracting
- 4) Work packaging
- 5) Fabrication
- 6) Module assembly
- 7) Lifting & shipping preparation
- 8) Transportation & receiving (offload)
- 9) Module installation

Focus on Transportation & Receiving Principles & Practices

8.0 Transport and Receiving

- 8.1 Transport
 - Integrated transport beam
 - Build on shipping beams
 - Self-load/offload versus hoisting
 - Leave temp steel as permanent



Focus on Transportation & Receiving (Offload) Principles & Practices

8.0 Transport and Receiving

8.2 Receiving

- Straight to hook (just-in-time)
- On-site laydown area
- Straight to piles



Focus on Module Installation Principles & Practices



- 1) Design
- 2) Procurement
- 3) Contracting
- 4) Work packaging
- 5) Fabrication
- 6) Module assembly
- 7) Lifting & shipping preparati
- 8) Transportation & receiving (offload)
- 9) Module installation
- 10)Completion

Focus on Module Installation Principles & Practices

9.0 Module Installation

- 9.1 Reduce work at heights
- 9.2 Early involvement of module installer
- 9.3 Bolted construction of interconnects
- 9.4 Preassemble at site
- 9.5 Include construction supports
- 9.6 Plan for site conditions



Focus on Completion Principles & Practices



- 1) Design
- 2) Procurement
- 3) Contracting
- 4) Work packaging
- 5) Fabrication
- 6) Module assembly
- 7) Lifting & shipping preparatio
- 8) Transportation & receiving (offload)
- 9) Module installation

10)Completion

Summary

- Goal: Establish and implement an industry accepted Modular Best Practice to improve Total Installed cost, Scheduling, Quality, Transportation and Safety.
- Provided brief overview of modular best practice work to date
- Prescriptive: needs to be tailored to your project
- Modular best practice: part of project execution plan
- Great committee: broad cross section representing all aspects of industry



Table Discussion: looking for feedback

- How will the principle based framework accomplish COAAs vision of twice as safe and twice as productive by 2020?
- Will this document benefit your business? If so, how or how not?
- Are the 10 best practice areas representative of the requirements for a module assembly best practice? Are there any areas missing?

Next Steps

- Draft document available on COAA website in June 2015
- Document completion
- Continued improvement
- Encourage industry feedback and additions
- Framework for your business
- Committee Contact information
 - Greg Prinsen, Williams Energy Canada, greg.prinsen@williams.com
 - Gary Trigg, PCL Industrial Management Inc., <u>gptrigg@pcl.com</u>
 - COAA Website: <u>www.coaa.ab.ca</u>



Module Assembly Best Practice Lower your total installed cost

COAA Best Practices Conference XXIII

May 13, 2015



The Knowledge Leader for Project Success

Leveraging 25 Years of Industry Leadership

COAA Benchmarking Phase III The 10-10 Program: from Lagging to Leading COAA Best Practices Conference XXIII

May 13, 2015 Edmonton, Alberta

Stephen P. Mulva, Ph.D. Associate Director

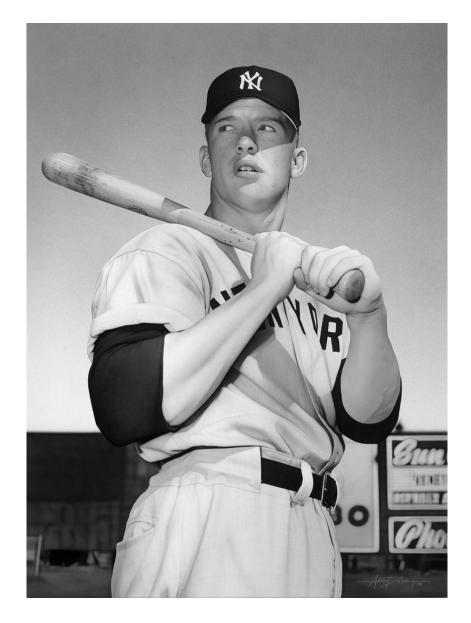
Jim Lozon, Ph.D., P.Eng. VP, PDE Systems Inc.

Agenda

- CII / COAA 10-10 Program Overview
- 10-10 Findings / Analyses
- 10-10 Portfolio Analyses (Corporate)
- 10-10 Program System
- New Frontiers
- COAA Benchmarking Phase III

Awareness Test

- "It's unbelievable how much you don't know about the game you've been playing all your life.
 - Mickey Mantle





A, B, or C Team? How to Know / Measure?

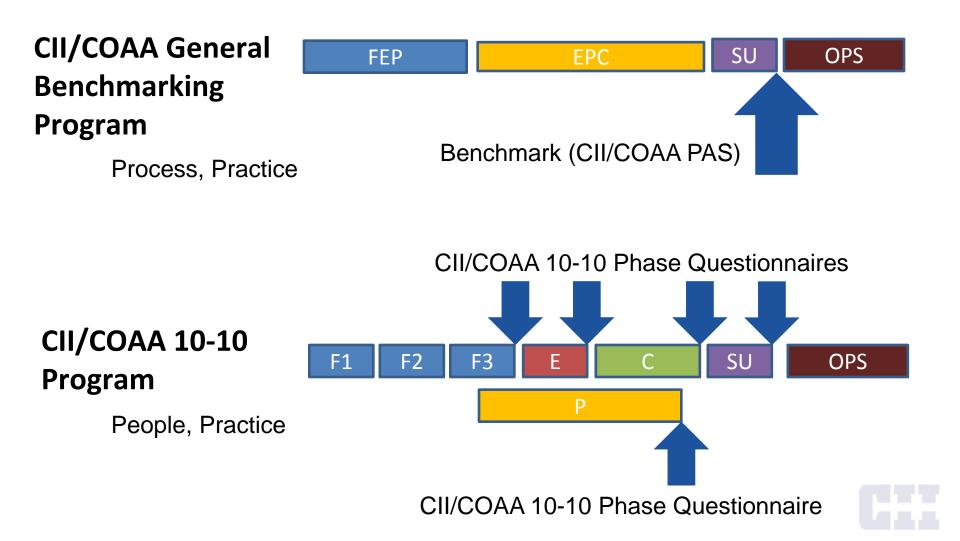
- 5 Principles of Project Integration
 - Work and Work Process
 - Organizational Engineering
 - Leadership and Governance
 - Communications and Information Flow
 - Business Environment and Culture
- CII's 10-10 Program Measures
 - 10 Leading (Team) Indicators
 - 10 Performance Outcomes (Cost, Capacity, etc.)



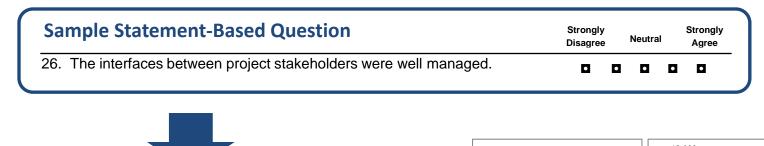
Cll's 10-10 Program

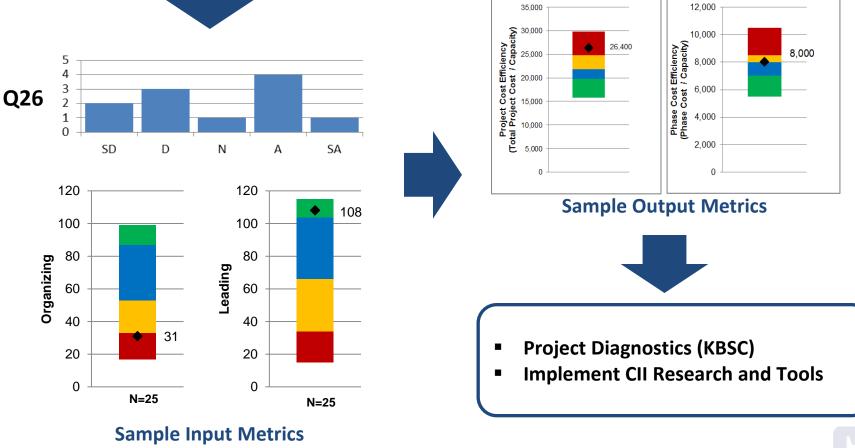
- Simple and Important Measures
 - 10 Input Measures (Leading Indicators)
 - 10 Output Measures (Cost, Duration, Capacity, FTE, Quantities)
- Research-Based
 - 75% CII / COAA Research (e.g., Project Health Indicators)
 - 15% Capital Projects Research (CII Members)
 - 10% Other Industries (Project Management Measures)
- Launched July 2013 (CII Annual Conference)
- Industrial, Building, and Infrastructure Sectors Phase-Based Surveys
- CII Requesting 10 Project-Phase Surveys from Each CII Member by May 15, 2015
- www.10-10program.org

Traditional Benchmarking vs. 10-10 Performance Assessment Program



How CII's 10-10 Program Works





10-10 Surveys ALL CII Practices

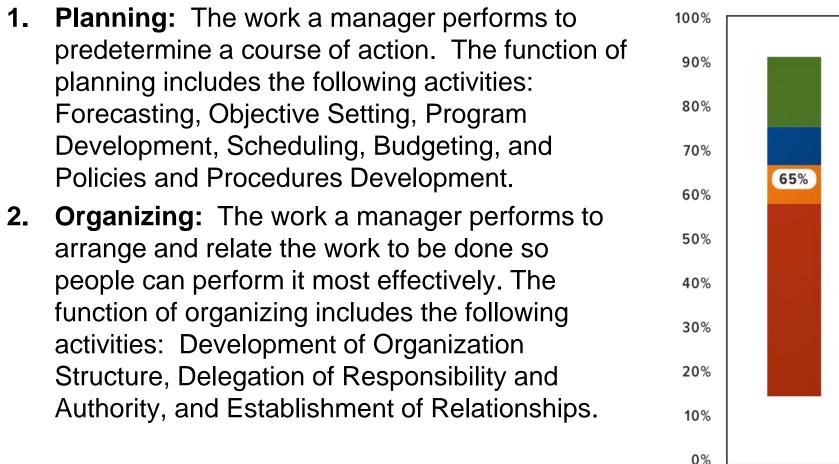
- Constructability (Engr.) RT3, 29, 34, 283
 - "Comprehensive constructability suggestions (e.g., preassembly, prefabrication, modularization, and offsite fabrication) were evaluated and incorporated into the Engineering of this project" (SA, A, N, D, SD)
- Quality Management (Proc.) RT10, 31, 36, 130, 172, 254, 257, 264, 307, 308
 - "This project implemented a supplier quality surveillance program" (SA, A, N, D, SD)
- Change Management (Const.) RT27, 43, 158, 244, 258, 290,
 - "Plan and progress including changes were communicated clearly and frequently amongst project stakeholders" (SA, A, N, D, SD)
- 41 Practices and Best Practices
- Surveys New Research



10 Leading Indicators (Team Indicators)

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CII

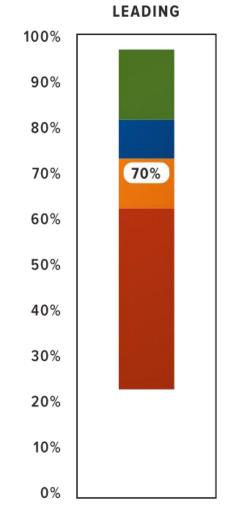


PLANNING

N=120



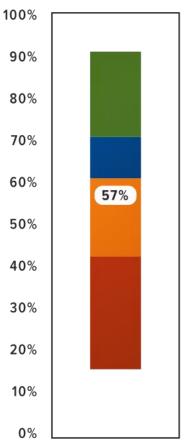
- Leading: The work a manager performs to cause people to take effective action. The activities involved in the function of leading include: Decision-Making, Communications, Motivation, Selection of People, and Development of People.
- 4. Controlling: The work a manager performs to assess and regulate work in progress and completed. Management controls are achieved through the following activities: Establishment of Performance Standards, Measurement of Performance, Evaluation of Performance, and Correction of Performance.



N=119



- 5. Design Efficiency: Measures if the project team is exhausting all techniques to optimize the design in its use of material quantities to provide maximum capacity at minimum cost.
- 6. Human Resources: Examines if the project is staffed correctly, with a minimum amount of staff turnover and appropriate training. Measures if people are capable of achieving project goals.
- Quality: Measures if the project team is strictly conforming to project requirements. Analyzes if programs are pursued to assure the delivery of material goods as intended.

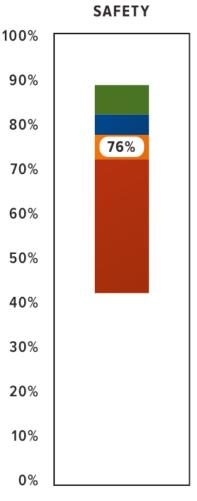


N=102

DESIGN EFFICIENCY

CH

- 8. Sustainability: Evaluates steps taken by the project team to reduce the environmental impact of the project during construction and operation.
- 9. Supply Chain Management: Examines the strategies used by the project team to promote enhanced working relationships amongst all project stakeholders including those in the project supply chain.
- **10. Safety:** Measures the steps followed by the project team to eliminate any possibility of personal injury or property damage on the project.





10 Outputs (Capacity and FTE-Based Metrics)

Table 5: List Output Metrics by Phase

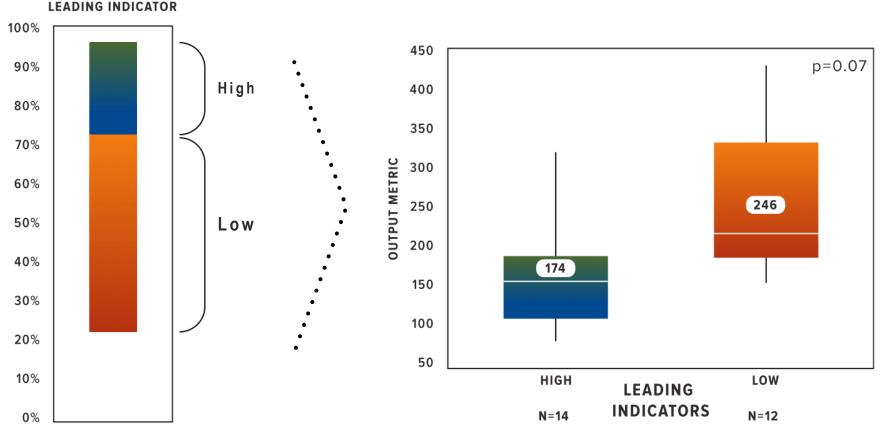
Metrics Type	FEP/PROG	ENG/DES	PRO	CON	STA/COM
	1. (Building) Forecasted Project Cost Efficiency	 (Building) Forecasted Project Cost Efficiency 	 (Building) Forecasted Project Cost Efficiency 	 (Building) Forecasted Project Cost Efficiency 	 (Building) Actual Project Cos Efficiency
ased	 (Building) FEP (Programming) Cost Efficiency 	 (Building) Engineering (Design) Cost Efficiency 	 (Building) Total Equipment Cost/Capacity 	2. (Building) Construction Cost Efficiency	2. (Building) Startup (Commissioning) Cost
Capacity-based Metrics	3. (Building) Forecasted Project Schedule Efficiency	3. (Building) Forecasted Project Schedule Efficiency	 (Building) Forecasted Project Schedule Efficiency 	 (Building) Forecasted Project Schedule Efficiency 	Efficiency 3. (Building) Actual Project
Cap	 (Building) FEP (Programming) Schedule Efficiency 	 (Building) Engineering (Design) Schedule Efficiency 	 (Building) Procurement Schedule Efficiency 	 (Building) Construction Schedule Efficiency 	Schedule Efficiency 4. (Building) Startup
		5. (Building) Capacity Efficiency		5. (Building) Capacity Efficiency	(Commissioning) Schedule Efficiency
ss Ss	 FEP (Programming) Cost Growth 	 Engineering (Design) Cost Growth 	 Procurement Schedule Growth 	6. Construction Cost Growth	 Startup (Commissioning) Cos Growth
Relative Metrics	6. FEP (Programming) Schedule Growth	7. Engineering (Design) Schedule Growth	6. Total Cost of Equipment/Total Project Cost	7. Construction Schedule Growth	6. Startup (Commissioning) Schedule Growth
Phase burn Metric	7. FEP (Programming) Burn Rate	8. Engineering (Design) Phase Burn Rate	7. Procurement Phase Burn Rate	8. Construction Phase Burn Rate	7. Startup (Commissioning) Phase Burn Rate
ant			 Total Cost of Equipment/Total Number of Major Equipment 		
Procurement Metrics			 Total Project Cost/Number of Vendors 		
Proc			10. Total Project Cost/Number of Purchase Orders		
Ţ.	 Project Management Team Size/Total Project Cost (Adjusted for Complexity) 	 Project Management Team Size/Total Project Cost (Adjusted for Complexity) 	11. Project Management Team Size/Total Project Cost (Adjusted for Complexity)	 Project Management Team Size/Total Project Cost (Adjusted for Complexity) 	8. Startup (Commissioning) Management Team Size/Total Project Cost (Adjusted for
FTE-Based Metrics		 Engineering Team Size/Total Project Cost (Adjusted for Complexity) 	12. Procurement Team Size/Total Project Cost (Adjusted for Complexity)	10. Craft Work Force/Construction Phase Cost	Complexity) 9. Startup (Commissioning) Phase Management Team
-		11. Engineering Team Size/Engineering Phase Cost	13. Procurement Team Size/Total Cost of Major Equipment		Size/Startup Phase Cost
ty cs				11. TRIR	
Safety Metrics				12. DART	

10-10 FINDINGS / ANALYSES



Round 1 Results (600+ Global Projects)

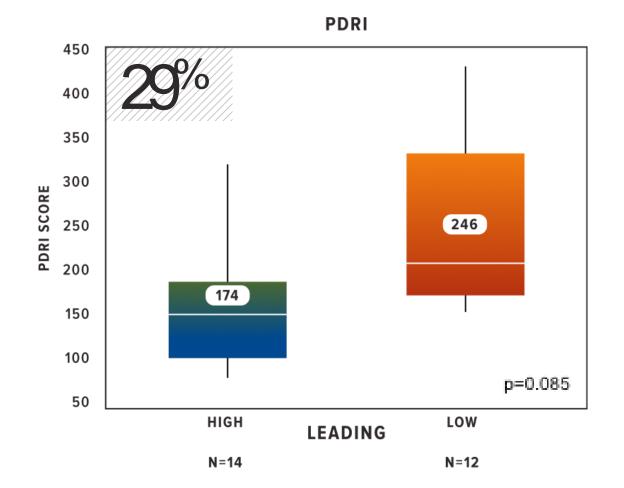
Typical Analysis of a Leading Indicator



N=119

Front End Planning (FEP)

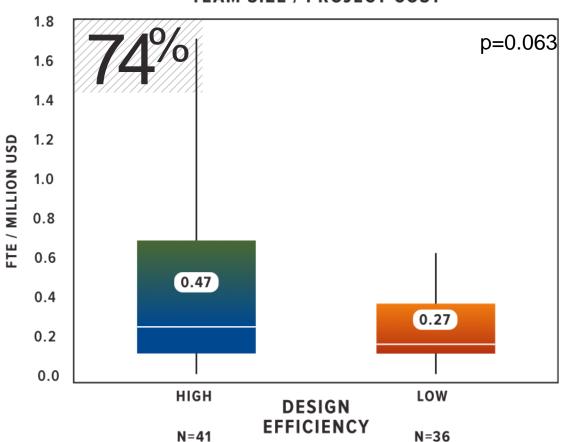
• Effect of Leadership





Engineering (Design)

• Impact of Design Efficiency

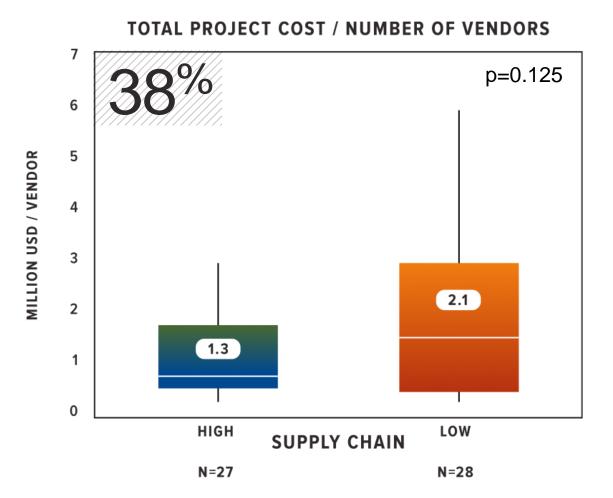


TEAM SIZE / PROJECT COST



Procurement

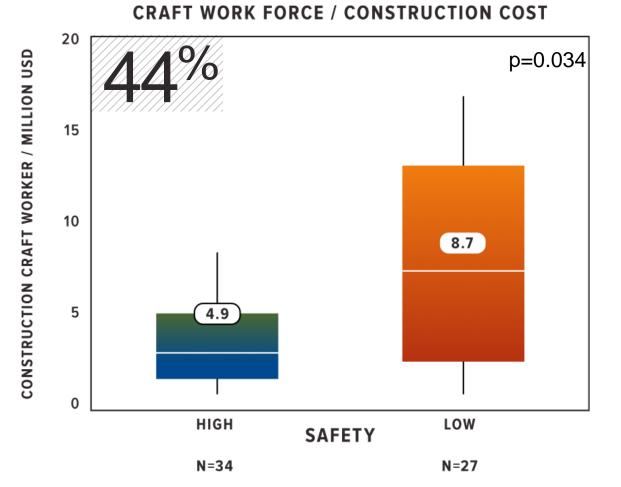
• Effect of Supply Chain





Construction

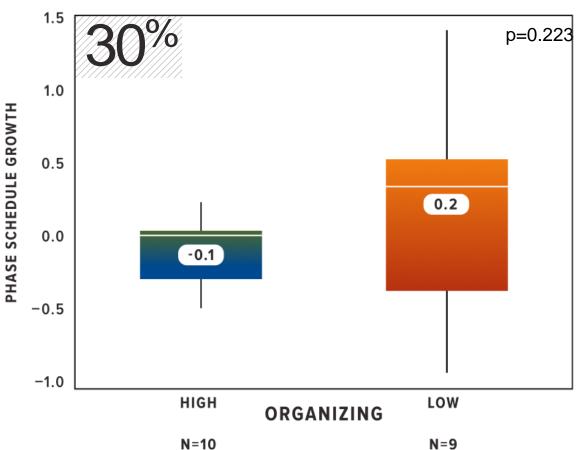
Impact of Safety





Start Up / Commissioning

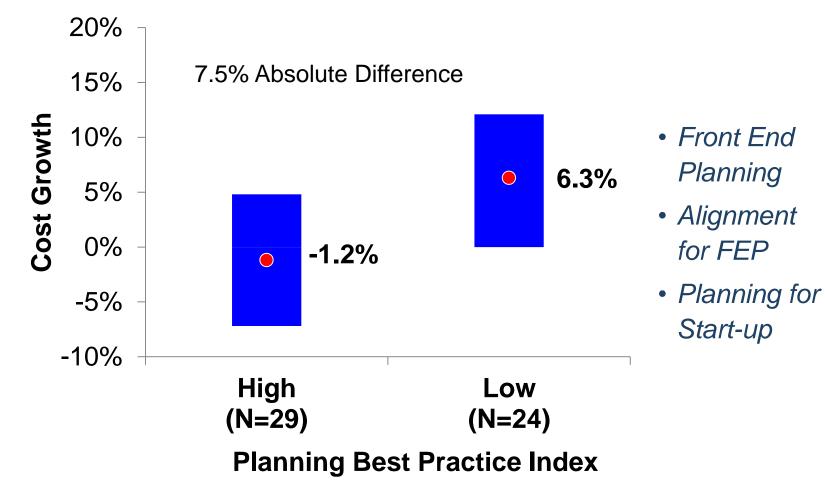
• Effect of Organizing



PHASE SCHEDULE GROWTH



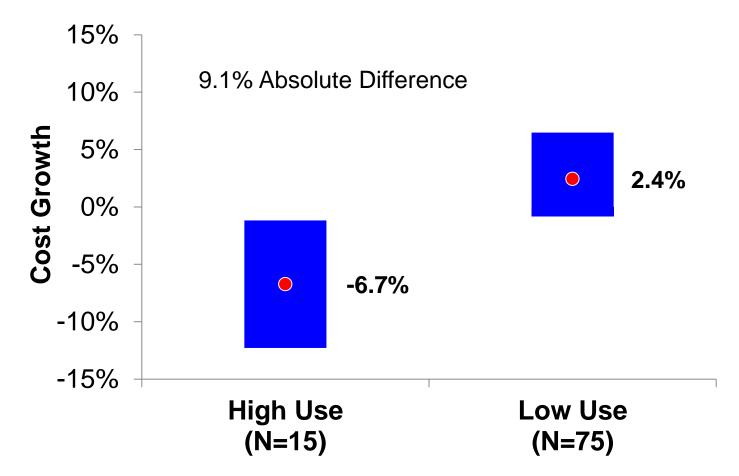
Cll VBP: Owner Planning (6.1% NPV Gain)



=standard error of mean (90% confidence interval)

CII

CII VBP: Owner Partnering (33.8% NPV Gain)



=standard error of mean (90% confidence interval)



CII Working Relationship

- The goal of the analysis is to assess whether projects that have CII members as owners and contractors have better performance (10-10 input measures)
- Each box and whisker plot shows:

Group of projects that had CII members as both owners and contractors

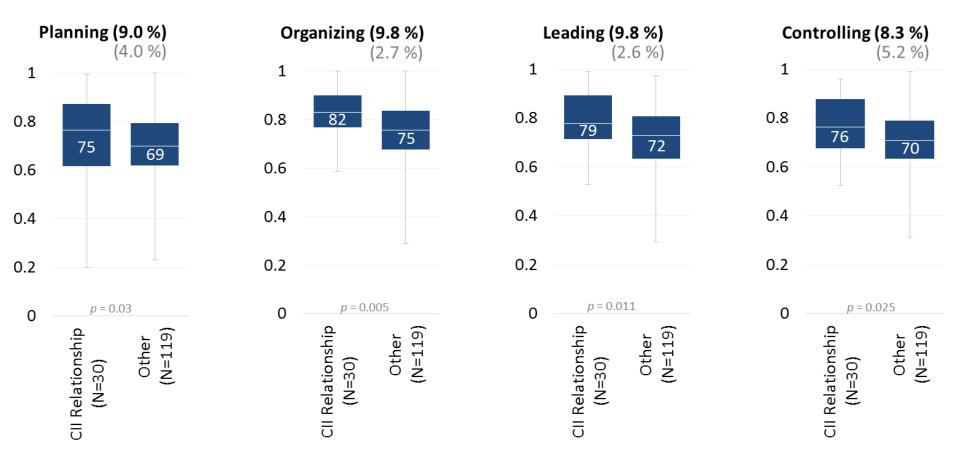
versus

Group of projects in which either the owner or contractor were not a CII member

The number in white within the boxes indicate the group average

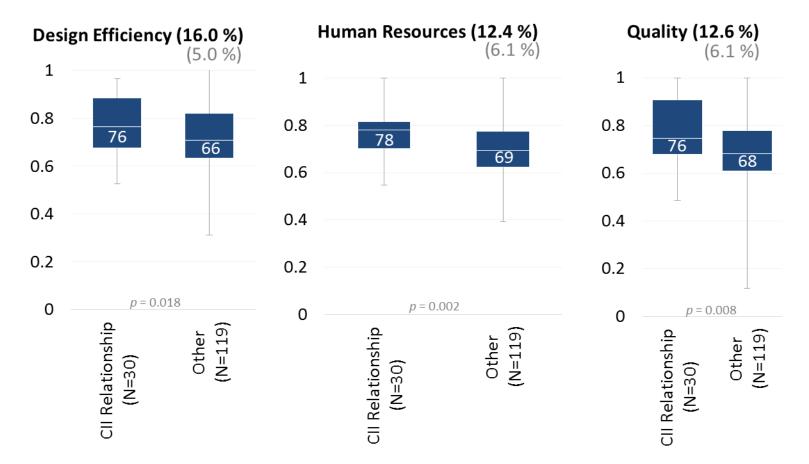


Input Measures by Working Relationship



The number in white within the boxes indicate the group average for projects with more than two respondents. The percentage in black indicates the difference between the two averages. The percentage in light gray indicates the difference for projects with only one response.

Input Measures by Working Relationship



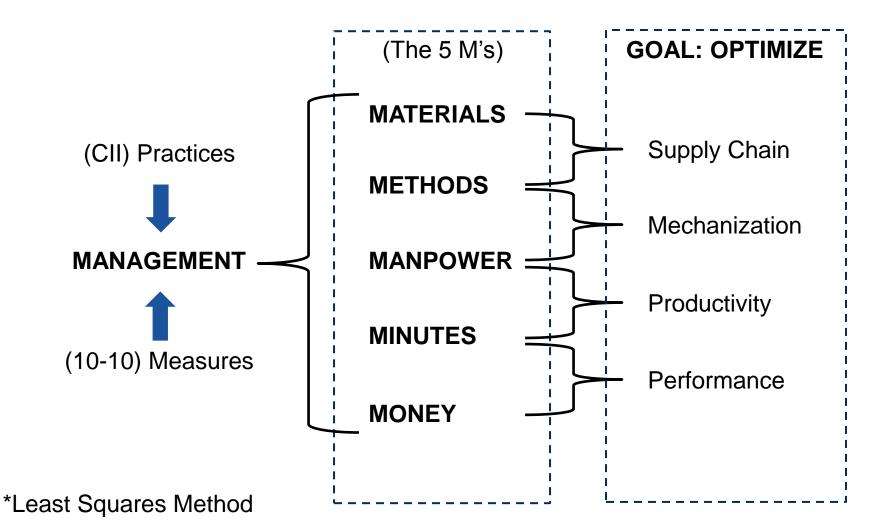
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Input Measures by Working Relationship



The number in white within the boxes indicate the group average for projects with more than two respondents. The percentage in black indicates the difference between the two averages. The percentage in light gray indicates the difference for projects with only one response.

The Logic of 10-10 (33.1% Better Management*)





10-10 PORTFOLIO ANALYSIS (BY COMPANY)



CII Company Portfolio 10-10 Analysis

10-10 Contractors's Rank by Project Performance

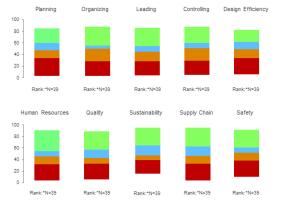


The white circle indicates your company average score in each phase.

The score is the average of the score of all 10 measures for all the projects submitted by your company in each phase.

* Rank and average score are reported only when more than three projects have been submitted in a given phase.

Rank by input measure (considering all projects submitted to any phases and sectors)



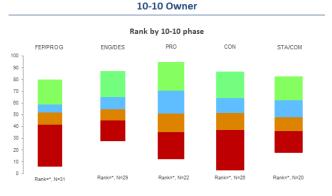
The white circle indicates your company average score.

* Rank are average score are reported only when more then five projects have been submitted.

Last update: 3/21/2015

CII 10-10

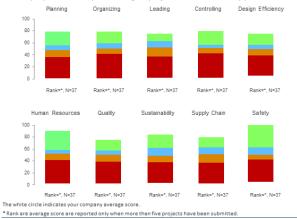
10-10 Owner's Rank by Project Performance



The white circle indicates your company average score in the phase.

The score is the average of the score of all 10 measures for all the projects submitted by your company in each phase. * Average score and rank are reported only when more than three projects have been submitted in each phase.

Rank by input measure (considering all projects submitted to any phases and sectors)

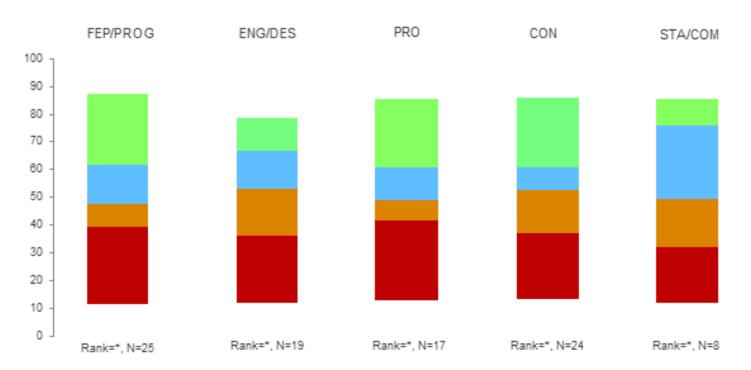


Last update: 3/21/2015

CII 10-10



CII Company Portfolio 10-10 Analysis



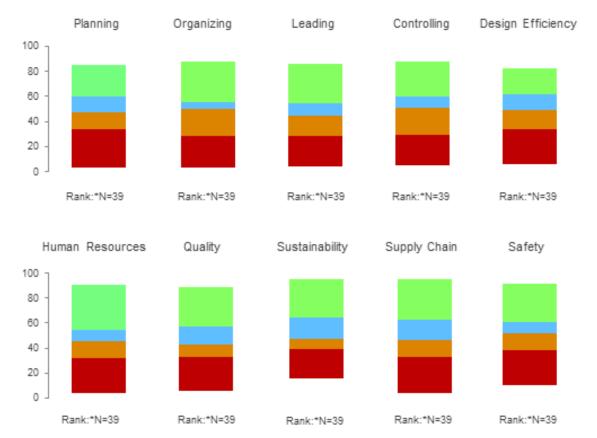
Rank by 10-10 phase

The white circle indicates your company average score in each phase.

The score is the average of the score of all 10 measures for all the projects submitted by your company in each phase.

* Rank and average score are reported only when more than three projects have been submitted in a given phase.

CII Company Portfolio 10-10 Analysis



Rank by input measure (considering all projects submitted to any phases and sectors)

The white circle indicates your company average score.

* Rank are average score are reported only when more then five projects have been submitted.

10-10 PROGRAM SYSTEM



NEW User-Friendly 10-10 System

L H	:: :0-	Welcome, P	harma Tester										User	Guide	The Know		er for Pro				
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	Projects	Click the Project ID or	Name to view team m	nember	s and r	reports								(click	k to add	a new pi	roject)	es.			
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10-10 User Guide

CII 10-10

Welcome, Pharma Tester



(click to add a new project) 🐈

SEARCH

Search Projects

gen In Out	General Section Input Section Output Section
	Not Created
	Not Started
	In Progress
	Completed
	Submitted to CII
	Validated

MY PROJECTS

Click the Project ID or Name to view team members and reports.

		-End Pla ogrami	anning ning		igineeri / Desigr		Pro	ocurem	ent	Co	nstruct	ion		nmissio Start-u	-
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Pharma Testco Owner															
TENO00258 ~ Test Project - Northweste															
TENO00259 ~ Houston PIW															

CII

Glossary, Metrics and Definitions

CII 10-10	The Knowledge Leader for Project Success Owners • Contractors • Academics
411 10 ⁻ 10	Glossary 🕑 Save & Exit 🗎
 Previous Pharma Testco Owner - TENO00258 ~ Test Project - North SURVEY PROGRESS — 1 of 5 	Next >
0 %	
1. Owner Company Name:	
2. Project Construction Location: City:	
3. Project Construction Location:(State or Province):	
4. Project Construction Location: Country:	
5. Lead Construction Contractor:	
+ Previous	Next →
© 2014 Construction Industry Institute™ All rights reserved Privacy Policy	THE UNIVERSITY OF TEXAS AT AUSTIN Cockrell School of Engineering



10-10 Questions/Results

Sample Report

		Mean SD	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
38	Leadership effectively communicated business objectives, priorities, and project goals.	2.73 1.27	11		<mark>45%</mark>	36%	18%
39	Project leaders were open to hearing "bad news", and they wanted input from project team members.	, 2.73 1.56	11		55%	18%	18% 9%
42	Plan and progress including changes were communicated clearly and frequently amongst project stakeholders.	2.73 1.27	11		<mark>45%</mark>	36%	18%
31	The project management team was adequately staffed.	1.82 0.87	11 <mark>9%</mark>		55	5%	36%
37	Project leaders recognized and rewarded outstanding personnel and results.	1.64 0.92	11 <mark>9%</mark>		36%		55%
43	A high degree of trust, respect and transparency existed amongst companies working on this project.	1.64 1.50	11 18%		45	5%	36%

CII

10-10 Questions/Results

		Mean SD	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
26	All of the necessary, relevant project team members were involved in an effective risk identification and management process for Construction.	5.00	1				100%
27	Project safety procedures were well defined and strictly followed.	5.00	1				100%
28	Project management team members were clear about their roles and how to work with others on the project.	5.00	1				100%
30	People on this project worked effectively as a team.	5.00	1				100%
39	Project leaders were open to hearing "bad news", and they wanted input from project team members.	5.00	1				100%
40	Plan and progress including changes were communicated clearly and frequently amongst project stakeholders.	5.00	1				100%
41	The project's Startup objectives were appropriately communicated to the relevant project team members.	5.00	1				100%
			•	-			

CII

10-10 Program Implementation

Question Mapping

Question - Input Metric map

	Industrial Projects – Construction Phase	Planning	Organizing	Leading	Controlling	Design Efficiency	Human Resources	Quality	Sustainability	Supply Chain	Safety
G	What was the typical foreman to craft ratio?										
G	Overall how many workers per safety professional were typically (i.e., in terms of the average workforce) on site?										
4	Did the project objectives change during Construction?										
5	This project experienced a high number of:										
6	Was a turnaround involved in the scope of this project?										
7	Please characterize how project meetings were conducted.										
8	Which of the following statements characterized the decisions made by the manager(s) of this project?										
9	This project used the following methods.										
10	Formal (classroom) safety training was attended:										
11	Did the original primary contractor(s) complete the project?										
13	Was safety performance a criterion for contractor and subcontractor selection?										
14	Were safety toolbox meetings held daily?										
15	Were accidents including near misses formally investigated?										
16	The availability and competency of craft labor was adequate.										
17	The owner level of involvement was appropriate.										
18	The owner and primary contractor(s) maintain a long- standing partnering arrangement.										

NEW FRONTIERS

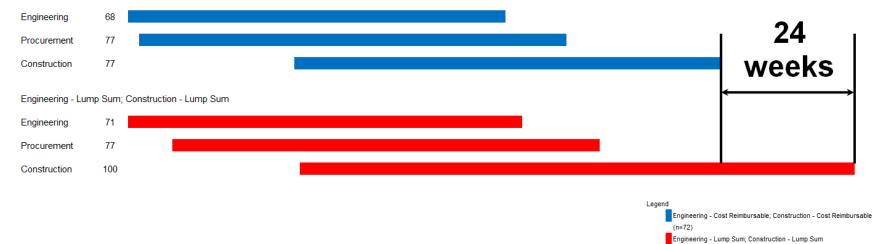


CII Phase Duration Research (2011-Present)

- Normalized \$250 MM Projects
- C/R (Blue) vs. L/S (Red) Contracting







(n=44)

Notes: the project cost ranges from \$25Million to \$500Million (in 2009 dollars)

Procurement Involvement in FEP

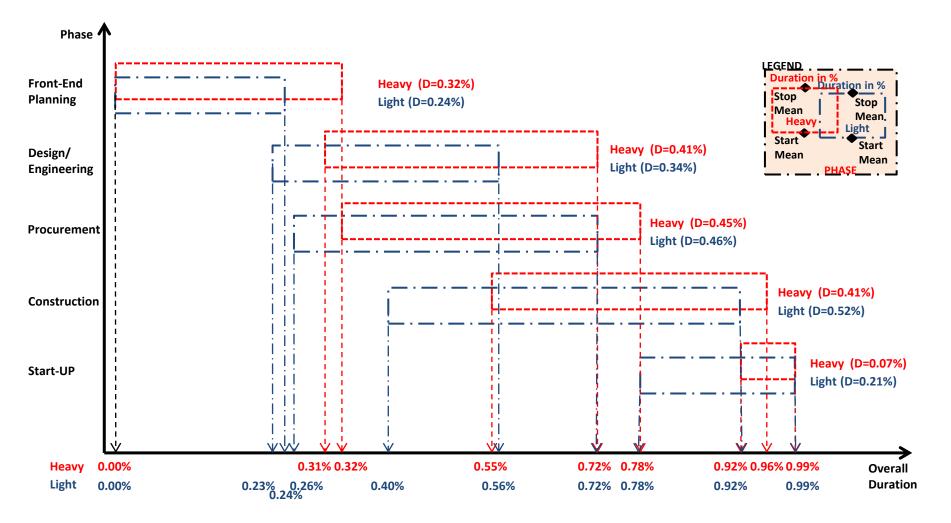


Construction Industry Institute[®]

Analyzed by: BMM Team *Each project's cost was normalized to \$ 250 MM

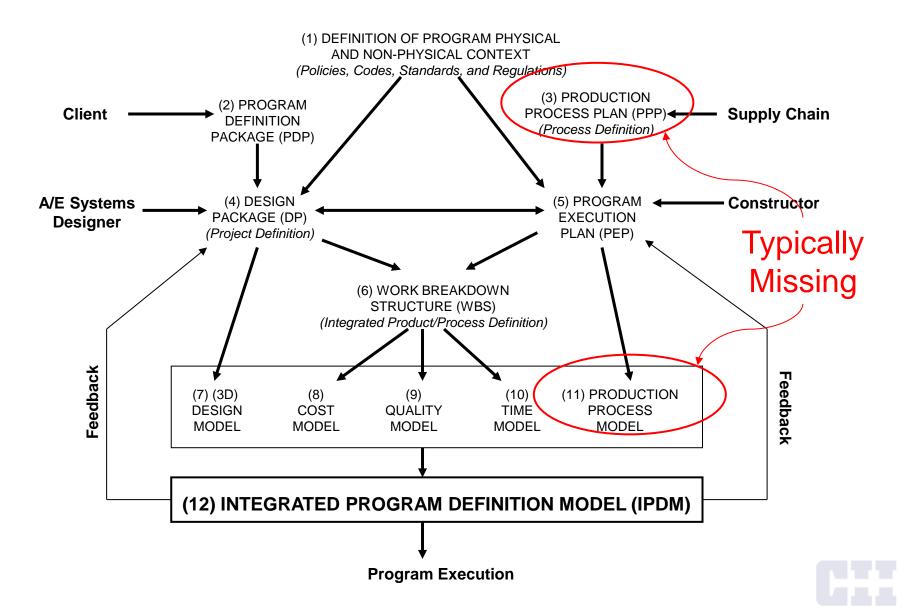
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Arrangement of Phases



CII

Interface Management



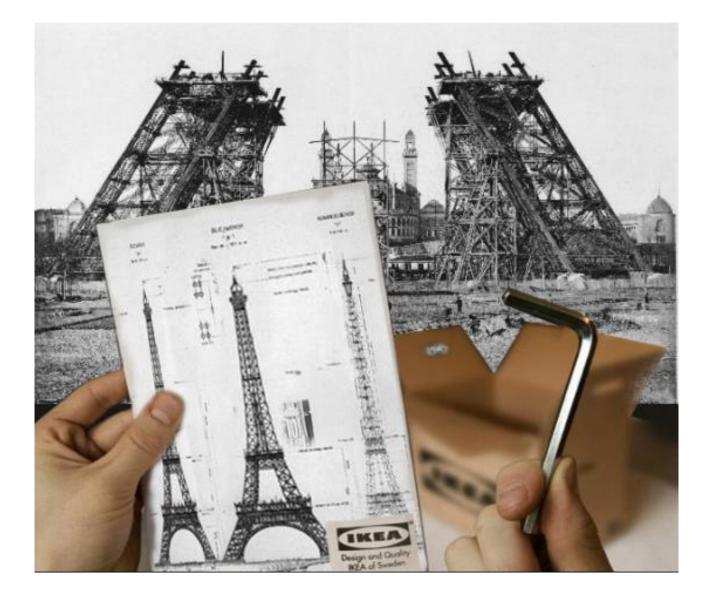
Collaboration?

- Communicate Too Much or Not Enough?
- Lines of Communication = (n(n-1))/2

# Project Team Members	# Lines of Communication
7	21
15	105
50	1225
100	4950
500	124750

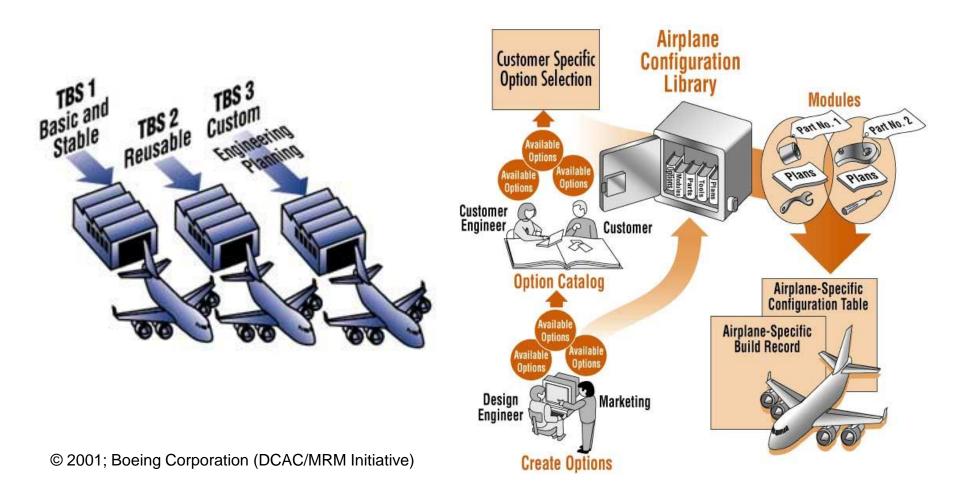


Advanced Work Packaging?



CII

Advanced Work Packaging!



COAA PHASE III JIM LOZON



- Coming together is a beginning; keeping together is progress; working together is success
 - Henry Ford





Questions?

www.10-10program.org

Stephen Mulva, Ph.D. Associate Director, CII <u>smulva@cii.utexas.edu</u> (512) 232-3013

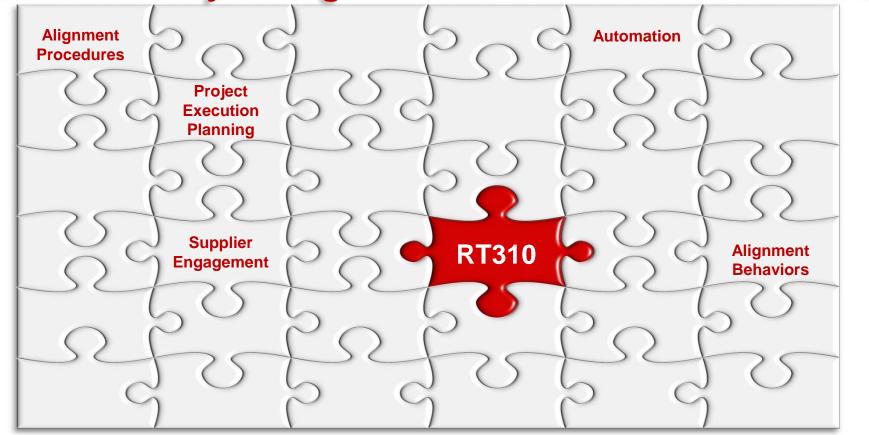
Jim Lozon, Ph.D., P.Eng. Vice President jlozon@shaw.ca

(403) 466-1449





Effective Project Alignment for Construction Success





RT310 Team

Andrew Coombes, BP America, Inc.

Amy Ehlert, Williams

Roy Forsyth, Parsons

Mark Hattersley, Bentley Systems, Inc.

Joe Hobbs, CoSyn Technology – Worley Parsons

Vikrant Joshi, ConocoPhillips

Andy Loftis, S&B Engineers and Constructors

Heather Myers, Air Products & Chemicals

William J. O'Brien, The University of Texas at Austin

John Raad, Co-chair General Motors Company

Jim Rammell, Wood Group Mustang, Inc

Clint Rosenbaum, Lauren Engineers & Constructors, Inc.

Bruce Strupp, Co-chair CH2M Hill

Wendy Sukowatey, American Transmission Company LLC

Glen Warren, Construction Owners Association of Alberta

Jeff Wellen, AECOM

Xiaopeng Liang, The University of Texas at Austin

Effective Project Alignment for Construction Success

Moderator - Joe Hobbs - CoSyn Technology, WorleyParsons

Panel

Andy Loftis – S&B Engineers and Constructors, Ltd.
Clint Rosenbaum – Lauren Engineers & Constructors, Inc.
Heather Myers – Air Products & Chemicals, Inc.
Mark Hattersley – Bentley Systems, Inc.
Bill O'Brien – The University of Texas at Austin



Alignment is a common problem

- 60% of survey respondents rate alignment less than good!
- We are not doing as well as we think we are in everyday practice.
 We know a lot of things we should be doing
 We are not doing them
 for multiple reasons
- We can take practical steps to improve alignment Particularly to assure success in Construction



Background

• Alignment is a CII best practice

- "The condition where appropriate project participants are working within acceptable tolerances to develop and meet a uniformly defined and understood set of project objectives" (RT113)
- CII products provide a solid framework for front-end alignment



RT113 Alignment Definition (circa 1997)

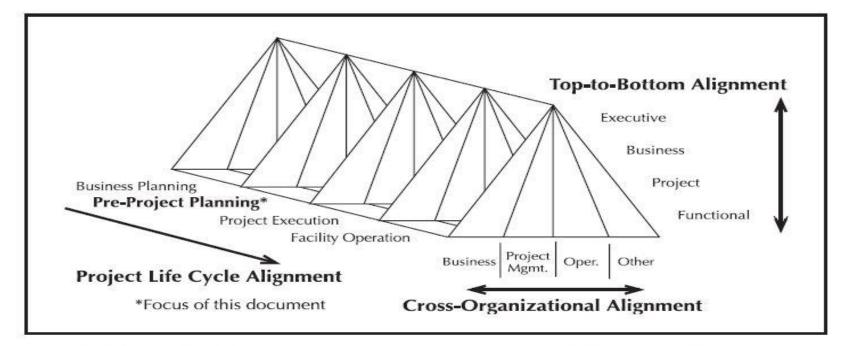
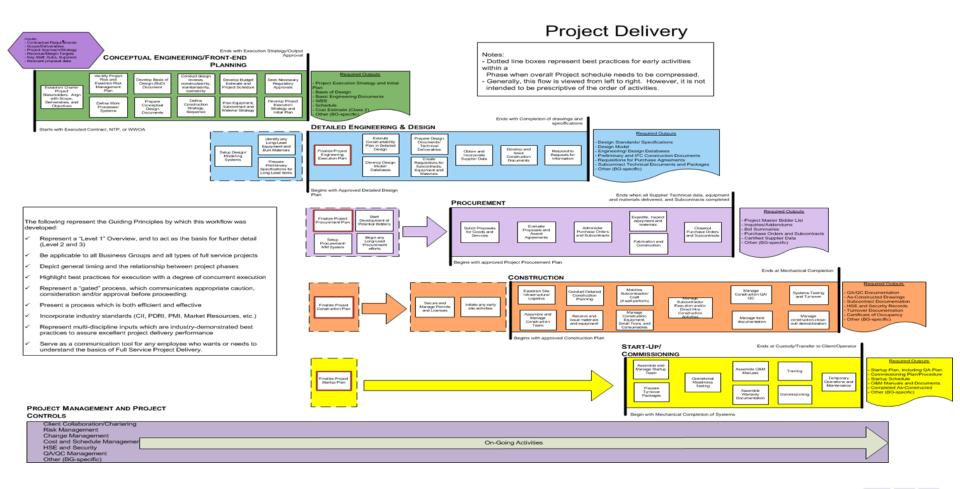


Figure 1.2. 3-D Schematic of Organizational Alignment for a Project

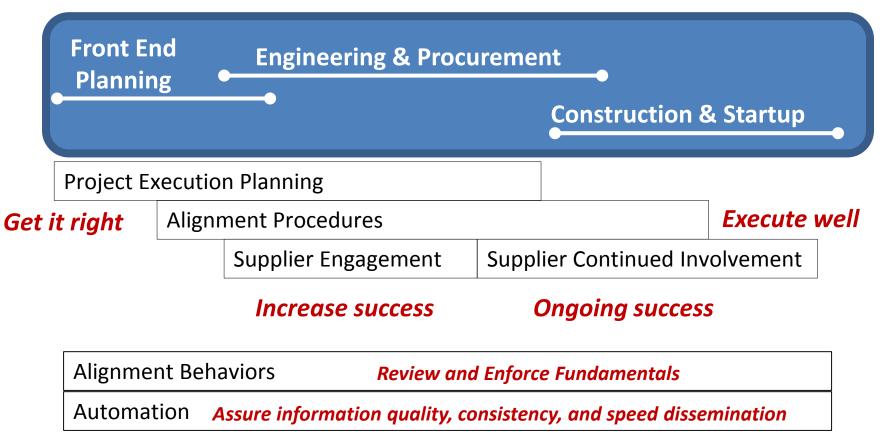
RT310

- Chartered to investigate alignment to improve construction performance
 - More focus on post front-end planning activities
- Guided by:
 - AWP/WFP
 - Modularization

Alignment has many touch points



Aids for Effective Project Alignment for Construction Success





Effective Project Alignment for Construction Success

Moderator - Joe Hobbs - CoSyn Technology, WorleyParsons

Panel

Andy Loftis	Project Execution Planning
Clint Rosenbaum	<u>Suppliers</u>
Heather Myers	<u>Procedures</u>
Bill O'Brien	Alignment Definitions, Automation and
	Research Wrap-up





Andy Loftis

S&B Engineers and Constructors, Ltd.



Project Execution Plan

- Front End Planning Deliverable
- Important for all Stages of the Project
- Outlines Critical Practices and Resources
- Key document for Alignment

RT 310 Found Problems

- No Standard PEP Template or Table of Contents
- No CII PEP Template
- PEP Content varies
- Company PEP Content often Project Driven
- PEP is not a living document

RT 310 - PEP Table of Contents (TOC)

- Developed a Standard PEP TOC
- Identified TOC elements that impact Alignment
- Team evaluation of Criticality and Frequency of Success
- Developed a Survey to Validate Findings
 - Over 200 professionals surveyed
 - CURT, CIRT, COAA, and CII events
 - Focused on PEP TOC Alignment Elements

PEP Survey Results

- All elements received high criticality scores
- Frequency scores were surprising
 - Ratings Very Common, Common, Frequent, Occasional, Rare, Very Rare
 - Highest frequency of success 'Scope of Work'
 - 'Scope of Work' only received a Common rating not Very Common
 - One half of all elements rated only 'Occasional to Frequent'
 - Critical elements such as Interface Management, Path of Construction, and System Identification are only Occasionally done well

PEP Recommendations

- PEP Must be a Living Document
- Procedures Must Include Alignment to Support PEP
- All Projects Should Utilize a PEP
- PEP TOC Provides a Guideline
- PEP Checklist Will Assess Key PEP Elements

Project Execution Plan – Table of Contents

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		а		G. Re		etc.) a	Project Execution				
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						(CWP) Plans	л	D. Purpose a	II. Project Executio	n Strategy#	
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							л	F. Project Goal Setting.			
							IV. Project Manage		ą	A. Advanced Work Packaging (AWP)+	
								A. Stakeholders & Contacts List.	.	1. Invancea nonci achaging [Ini]+	
							L	B. Champion(s) / Sponsors for Strategies 1			



IR310 – 2 PEP Checklist

Appendix	B Project Execution Planning Checklist
Project Sur	nmary.
□ Sco	pe.
Project Ma	usgement .
Mai Apj Part Risi Cor	ject Roles & Responsibilities and Responsibility Matrix(Defined, effective, accountablé), nagement of Path of Construction Process proval Authority Matrix (change order, commitment amounts, etc.)., icipative Planning (planning, cost, and schedule meeting process). k Management Plan (Risk Register - Matrix tool)., tertace Strategy Registerements. erface Management Matrix.
Engineerin	ig.,
	gineering work package(EWP) Construction WorkPackage (CWP) Plan., wnfield Design & Planning Considerations.,
Supply Ch	ain Management.
D Exp	ntify Long Lead Equipment. pediting / Material Delivery., rehousing.
Constructi	
Cor Sub Cor	astruction Interface & Integration Management Procedure astructability Plan constracting Strategy astruction Execution Plan (CEP) tem Turnover Identification Packaging
Commissio	oning & Start Up.,
🗆 🗆 Mec	tem Identification. chanical Completion Plan. SU Plan.
Project Co	ntrol .
D Det	ailed Schedule by EWP/CWP/ critical path.
Document	and Information Management.
O Tur	nover Documentation Vendor specific established agreements are identified.

Appendix B Project Execution Planning Checklist

Project Summary.

Project Management #

- □ Project Roles & Responsibilities and Responsibility Matrix(Defined, effective, accountable),
- □ Management of Path of Construction Process.
- Approval Authority Matrix (change order, commitment amounts, etc.)
- \Box Participative Planning (planning, cost, and schedule meeting process)_{ν}
- □ Risk Management Plan (Risk Register Matrix tool)₊
- □ Contract Strategy/Requirements₊
- □ Interface Management Matrix_{*}

Conclusion

Alignment doesn't just happen!

If your PEP is not Alive then your project is Dead!





Clint Rosenbaum

Lauren Engineers & Constructors, Inc.



Motivation: Supplier Engagement

- Background and Motivation
 - Essential Tie
 - Procurement Involvement Alignment Procedures
 - 40% in kickoff meeting
 - 30% in schedule planning 8% to 12% sign off
 - 20% in design reviews
 - Proper Alignment with Stakeholders
 - Valued Team Members
 - Often "Exercised"

Why: Supplier Engagement

- Why engage suppliers?
 - ~50% of EPC cost
 - Drive project success
 - CII Resources RS130 PEpC, RS257 Global Procurement



Survey: Supplier Engagement

Supplier Survey

- Contractual Arrangements
- Project Involvement
- Commercial Terms
- Information Management
- Feedback
 - Quality of Requests



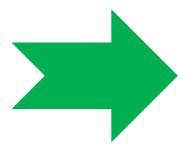
Evidence: Supplier Engagement

- Suppliers are not involved in planning
 - Technology and Scope
 - Suppliers want to be involved earlier
 - Schedules, required submittals, approvals
- Lack of clarity on scope a common concern
- Supplier data expectations are unclear:
 - 50% report Requests for Quotation lack specific dates when data is required
 - 35% report that Purchase Orders lack specific dates when data is required

Result: Supplier Engagement

Supplier Engagement Checklist

- Identification and Involvement
 - Preapprove
 - Early Onboarding
- Request for Quotation
 - Clear and Well Defined
 - Deliverables Identified
 - Delivery Dates Identified
- Terms
 - Vendor Specific
 - Project Flow Downs
 - Appropriate Risk Requirements
 - Change Management Identified



Contonal							
	Have resource considerations been established to by to have continuity of project personnel to						
	carry through from establishing data sheets, to quotation evaluation, through						
	manufacturing/fabrication to final delivery to ensure considerations in the early phases of the						
	cycle are carried through to final deliveries and payments.						
	is the change management process in place to minimise / mitigate changes that would affect the						
	supplier's ability to most quality / schedule requirements to most project domands?						
long T	om Adationships						
	Utilize existing pricing agreements that ewners/67C have in place set up						
	Consider pro-qualifying fabricators and suppliers						
	 Consider shop capacity and workload 						
	 Consider utilizing multiples fabricators/supplies if large order 						
	Onboard key suppliers early - allow them to provide valuable input on design and schedule						
	Partnering allows continual business, mutual benefit to all parties involved						
	Consider team building opportunities to encourage a culture featoring honesty and shared						
	values / build open and effective communication						
Reque	is for Quolation / Procurament						
	Provide basis by which responses will be "conditioned" – 🚌 Cost, delivery, alternatives, etc.						
	Provide clear scope of work with clear deliverables (timing of receipt, for data for all items,						
	format of deliverables, timing for shipping dates, tum-around times for documents, correct tag						
	numbers for each item etc.)						
	Indication of payment schedule (gg. Adequate and timely payments for milestones such as						
	receipt of data in format to meet design requirements, payment for completion of detailed						
	design, etc)						
	cts and Commorcial Toms						
	Optimize payment terms						
	Include specific terms on cost:						
	o Labor cost						
	 Labor cost fluctuation 						
	o Cost on unknown						
_	 Price adjustment formula 						
	Ensure specifications and data needs are in the contract						
	Develop contract that creates a relationship of mutual respect and combined effort						
	Involvement						
	Involve suppliers or fabricators in early design stages						
d	Include suppliers or fabricators to kick off meetings, design reviews, schedule reviews and field						
	support motings						
	Provide agendas for all meetings that include previous meeting's action items						
	ensure that key personnel with associated authority are in attendance for regular meetings						
	Determine long lead items and ensure that supplies can meet the schedule for these						
	components						
	ation Management:						
	document deliverable dates to vendor document requirements schedule and final delivery aligns						
	5 ZO						
100							

Conclusion

Alignment doesn't just happen!

Engage your suppliers – earlier and smarter





Heather Myers

Air Products & Chemicals, Inc.



Procedures

- Key driver for project alignment
- Critical component to successfully executing projects consistently
- Potential to support or hinder alignment

Alignment Procedures Questionnaire

- 20 companies
 - 7 owners, 13 contractors
- Detailed questions
 - Y/N, follow up, check all that apply questions
 - 440 data points per company
- On 66 Y/N questions:
 - Owners average yes 67% [range: 53%-86%]
 - Contractors average yes 73% [range: 35%-100%]



Startling Findings

- 50% lack a procedure titled 'team building, alignment, or chartering'
- 80% do not consider cultural or regional differences in their processes
- 53% lack procedures that address continuity of key roles across project phases
- 60% do not address mechanisms for communication in the kick off meeting
- 60% do not get input from Owner Operations, Procurement or Construction when developing the schedule



Alignment Procedures Recommendations

- 1. Companies should have more robust processes clearly defined within their procedures addressing the following:
 - Team building and team alignment
 - On-boarding of team members and stakeholders
 - Cultural differences and constraints in the team make-up
 - Continuity of resources
 - A mechanism to measure team alignment throughout the project life cycle

Audit Procedures Recommendations

- Companies should have procedures requiring all stakeholders to be involved in the development, review, and sign-off of key project deliverables and tasks in Front End Planning.
 - Involve: Owner Project Management, Owner Operations, Engineering, Procurement, Construction, and Supply Chain
 - Deliverables include the Basis of Design, Schedule, Risk Management, Team Building, Alignment/Chartering, Execution Plans, Budget Development, and Path of Construction



Audit Procedures Recommendations

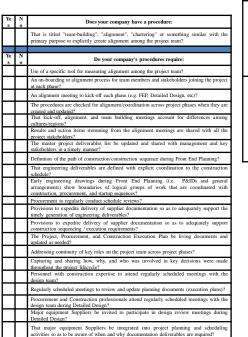
- 3. Stakeholder Involvement
- 4. Alignment Meetings
- 5. Engineering Deliverables Align with Construction Needs
- 6. Coding/Naming Conventions

Alignment Procedures Checklist

- Quick way to review procedures related to alignment
- 22 questions to help identify the most common gaps
- Answer Yes or No
 - Any responses of No = Opportunities for improvement
- Deeper audit can use the full questionnaire



Alignment Procedures Checklist



Yes No Do your company's procedures require:					
		Provisions to expedite delivery of supplier documentation so as to adequately support construction sequencing / execution requirements?			
		An on-boarding or alignment process for team members and stakeholders joining the project at each phase?			

Conclusion

Alignment doesn't just happen!

Procedures need to address alignment

Procedures need to support the PEP and Supplier Engagement





Mark Hattersley

Bentley Systems, Inc.



Automation and Alignment

- Project information is not well integrated
- Automation can enable alignment
 - Can impede alignment if not implemented properly
- Automation is journey
 - Different maturity levels for automation
- Need a set of common terminology





Automation Assessment Deliverables

- Identified and prioritized 10 automation areas that can enhance project functionality
- Created definitions for each concept to provide guidance to project teams
- Developed a maturity index to provide a path on the automation journey



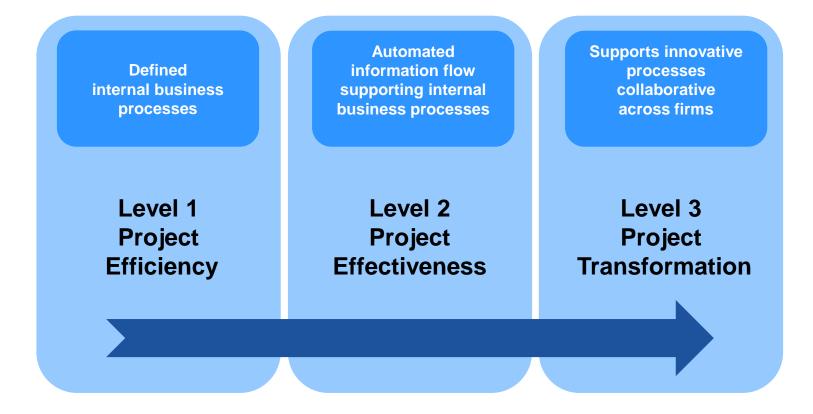
Automation Areas Defined

- Model of Record
- Work Packaging
- Information Management
- Document Control
- Project Standards

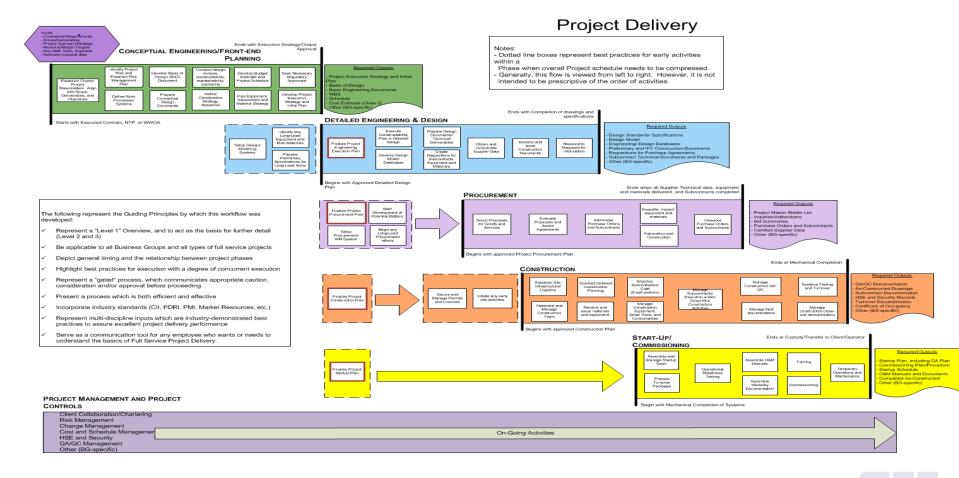
- Project Controls
- Reporting
- Materials Management
- Change Management
- Communication\ collaboration Systems



Automation Maturity Model



Alignment has many touch points



Automation Maturity Model Details

Function Group	Alignment Behaviors and Actions	Level Project Eff		Maintain stability of		
General		Defined business proc		organizational structure (retention plans for critical		
Conceptual Engineering/Front- End Planning			Fatablich/Charter	personnel) including suppliers and subs ensure all stakeholder reps are		
Establish/Charter Project Stakeholders Align the Scope,	Maintain stability of organizational structure (retention plans for critical personnel) including suppliers and subs ensure all stakeholder reps are involved	 Emails File folders Conference c Face to Face 	Doliziona blog and	involved Define roles and		
Deliverables, and Objectives	Define roles and responsibilities - shared at project level. Project leadership is defined, effective and accountable.	 Emails File folders Conference c Face to face a 		responsibilities - shared at project level. Project leadership is defined, effective and accountable.	:m :nt	
Identify Project Risk and Establish Risk Management Plan	Determine equitable risk allocation among stakeholders	 Word docum Spread sheet: 	-	 Data drive system Integration with project phases]	

Conclusion

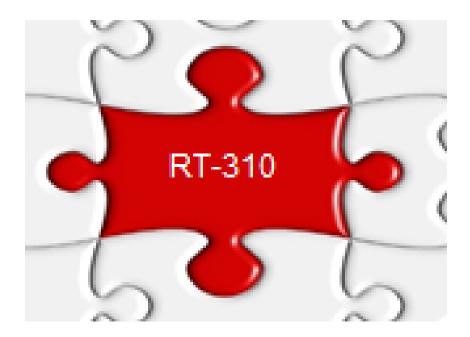
Alignment doesn't just happen!

Automation can enhance alignment

Use the maturity model to assess your project

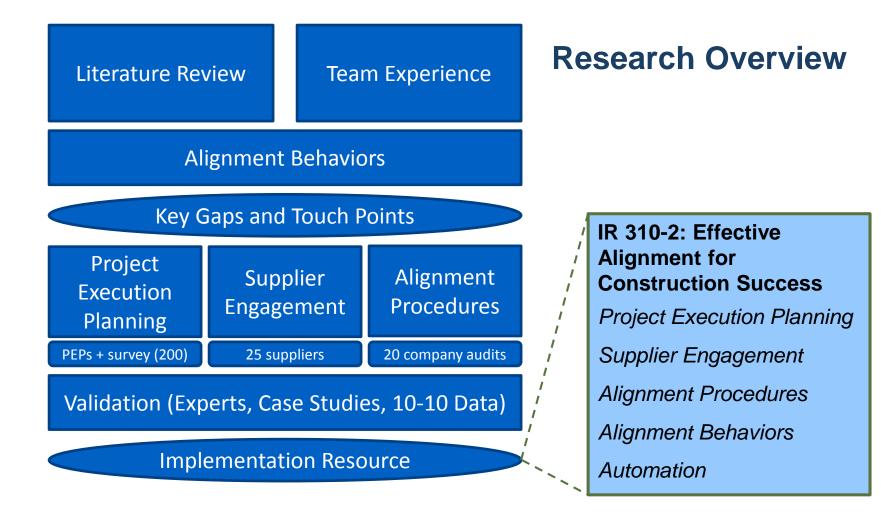


Research Wrap-Up



Bill O'Brien

The University of Texas at Austin



Key Findings and Recommendations

- Back to basics
 - We know what we should be doing but we aren't doing it well
- Complexity of modern projects stresses alignment
 - Need to reconsider and review practices
- Hard to assure construction success without extra steps
 - Broadly engage, coordinate, disseminate

Some Summary Findings

- Scope definition is a common problem
 - Suppliers note poor scope in RFQ, PO
 - PEP survey finds scope definition less than Very Common
- Team building, on-boarding, considerations for culture
 - <50% of companies include in procedures
- Engagement is lacking

Broadening the evidence

CII 10-10 Performance Assessment Data

- Assess projects over lifecycle on many metrics
- Generally shows good projects, but many 'holes'
- Some key points
 - Supplier schedules frequent challenge in FEP, Engineering
 - 73% in Engineering report challenges from supplier schedules
 - Many unsatisfied with alignment
 - 31-36% report neutral or negative on alignment during E, P, C
 - Differences of opinion on engineering deliverables
 - Construction: 50% late, 75% incomplete
 - Engineering: 41% late, 36% incomplete

RT 310 Delivers

- General recommendation:
 - Back to basics, assess, refine don't assume
 - Alignment doesn't just happen!
- Specific advice
 - Project Execution Planning
 - Supplier Engagement
 - Alignment Procedures
- Broader tools for assessment
 - Alignment behaviors and automation







Get the workers you need

1 Plan 2 Recruit 3 Retain Sknow

COAA Workforce Development Committee

Niaz Ahmed M.Eng., P.Eng. MBA Director, Construction Management Project Services, Major Projects Suncor Energy Inc.

8 Retain Know



Plan

COAA Best Practices Conference XXIII & Training

- Conference Theme –
 Driving to Excellence, Thriving Amid Challenge
- COAA Membership's Mandate Twice as Safe, Twice as Productive by 2020

2 Recruit

8 Retain Know

COAA Workforce Development Vision

Construction Industry has the access to a workforce with:

- The right skills
- At the right time
- In the right numbers
- With Right Supervision
- Supply = Demand

Get the Canada-Alberta Job Grant Working for You

- COAA Workforce Development
- Canada Alberta Job Grant supplements training investment

2 Recruit

- Training Opportunities
- Employer Perspective



Canada



Canada-Alberta Job Grant Introduction & Eligibility Criteria

COAA Conference May 2015



Plan

2 Recruit 3 Retain ✓Know

Introduction

Overview

- The Canada-Alberta Job Grant funds employer-demanded training.
- Employers determine
 - what training is needed to meet business goals and objectives
 - who will be trained
- The employer-driven program ensures the training reflects skills employers are looking for.

Objective

- The Canada-Alberta Job Grant will help increase:
 - employer investment in training
 - productivity
 - worker skills
 - worker retention



8 Retain Know

Process at a glance	
Before you apply	 Identify employee training needs Select a training provider
Application process	 Submit application Receive decision and reference #
Training and reimbursement	 5. Pay for and begin training 6. Submit reimbursement form and all training receipts 7. Receive partial reimbursement
Success! You have a skilled employee	 8. Employee gets training credential 9. Submit completion form 10. Receive remainder of reimbursement
OPlan 2 Recruit ORetain OKnow Aberta −	

Eligibility Criteria

Eligible Employers

 Open to private and non-profit sector employers in Alberta





Eligible Trainees

- Eligible trainees
 - New or existing employees
 - Canadian citizens, permanent residents
- Ineligible trainees
 - Temporary Foreign Workers, those with temporary work permits and students here on study visas

- Immediate family members



Eligible Training Providers

- Third-party, unrelated to the employer
- Cannot be the organization that will employ the trainee

2 Recruit





8 Retain Know

Eligible Costs

- Only direct training costs are eligible
 - Tuition fees or fees charged by training provider

- Mandatory student fees
- Textbooks, software and other required materials

2 Recruit

Examination fees



Eligible Training

- Short-term, incremental training
 - Minimum 24 hours per trainee *NEW
 - Courses may be "bundled" for 24 hour minimum
 - Completed within a 52-week period <u>after</u> the training start date

8 Retain Know

- No restriction on learning type or learning method
 - Part-time, Full-time, On-site, classroom and online learning are all eligible
- Must result in some sort of credential
 - e.g., record of completion, mark, certificate, industry-recognized credential
- Apprenticeship training is NOT eligible

Grant Process

Application Forms

 Employer will access forms on the Canada-Alberta Job Grant Website

- <u>AlbertaCanada.com/jobgrant</u>

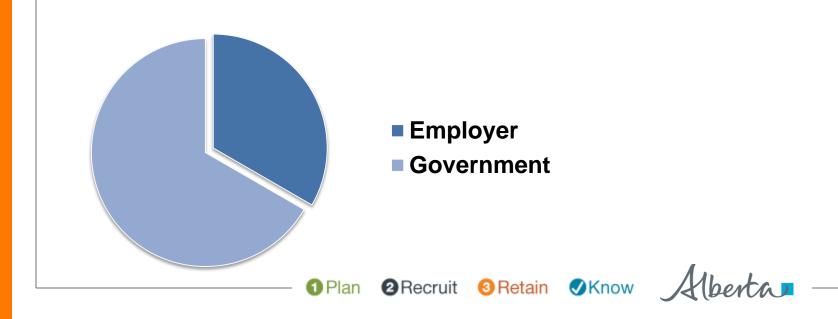
 Forms must be printed, signed, and submitted by mail

2 Recruit



Program Funding Model

- The employer will cover a minimum of ¹/₃ and the grant will cover ²/₃ of training costs
- Maximum \$10,000 of grant funding per trainee



Caps on Employers

- Individual employers will be capped at \$300,000 of grant funding per fiscal year (Apr-Mar)
- Maximum of \$10,000 per trainee per fiscal year



Reimbursement & Completion

- Employers pay the full cost of training
- Government refunds ²/₃ of approved training costs in two equal payments
 - ¼ of training costs deposited when employer submits all training receipts

3 Retain √Know

 – ¼ of training costs deposited after training completion form submitted



Let's Look at an Example

- Pat's Industrial needs to recruit 5 Foreperson.
- Job applicants will need some skills training (eg. Supervision and Safety), from an external provider to allow them to get the job.
- Cost of training = \$1,500 per worker
- Cost of training 5 workers = \$1,500 x 5 = \$7,500

2 Recruit

8 Retain Know

- ➤ Grant pays 2/3 = \$ 5,000
- ➢ Pat pays 1/3 = \$ 2,500



Another Example

- 1 trainee \$17,000
- ²/₃ (\$17,000) = \$11,333
 - However, Grant max/trainee = \$10,000

8 Retain Know

• Employer pays remainder \$7,000

Help for Employers

- Applicant guide, FAQ's and instructional videos at <u>AlbertaCanada.com/jobgrant</u>
- Workforce Consultants are available to help employers with questions about the applications.

2 Recruit

Email jobgrant@gov.ab.ca



Common Questions

Questions:

• Timeline for Approval - 30 days

Reminders:

- Fill out all required information on the forms
- Do not submit for training that has already been paid for <u>or</u> the training has already started

2 Recruit 3 Retain S Know

• Courses under 24 hours are ineligible

Plan

Alberta Workforce Information

 Sign up to receive updates about the Canada-Alberta Job Grant and other workforce information, delivered to your inbox.

www.ABWorkforceinfo.com/subscribenow

8 Retain Know



Thank You!

Utilizing the CAJG

Tammy Hawkins Director of Learning Services Alberta Construction Safety Association (ACSA)



3 Retain ✓Know

Plan

Employer Perspective

Amanda McBey Human Resources and Immigration Administrator Clark Builders



3 Retain ✓Know

Plan

Question and Answer

























Advanced Work Packaging Work Face Planning















Advanced Work Packaging

Gary Orton

Bentley Systems Inc.

Construction Evolution











Construction Industry nstitute



RT 272 Team

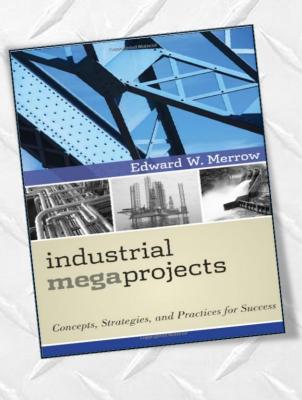
Steve Autry, ConocoPhillips Michael Bankes, Fluor Jim Blevins, Pathfinder Roy Burnette, CH2MHill Keith Critzer, ExxonMobil Joel Gray, Coreworx Olfa Hamdi, The University of Texas at Austin Ken Kohl, GE Power & Water Jose LaRota, Southern Company Fernanda Leite, The University of Texas at Austin

Advanced Work Packaging

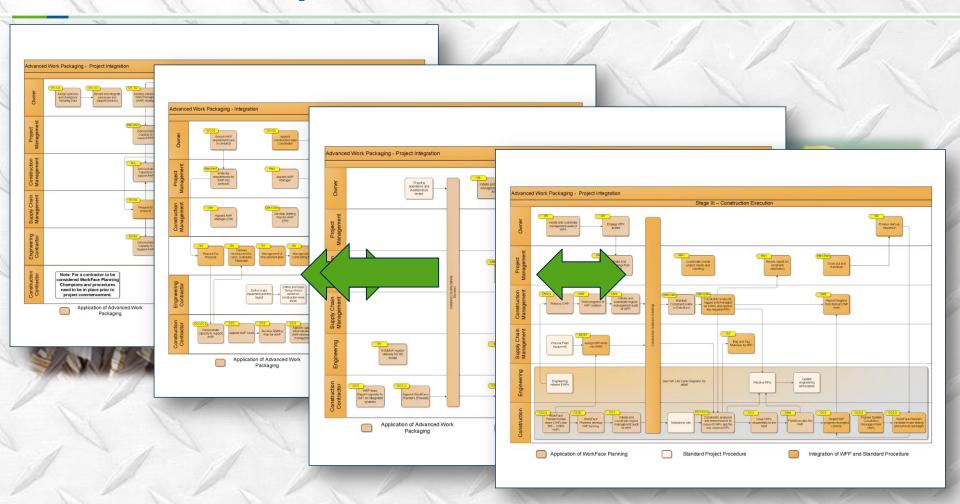
Robin Mikaelsson, Bentley Systems Bill O'Brien, The University of Texas at Austin Bryan Parsons, KBR Sean Pellegrino, Chevron Jim Rammell, Wood Group Mustang Lloyd Rankin, Ascension Systems Yogesh Srivastava, North West Redwater Partnership Stan Stasek, DTE Energy Jim Vicknair, WorleyParsons **Glen Warren**, COAA

The Need For Innovation

- Success in construction is elusive
- Independent Project Analysis (IPA) study of 318 projects > \$2B:
- 65% of projects FAILED, experiencing either:
 - > 25% cost overrun
 - > 25% schedule slip
 - Significant underperformance of the asset once constructed

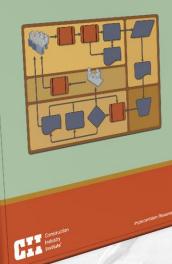


AWP/WFP Explained



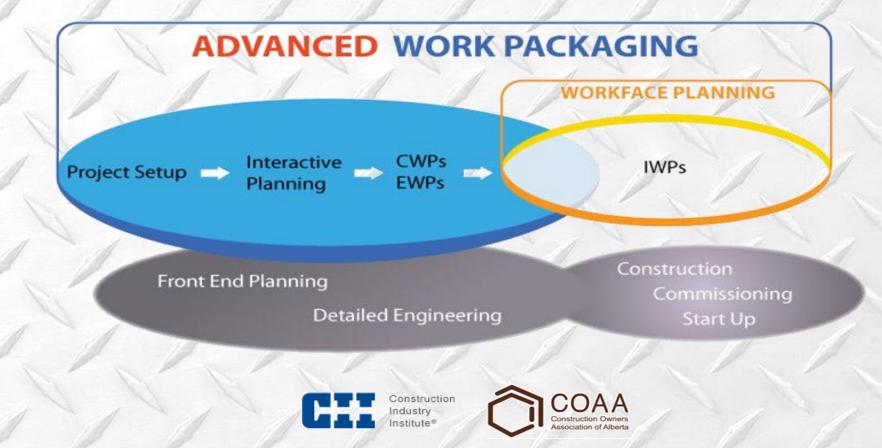
Creation of Industry best practice Standards...

Enhanced Work Packaging: Design through Workface Execution



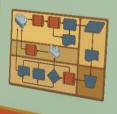


AWP/WFP- The Industry <u>Best Practice</u>



Extensive Industry Research





Volume I: Recommended Process Advanced Work Packaging:

Volume II: Implementation Guidance

CII/COAA AWP Implementation Resource IR 272-2

✓ 400 pages of guidance, tools, and templates

Advanced Work Packaging: Implementation Case Studies and Expert Interviews



Volume III: Case Studies and Expert Interviews

Making it Work



ALL-IN-ONE SYSTEMS SLASH PLANNING TIME

Industrial-plant design software maker

Aveva offers work-packaging capabilities as

part of its suite. The modular system offers

management capabilities that can be linked

materials requirements for work packages

and enable visualization of data on materials

status and availability. The company claims

its products are interoperable with third-party

to a 3D model. The Aveva system can define

project planning, workface planning,

construction simulation and materials

echnology platforms are evolving guickly in their ability to improve work-packaging capabilities for multiciscipline project teams. Like the rise of web-based software before it, platforms-as-a-service now enable teams to ntegrate project data from multiple sources as well as collaborate more easily during the

planning process. Bentley has released its ProjectWise Construction Work Package Server, which offers software and services developed around work-packaging standards and best practices advocated by the Construction ndustry Institute and the Construction Owners Association of Alberta (ENR 11/18-25/13 p. 35). The server platform inables consolidation of models, drawings and other types of project data. Users can reate, publish, edit, manage and distribute ingineering work packages and construcion work packages. Planners use 3D nodeling tools for package development and status reporting and can build 4D simulations, using ConstructSim V8i, to show look-ahead planning and animate construction schedules.

seers and Constructors, Houston, says producing safe ind productive jobsites is critical in light of the manower shortages forecast for industrial projects along he Gulf Coast. "I asked a [craftsman], who has been vith us for while, why he chooses to stay," Morrow said. The No. 1 thing he said was safety. The second is that, when he goes out in the morning, he knows the tools ind materials will all be there for him to do his job." A COAA study shows that, on projects using tradiional methods, workers spent 37% of their time on ools. By comparison, on projects that implement Forkface planning, workers spend 46% of their time in tools. With billions of dollars in additional projects planned for the Gulf region in the coming years, Morow says, "We need to be using the workforce we have nday more efficiently."

expanding Applications

is advanced work packaging is gaining momentum in he industrial market, some are looking to use it in ther sectors. DTE Energy is applying advanced work ackaging to projects ranging from power work to of-

STATUS SYMBOLS Software offerings ning time. Bentley's tion Work Package

significantly out plan-ProjectWise Construc-Server enables portions of a model to be color-coded to show project status.

scheduling software platform Primavera. Further, users can integrate schedules for 4D

simulations. Intergraph SmartPlant Construction also offers work-packaging capabilities. The system also offers 4D visualization to help planners sequence construction and maintain a project's critical path. Field construction status can be recorded based on configured rules of credit and used for reporting. These can be reviewed in a 3D model.

fice renovations. DTE started two pilot projects using AWP in 2013 and plans to apply it to all new projects by the end of the year. Stanley Stasek, director of quality management for major enterprise projects at DTE, says the company is expanding its in-house construction-management capabilities and sees AWP as a key component in that initiative. "We need our contractors to be as efficient as possible," he says.

One of the pilot programs involves dry-sorbent injection upgrades at multiple DTE powerplants. "They will install on two plants in parallel and then move on. Work packaging makes sense because you can build (packages) up front, then make adjustments due to location, but the core work remains the same." The second pilot is treading in less familiar terri-

tory. The company is employing AWP on a program that will renovate 54 floors of DTE office space in four buildings on its Detroit campus as well as numerous service centers and powerplant offices. As a new application of AWP, Stasek acknowledges it is more of a struggle. "We are working with contractors that do office renovations for a living," he says. "This is new

enr.com July 7, 2014 - ENR - 37

surrous yet 1' Sold + ERH + 31

office furnitums for a lithtig." In says. "First in these

business systems, including integration with "In our

lingo, an engineering work package isa deliverable to construction,"

essociate professo University of Texas, Austin

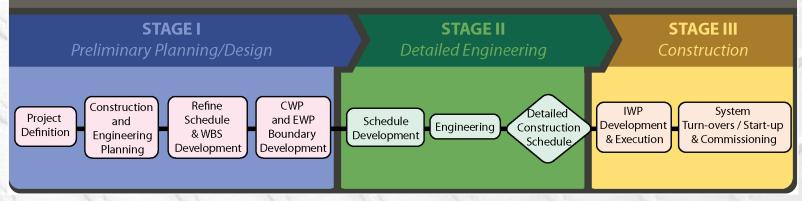
Advanced Work Packaging

- Takes a proactive, structured approach to managing constraints prior to the work face
- Involves deliberate, early planning to support execution
- Holistically incorporates the full project life cycle
- Gives supervisors more field time



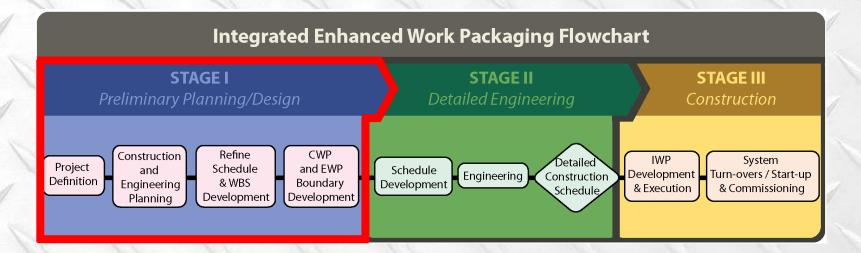
Recommended Practice Model





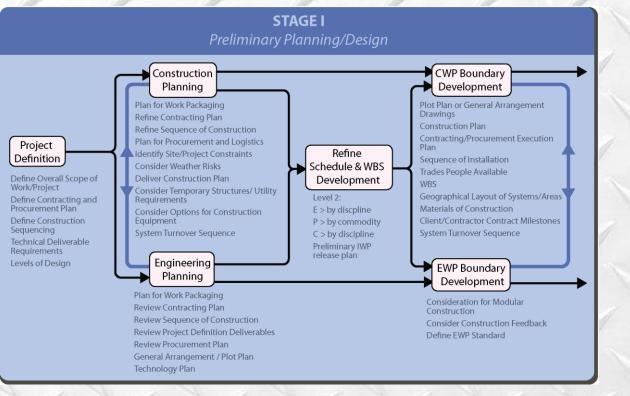


Recommended Practice Model

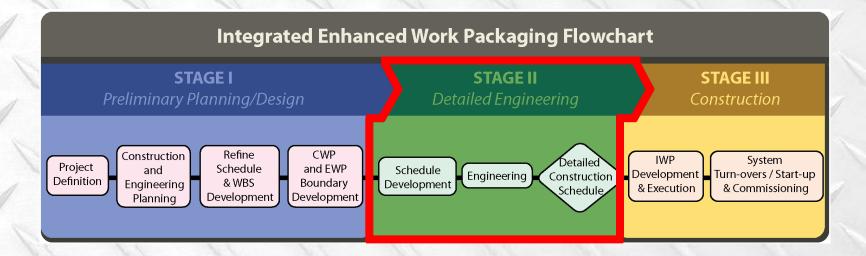




Stage I: Preliminary Planning/Design

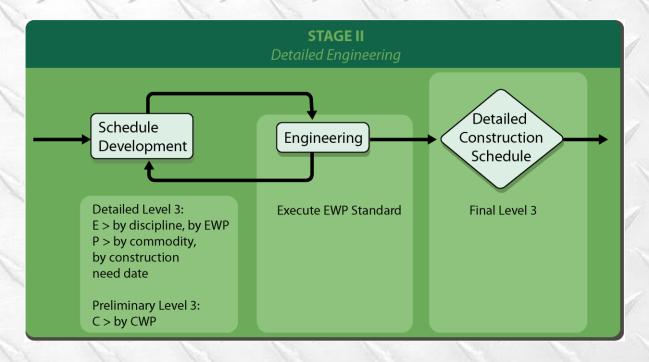


Recommended Practice Model



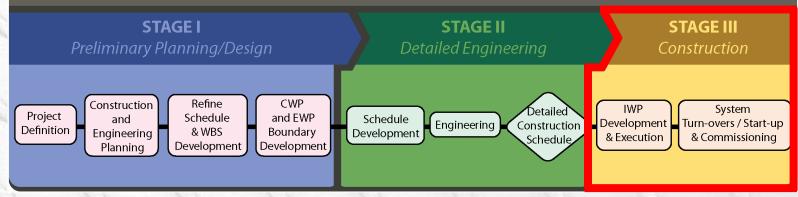


Stage II: Detailed Engineering



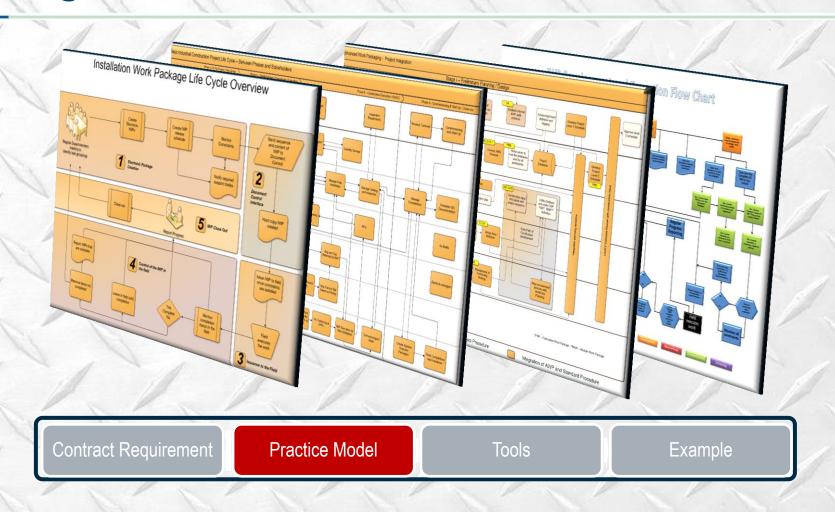
Recommended Practice Model



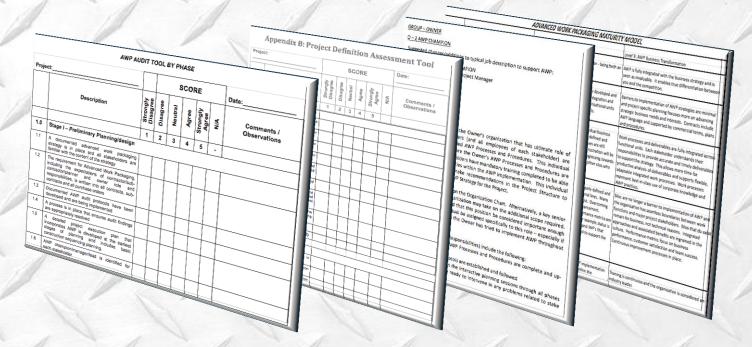




Integrated Practice Model



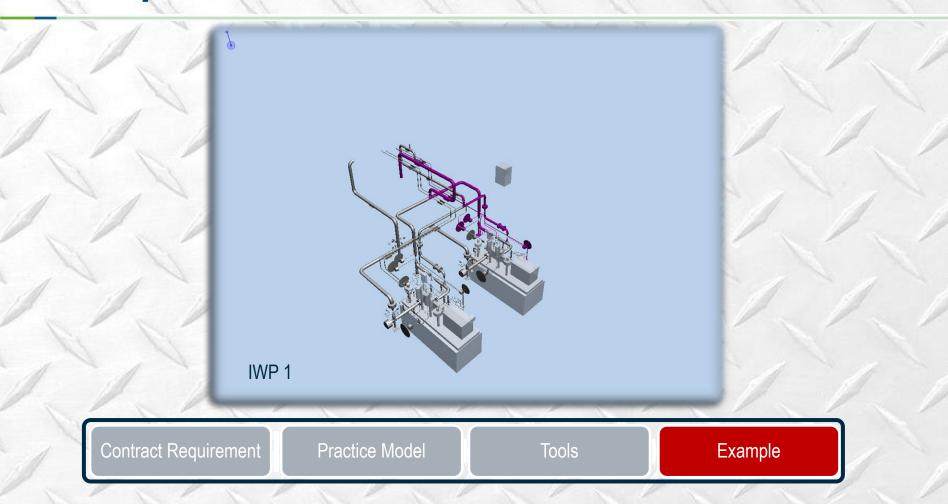
Tools



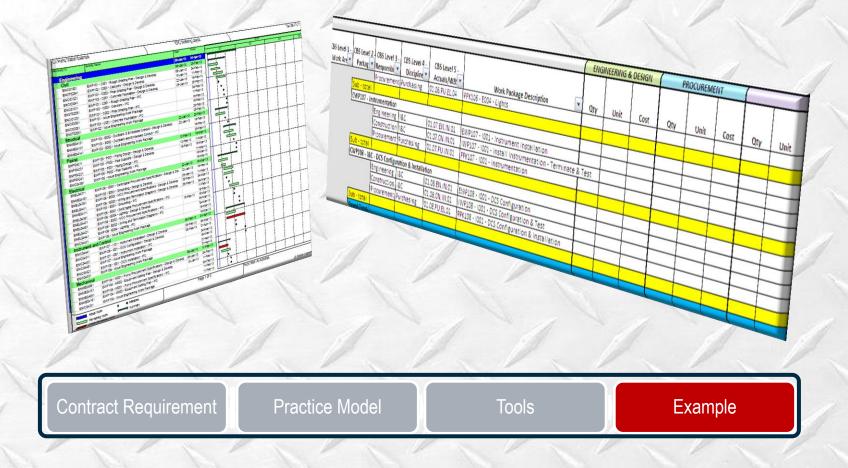
AWP Audit tool, Project Definition Assessment, Job Description, Maturity Assessment



Example



Example

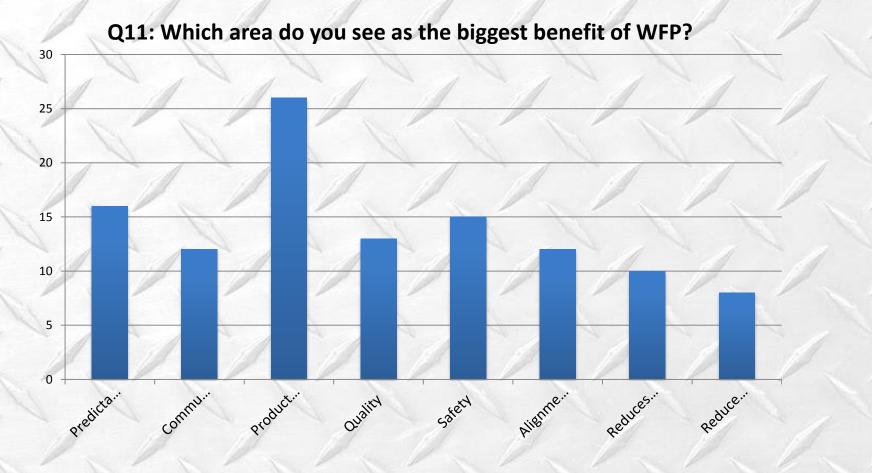


RT 272 Contributions: A model for Advanced Work Packaging

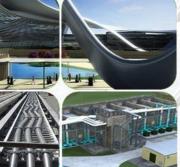


Productivity & Predictability

Perceptions of workface planning: WorkFace Planning perceived advantages







WorkFace Planning

Ben Swan

WFP - POINTS

Define Dequirements

Requirements

• Timeline

Resource

WFP Definition

"Installation Work Package (IWP) is a grouping of tasks targeted at one shift in duration. These IWPs will contain all of the necessary documents and descriptions required to carry out the tasks required"

COAA & CII Best Practice

PRINCIPLES are timeless "There is nothing new under the sun"

PRACTICES are timely – "Continuous improvement"

Secondary Definition

"Installation Work Package (IWP) is a grouping of tasks targeted at one shift in duration. These IWPs will contain all of the necessary documents and descriptions required to carry out the task required

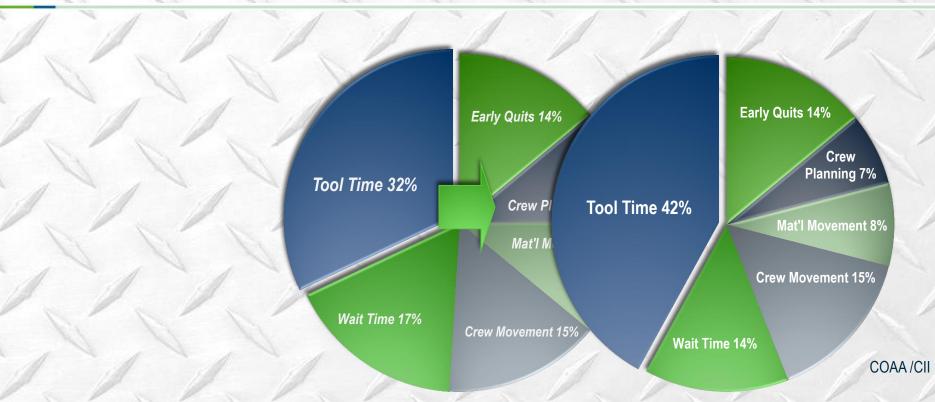
Cable Pull (15 Workers)



IWP Content

- KISS Keep it Simple.....Don't be building books!
 - Scope
 - Drawings
 - Material
 - Safety
 - Quality
- Remember who your customer is the tradesperson

Productivity of a typical Construction Crew



10% more tool time is nearly 25% improvement in productivity Labor is typically 40% of TIC = AWP Provides Up to 10% Reduction in TIC

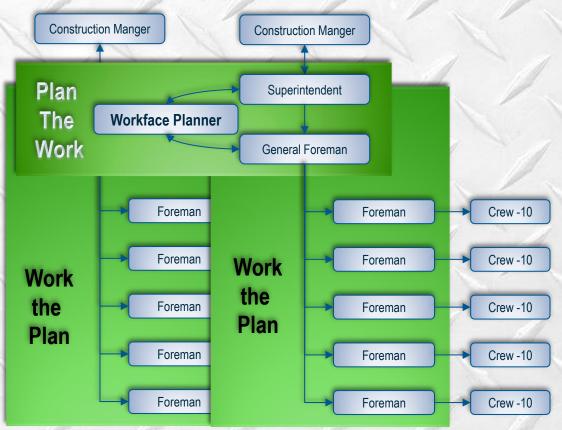
Supervisors Duties

Excessive other duties reduces direct supervision and negatively effects safety.



Model for Workface Planning

Conventional WFP Best Practice



WFP Requirements

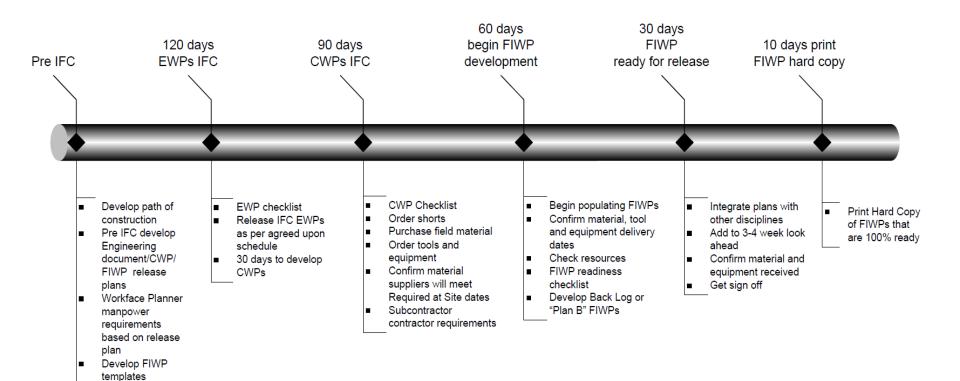
- 1. Appoint Dedicated Planners
- 2. Develop Level 3 Schedule prior to Detailed Engineering
- 3. IWP complete 4 weeks prior to starting actual work
- 4. Workface Planners have access to latest information
- 5. Assign Integration Coordinator
- 6. Assign responsibilities for signoff of IWP's

WFP Requirements Continued

8. IWP's signed off before release to the field
9. Track progress of IWP's
10. Develop backlog of IWP's
11. Include WorkFace Planning into Contract
12. Audit the process

WFP Timeline

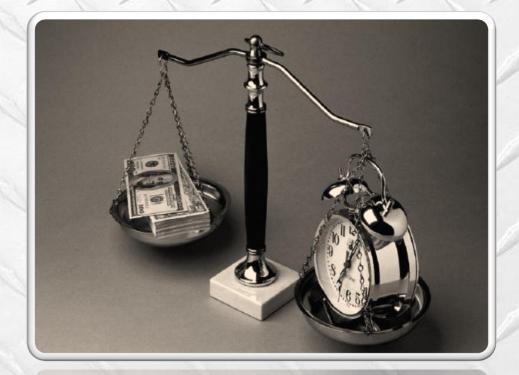
Timeline 120 Days



Note: Initial procurement is outside the scope of this timeline

Why Implement WorkFace Planning?

- Improved site safety
- Up to ~10% reduction in TIC
- Better Coordination of Crews
- Greater predictability
- Lower Costs
- Greater Quality
- Less Rework
- Improved Project morale
- Ability to Compare across Contractors
- Schedule Optimization



Resource

www.coaa.ab.ca/construction/awpwfp

www.coaa.ab.ca/construction/AWPWFP/Flowcharts/Install ationWorkPackageLifeCycle

Thank You





ADVANCED WORK PACKAGING "BACK TO BASICS" for **MANAGING ENGINEERING BEST PRACTICES CONFERENCE - 2015 Presenter: Glen Warren Co-Chair - COAA AWP/WFP Committee**



AWP - BACK TO BASICS

AGENDA

- 1. Basics of AWP some definitions
- 2. Flowchart of AWP Packaging
- 3. Barriers to Implementation
- 4. Owners what you need to key on
- 5. Owners what is different from traditional?
- 6. Wrap-up and Q&A



AWP - BACK TO BASICS

AWP in simple terms is the formalization of the "packaging" process for all:

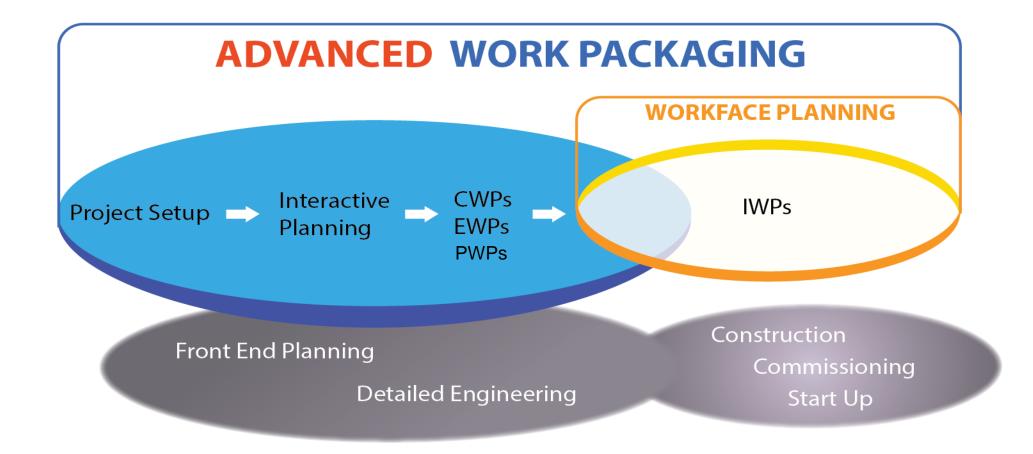
- Construction Work Packages (CWPs)
- Engineering Work Packages (EWPs), and
- Procurement Packages (PWPs)

To support safe, efficient, and productive

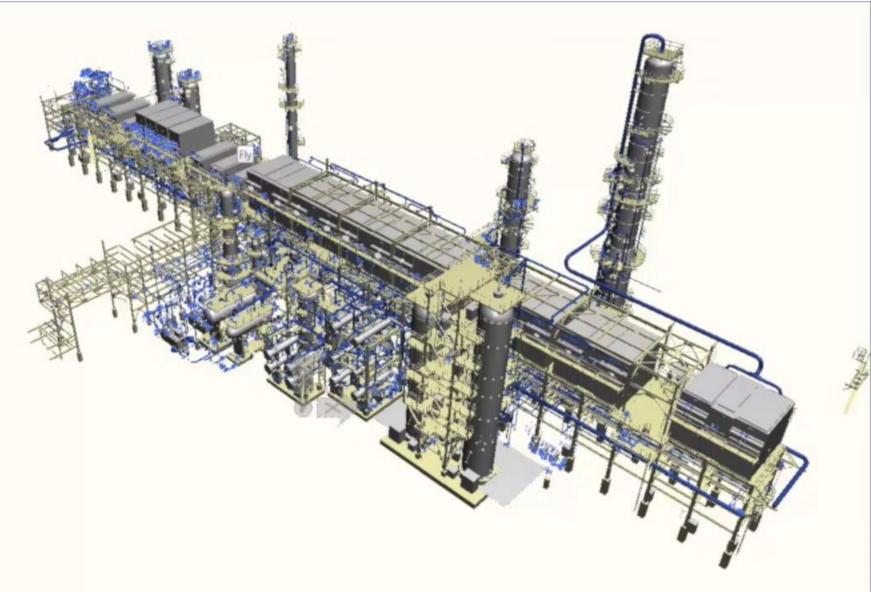
Installation Work Packages (IWPs).

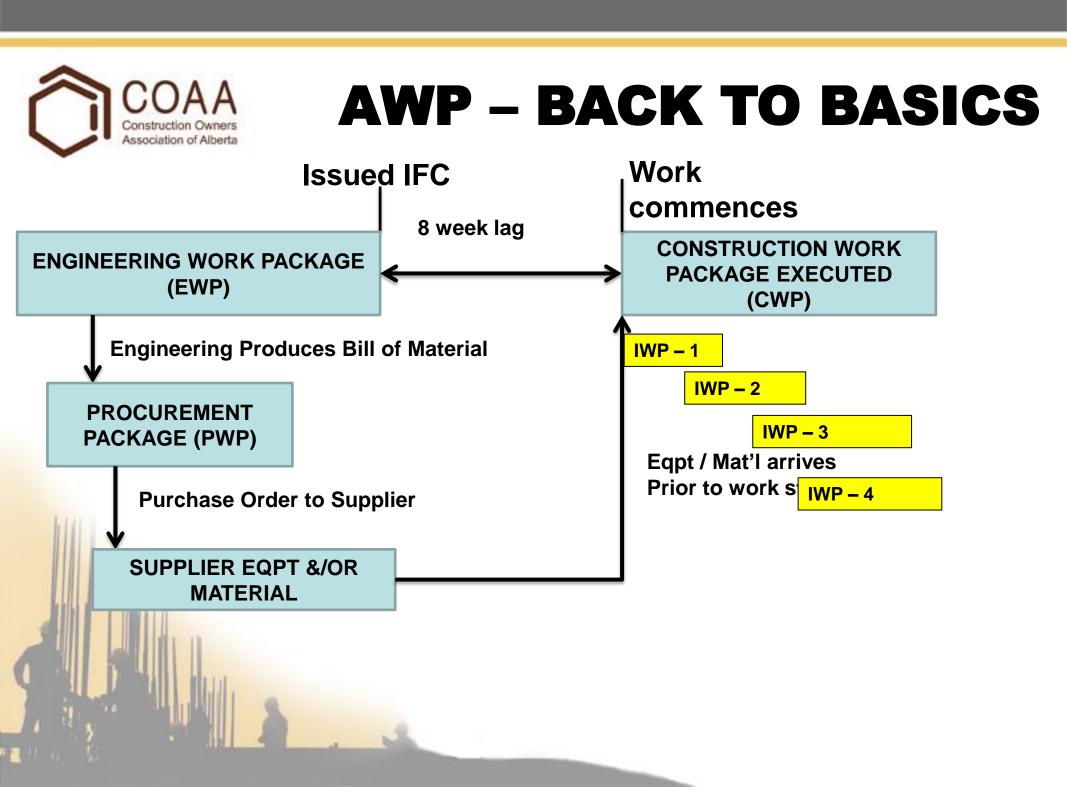


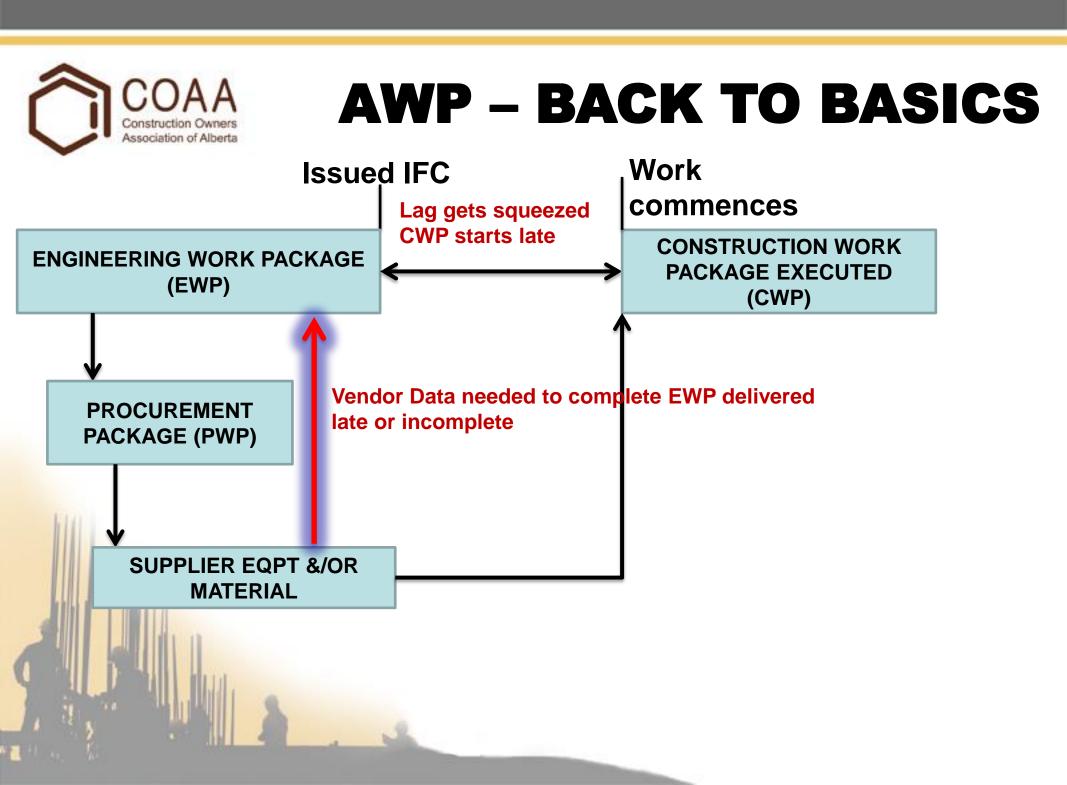
AWP - BACK TO BASICS











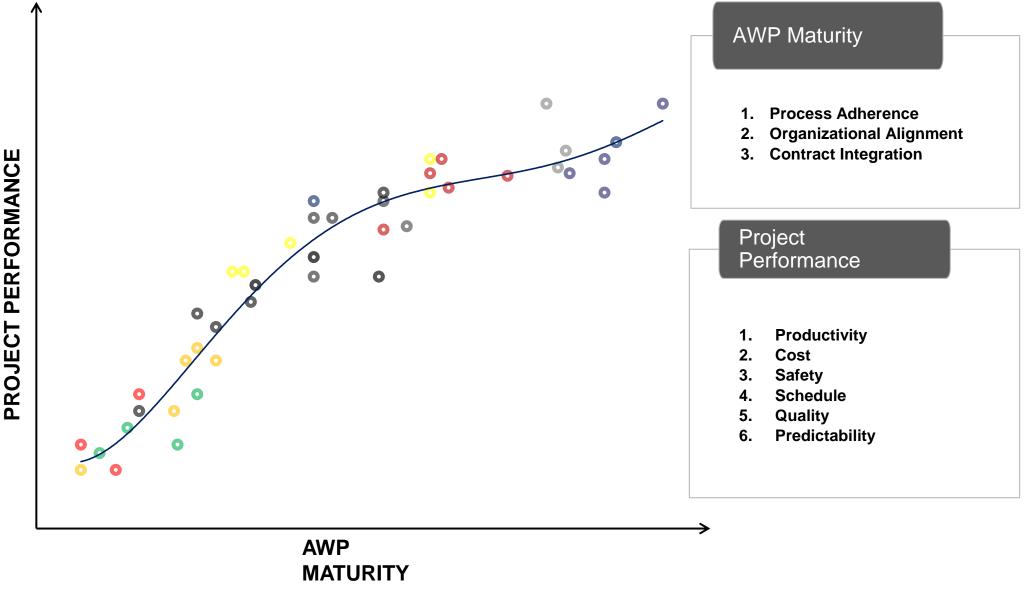


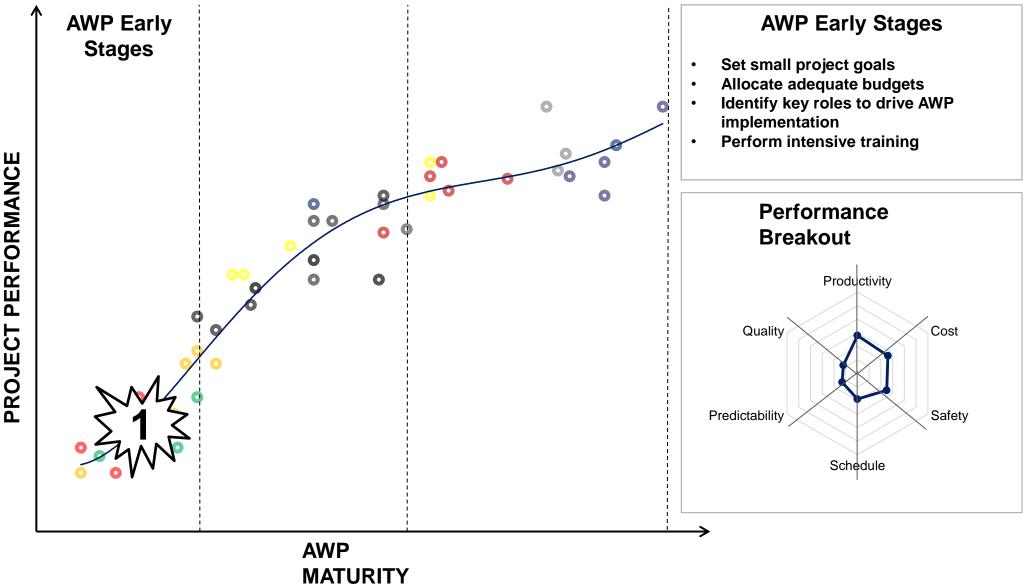
Barriers to implementation:

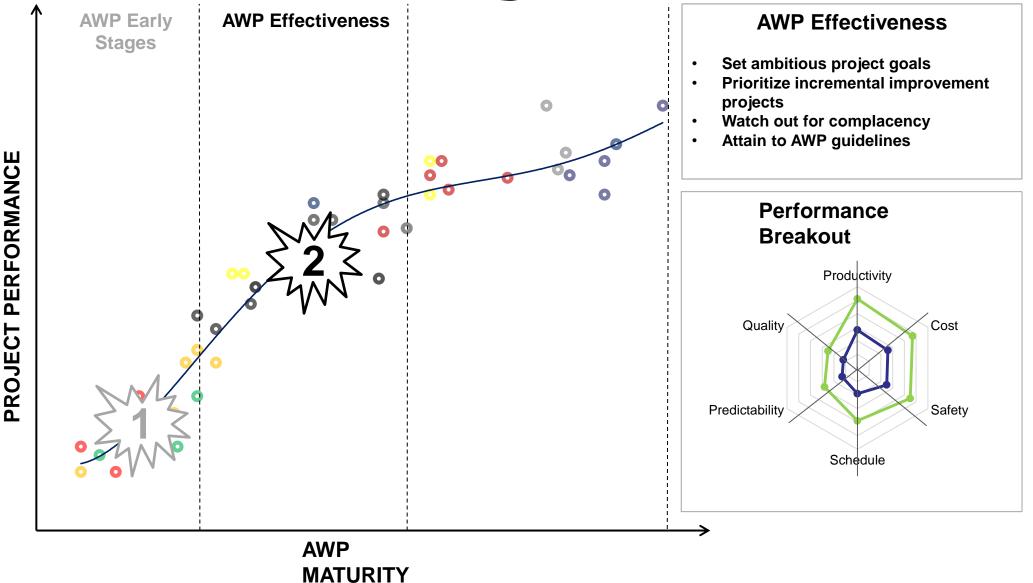
Benefits not clear (not enough case studies) - which makes buy-in more difficult

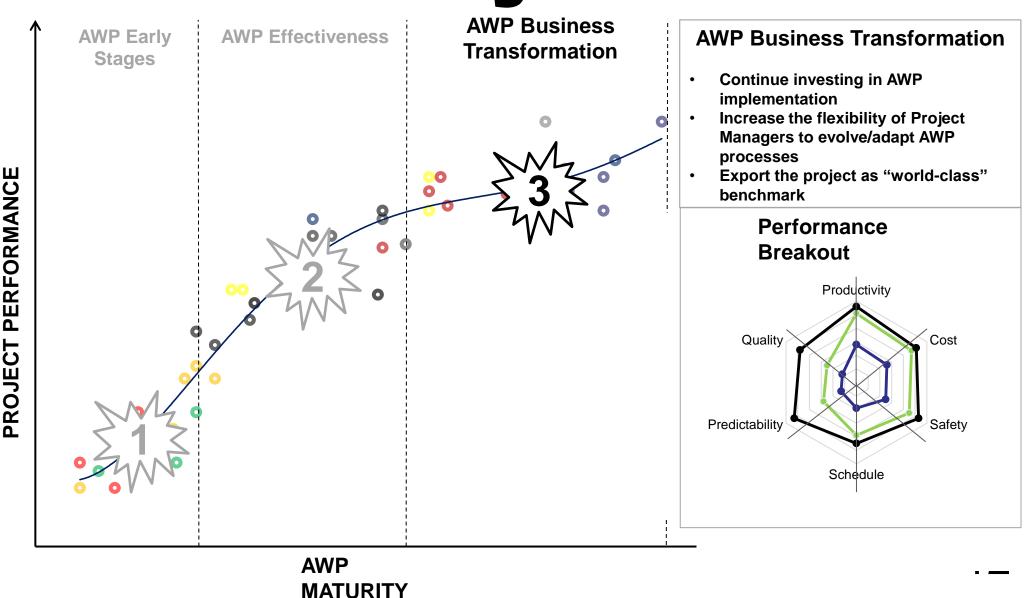
Too much effort involved in Front End

Moves additional costs into Front End











Owners – What you should be doing

- AWP/WFP This should be a key project strategy. Announce it. Support it. Tell the stakeholders your expectations!
- Prequalify your EP and C (or EPC)
- Ensure contract T&C's support AWP
 Support your champion(s)



Owners – What you should be doing

Clarify Scope









Owners – What you should be doing

Review Project Management

- Confirm templates for CWP, EWP, and PWP
- Confirm data requirements (content, format and schedule for all deliverables)
- Confirm Rules of Credit for CWP, EWP and PWP for progressing and forecasting completion dates



Implementation Setting Controls



Owners – What you should be doing

Contractual Issues

- Prequalify stakeholders on ability to support AWP implementation.
- T&C's support AWP and have incentives for timely completion of CWPs, EWPs, and PWPs.



Owners – What you should be doing <u>Review Model of Record</u>

- Boundaries of each CWP/EWP clear (no overlaps)
- Attributes of all items (spools, bulks and tagged equipment) tied to EWP and also support system identification

 Clarify use of model for engineering design construction planning, project progressing etc?



Owners – What you should be doing

Review Schedule

- Each CWP supported by predecessor
 EWP(s)
- Dates for associated vendor data tied to each EWP.
- Adequate lag from scheduled EWP IFC date and associated start of CWP.)



Owners – What you should be doing

Review Procurement Packages

- ALL materials / equipment can be traced back to individual EWP
- ALL materials / equipment can be traced back to individual SYSTEM



Owners – What you should be doing

Review Material Management Process

- Clarity of who receives / warehouses material
- What is process to get material from warehouse (eg. pick sheets by IWP or EWP?)
- Who bags and tags material?



What is needed – and is it new?

- 1. Clear correlation between content and schedules of CWP and EWP releases.
- 2. Clear definition of package boundaries
- 3. Defined templates for packages
- 4. Procurement packages mapped to EWP/CWP
- 5. Strategy for vendor data deliveries
- 6. Process to progress / forecast EWPs/CWPs
- 7. Prequalify stakeholders for AWP/WFP
- 8. Expectation clear in contract language
- 9. Defined materials management processes



Q & A



THANK YOU



COAA Best Practices Conference

Canadian Model Best Practice Update

May 2015



Workshop Ground rules

Please:

- Put your cell phone on silent or vibrate, and
- Please avoid side conversations.
- Questions are welcome at any point in the workshop.



Workshop Participants and Panel

Neil Tidsbury

Construction Labor Relations - Alberta

Dr. Bruce Demers

CannAmm Occupational Testing Services

Rene Boisvert

CannAmm Occupational Testing Services

Joe McFadyen

Construction Labour Relations – Alberta

Gary Truhn

PCL Industrial Constructors Inc.

Shelley Gallant

Organizational Health

Dave Hagen

Chemco Electrical Contractors

Hal Middlemiss

Construction Owners Association of Alberta



Canadian Model Workshop Outline

- 1. Selecting and Administering Service Providers.
- 2. Point of Collection (POCT) as a risk assessment tool.
- 3. Safety Advisory, disclosure of prescription drug use.
- 4. Post Incident Testing.



Canadian Model Workshop Outline

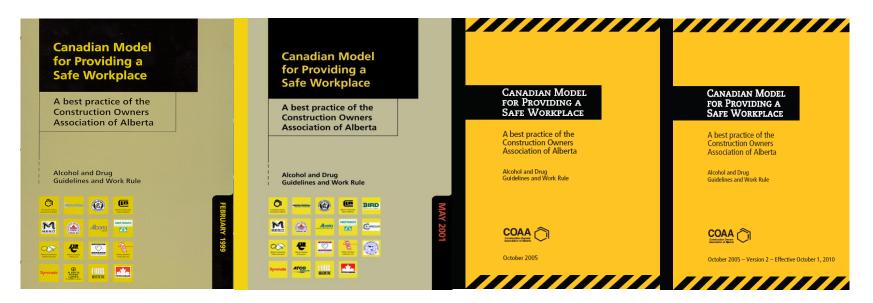
- 6. Redeployment and Support of Workers Returning Following Violations.
- 7. Keep Statistics.
- 8. Scope and Application of the Canadian Model.



Bugs on Drugs



Canadian Model History



Development of the Model has been an evolving process since 1997

The Model has been updated and revised to reflect the state of law and industry needs with versions published is 1999, 2001 and 2005

The most recent version of the Model was published in October 2014.



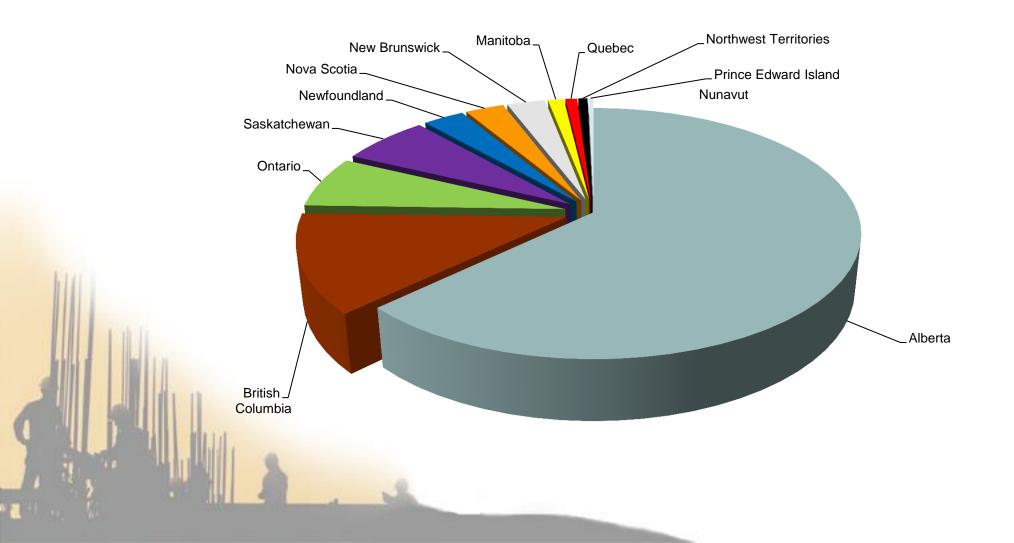
Canadian Model History - Observations, Learnings, and Trends from the past 15 years.

- Multi-stakeholder support important
- Training and mentoring essential
- How those that fail are treated affects policy acceptance
 - Declining positivity rates
 - Maintain data!



Testing By Province

Approximately 50% of tests conducted in Canada. (200,000).





2013 DRUG TESTING POSITIVITY RATES BY PROVINCE: NON-DOT & DOT

BC 4.3% (2012: 4.7%) provision AB 4.1% 4.2% provision SK 3.5% 4.3% reduct MB 3.3% 4.4% rate f ON 4.1% 5.0% 2013 QC 1.7% 2.0% 2013 NS 2.1% 2.3% • NB 1.5% 1.9% consider PE 0.8% 1.5% • NL 1.4% 1.7% • YT 11.9% 12.3% •	Province	Positive Rate	Including Refusals	• Gener
ND 4.1% 4.2% SK 3.5% 4.3% reduct MB 3.3% 4.4% rate f ON 4.1% 5.0% 2013 QC 1.7% 2.0% 2013 NS 2.1% 2.3% • Rang NB 1.5% 1.9% consi PE 0.8% 1.5% consi NL 1.4% 1.7% • Ter NT 6.3% 7.7% fold YT 11.9% 12.3% • SK,	BC	4.3%	(2012: 4.7%)	
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NT 6.3% 7.7% follow YT 11.9% 12.3% • SK,	PE	0.8%	1.5%	CONSIS
YT 11.9% 12.3% • SK,	NL	1.4%	1.7%	• Terri
	NT	6.3%	7.7%	follow
	ΥT	11.9%	12.3%	• SK, I
NU 0.0% (no testing either yr)	NU	0.0% (no	o testing either yr)	(last

- Generally all provinces saw a reduction in positive rate from 2012 to 2013
- Ranges stayed consistent:
 - Territories are highest, followed by Ontario
 - SK, MB lowest in prairies (last year it was AB)
 - Atlantic provinces lowest region in Canada



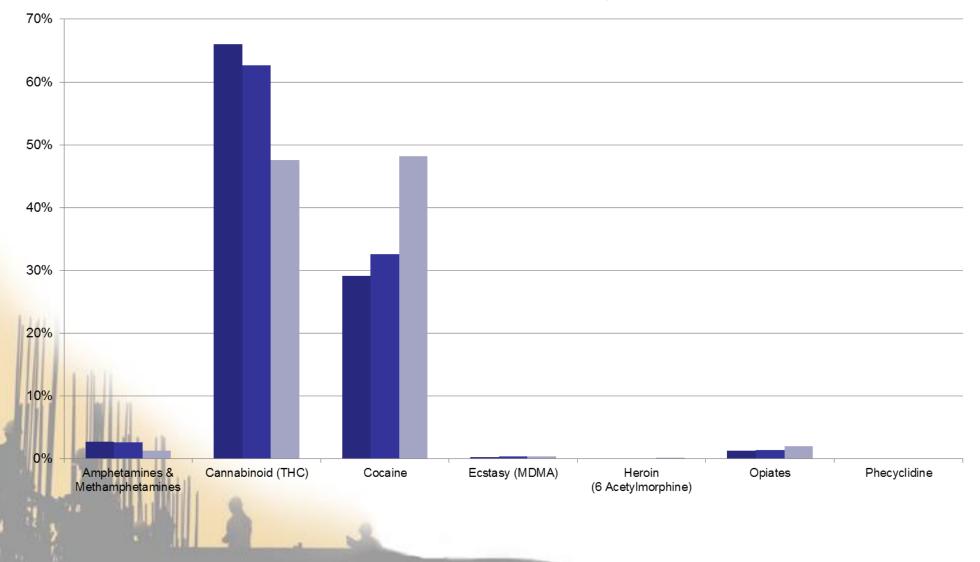
2013 DRUG TESTING POSITIVITY BY DRUG AS % OF TOTAL: NON-DOT & DOT

Drug	Canada	Alberta	Ft. McMurray
Amphetamines & Methamphetamines	2.7%	2.6%	1.3%
Barbiturates	0.0%	0.0%	0.0%
Benzodiazepines	0.0%	0.0%	0.0%
Cannabinoid (THC)	66.0%	62.7%	47.6%
Cocaine	29.1%	32.6%	48.2%
Ecstasy (MDMA)	0.3%	0.4%	0.4%
Ethanol Urine Alcohol	0.5%	0.4%	0.2%
Heroin (6 Acetylmorphine)	0.1%	0.0%	0.2%
Ketamine	0.0%	0.0%	0.0%
Methadone	0.0%	0.0%	0.0%
Opiates	1.3%	1.4%	2.0%
Oxycodone	0.1%	0.0%	0.0%
Phencyclidine	0.1%	0.0%	0.0%
Propoxyphene	0.0%	0.0%	0.0%



2013 DRUG TESTING POSITIVITY BY DRUG AS % OF TOTAL: NON-DOT & DOT (con't)

Canada Alberta Ft. McMurray





ALL CANADA TRENDS: DRUG TESTING 5-YEAR TREND

Test Reasons	Positive Rate by Year					
	2009	2010	2011	2012	2013	
Pre-Access	2.7%	2.7%	2.8%	2.9%	2.6%	
Pre-Employment	4.4%	4.1%	3.9%	3.5%	3.1%	
Post-Accident	6.5%	7.2%	6.2%	5.7%	5.3%	
Reasonable Cause	34.7%	33.2%	30.7%	34.1%	27.1%	
Total Positive Rate	3.6%	3.6%	3.6%	3.4%	3.1%	
Total Positive Rate including refusals	4.7%	4.7%	4.1%	4.1%	3.9%	

These rates do not include refusals, until the last row.



Selecting and Administering Service Providers

- 1. Sample Collection
 - A. Breath Testing:
 - i. Only personnel trained, documented, refresher trained (STT, BAT)
 - ii. Screening and Evidentiary Devices from Conforming Products Lists (NHTSA)
 - iii. Communications with Donor
 - iv. Reporting to Designated Employer Rep
 - /. Documentation of Irregularities
 - i. Service Standards



Selecting and Administering Service Providers

- 1. Sample Collection
 - B. Drug Testing:
 - Only personnel trained, documented, refresher trained
 - Compliant specimen bottles
 - Split sample for urine; Sufficient volume for second assay for oral fluid
 - Documentation for incomplete collections, refusals
 - Service Standards



Selecting and Administering Service Providers

- 2. Analysis
 - ✓ Certified Laboratory (SAMHSA)
 - ✓ Trained personal
 - Results reviewed by certifying scientist
 - ✓ Reports through Medical Review Officer
 - ✓ Report confidentiality maintained
 - Service Standards



Selecting and Administering Service Providers

- 3. Employee Assistance Service Provider
 - Substance Abuse Expert Assessment competency and qualifications
 - ✓ Qualified for Medical Diagnoses
 - ✓ Service Standards
 - Indemnification
 - ✓ Eligibility Requirements
 - SAE Report Requirements



Redeployment & Support of Workers Returning Following Violations or Self Disclosure

Self Disclosure is optimal for all workers with Substance Abuse issues. We must provide an environment for the worker to come forward to his/her Employer, Union, or Co -Worker and initiate Early Intervention.

Best Practice for Workers following violations/self disclosure includes Early Intervention and Supportive Aftercare Services:

Early Intervention starts with the SAE assessment followed by treatment planning & completion of the treatment recommendations prior to redeployment.



• **Supportive Aftercare Services** are essential in relapse prevention to ensure safety for all workers. These include counseling, unannounced A&D testing and regular support through case management services and/or the Employer.

Relapse behavior such as:

- Attendance & productivity excuses for not attending work or leaving early
- Physical symptoms red eyes, fatigue, appearing unwell
- Psychological Symptoms mood swings, anger, despair
- Canceling Counseling sessions
- Unannounced A&D Testing refusing, un-cooperative



Relapse behavior cannot be ignored and enabling workers with Addiction issues puts all workers in a safety sensitive worksite at risk.

It is difficult to approach and confront the worker regarding the behaviors you have witnessed and they may respond with denial, anger or despair.

It is important to remember that the worker with Addiction has the most incentive to change following consequences.



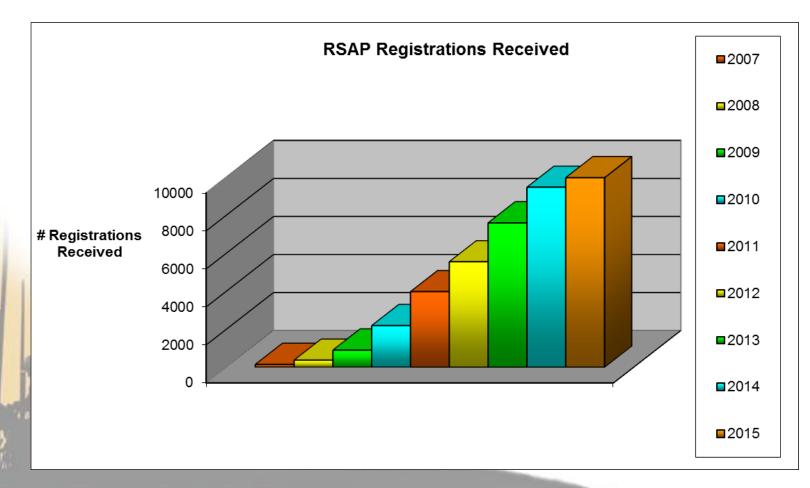
Addiction changes the brain the worker can often appear normal when they are not. For up to 6 months after stopping usage of their drug of choice the brain is trying to reestablish normal but until this happens confusion and impulsivity is heightened.

Compliance with Aftercare is essential for Recovery.



Rapid Site Access Program (RSAP) 2007-Present

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total	150	372	901	2192	3978	5548	7595	9470	9870





Q&A to the Panel

• Questions





The Journey from "Safety 2000"

to

"Safety 2020"

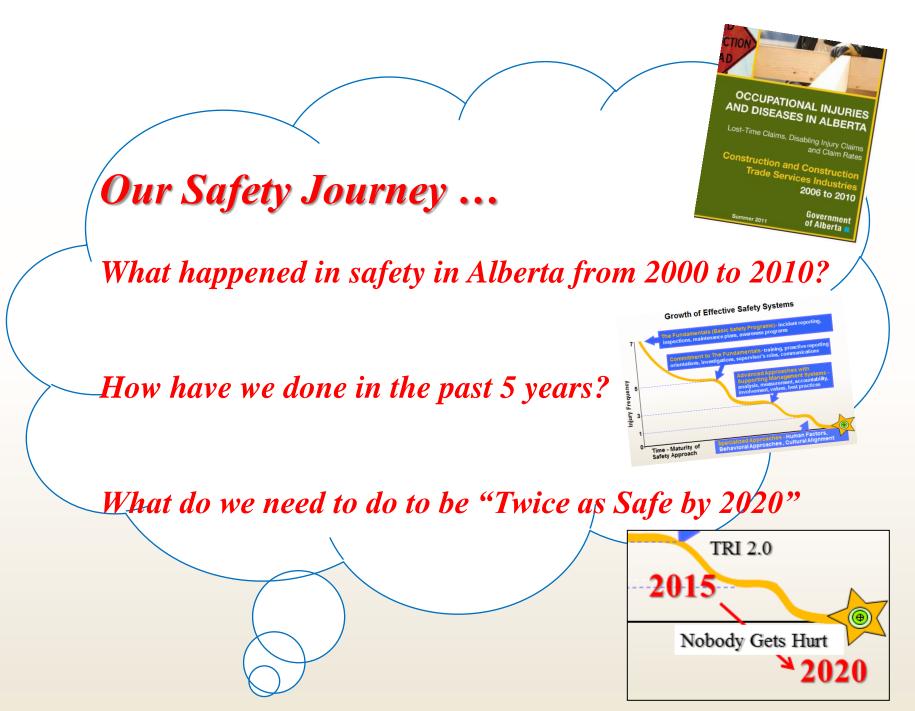
"Twice as Safe by 2020"

May 2015 COAA Best Practices

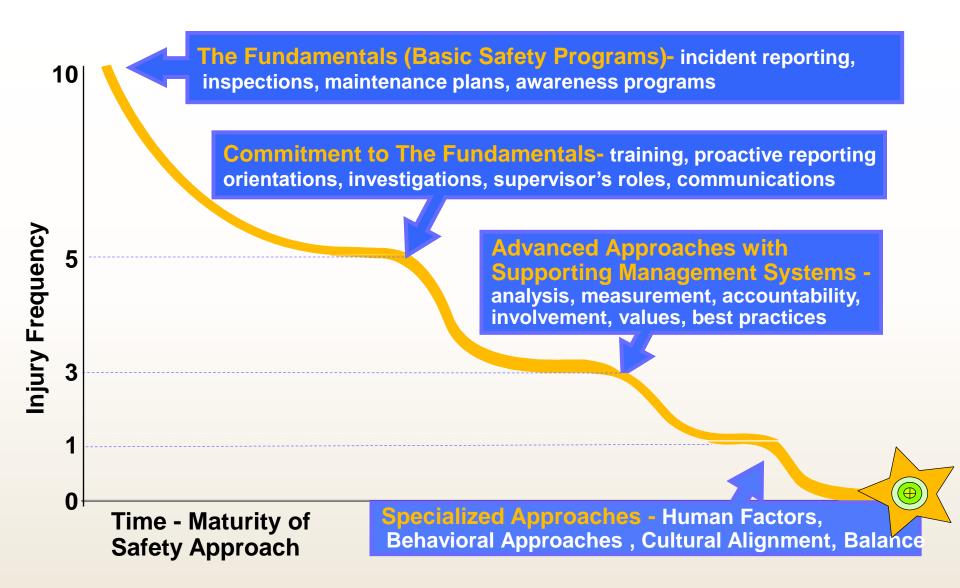
Dave Fennell

Senior Safety Advisor – Imperial Senior Technical Professional, Safety - ExxonMobil

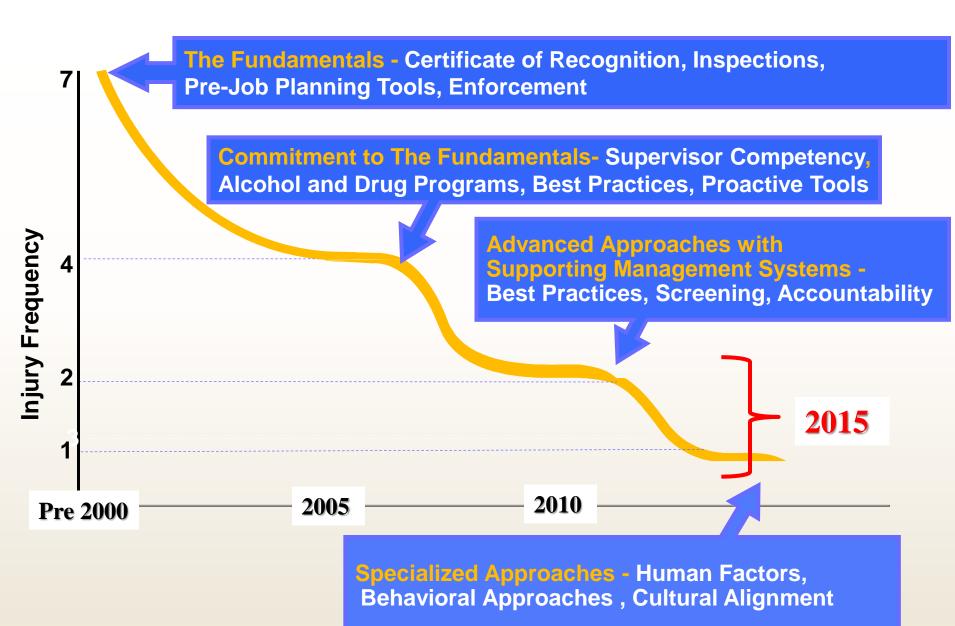
Dave Fennell, Imperial Oil



Growth of Effective Safety Systems

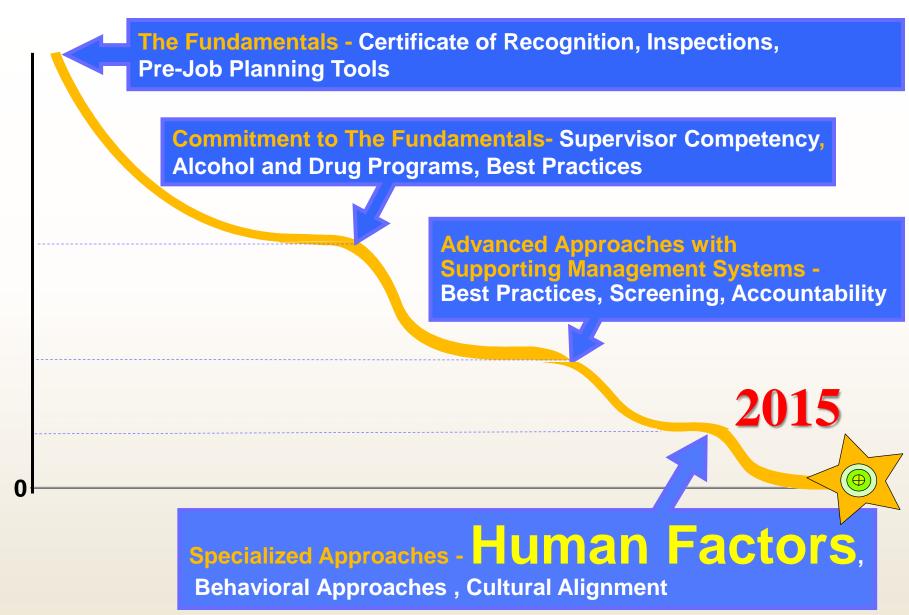


Our Journey

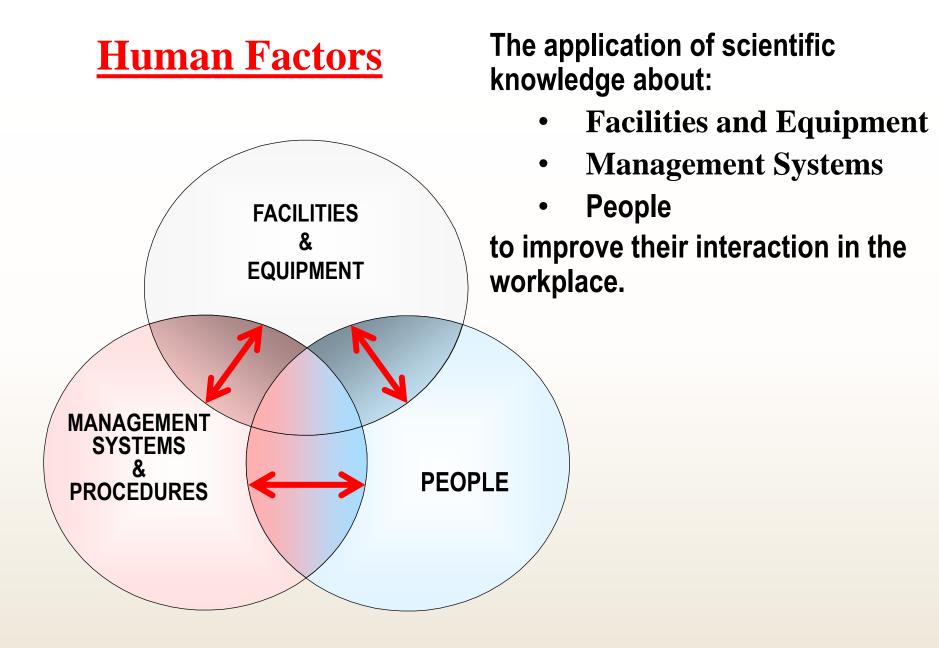




Our Journey

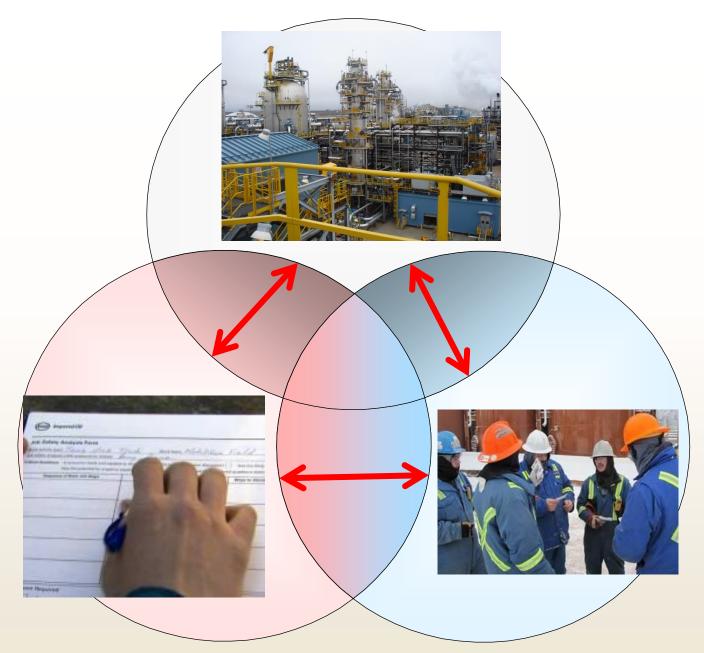


Injuries

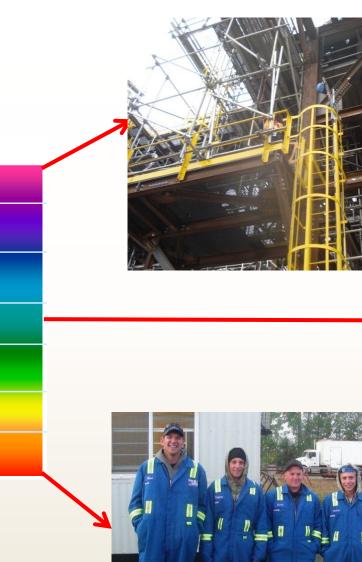


Dave Fennell, Imperial Oil

What does it take to make a safe work site?

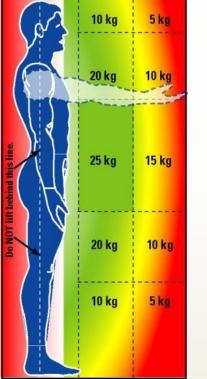


Human Factors



The Human Factors Spectrum

Workplace Design	Accessibility Work Station Set Up			
Equipment Design	Displays Hand tools Control Panels			
Work Environment	Noise Lighting Temperature			
Physical Activities	Force Repetition Posture			
Job Design	Schedule Workload Behaviour Based Safet			
Information Transfer	Signs Labels Procedures			
Personal Factors	Stress Fitness Fatigue			



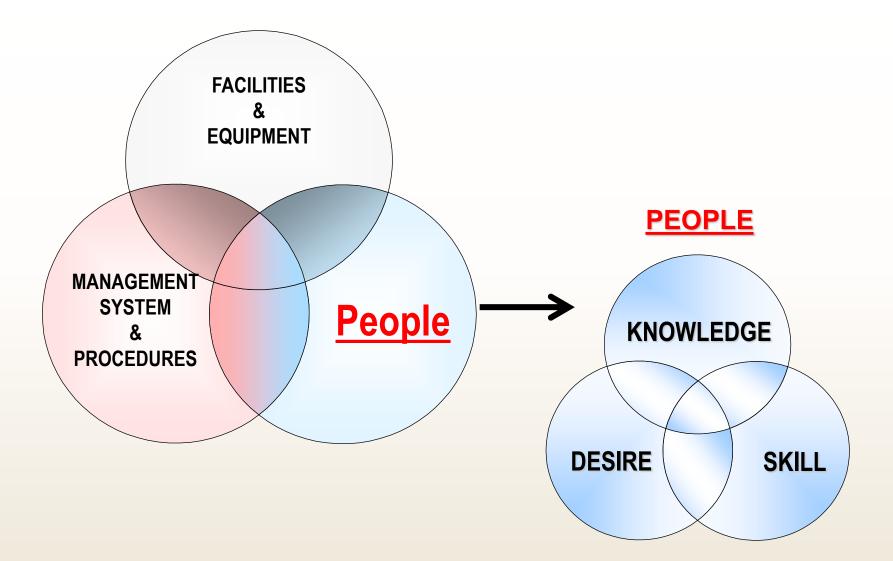
Our Journey



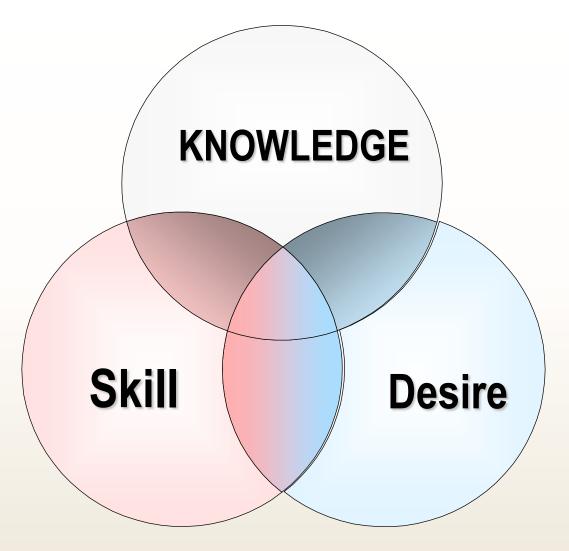
Specialized Approaches - Human Factors, Behavioral Approaches

Injuries

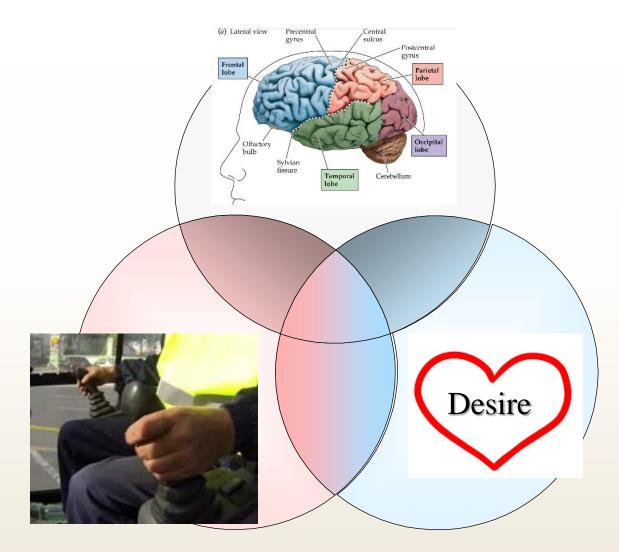
Behavioral Approaches

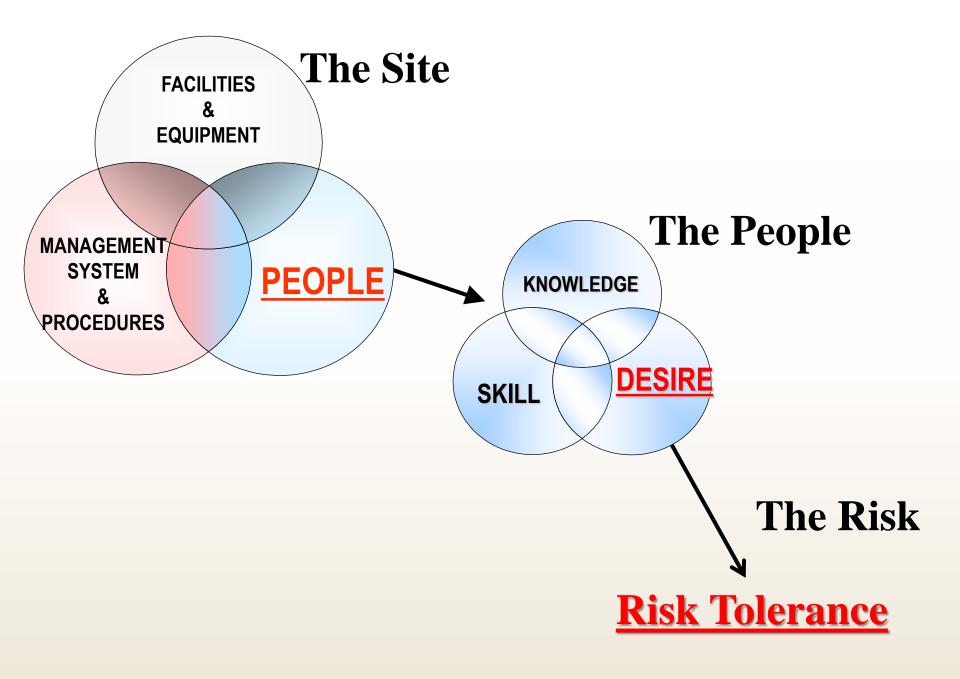


What does it take to make a safe worker?



What does it take to make a safe worker?





Risk Tolerance

Risk Tolerance

 Risk tolerance involves weighing a number of factors that influence a decision to either accept or reduce risk



- Understand the factors that influence decisions to take chances
- Understand why people make the decisions they make

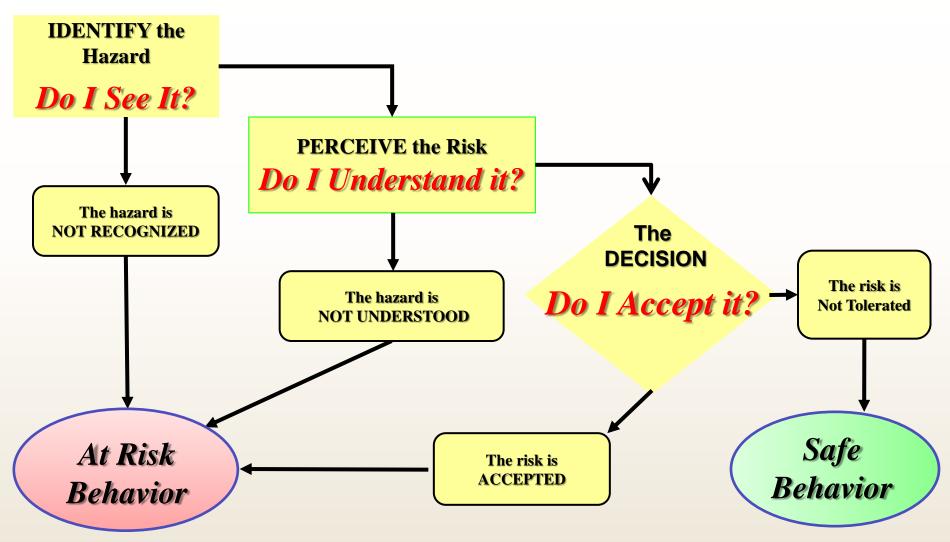






Risk Perception and Tolerance Model

EXPOSURE





- JSA often identifies the hazard
- Hazard is discounted or no mitigation





10 Factors That Influence Risk Tolerance

- 1. Overestimating Capability/Experience
- 2. Familiarity with the Task
- **3.** Seriousness of Outcome
- 4. Voluntary Actions and Being in Control
- 5. Personal Experience with an Outcome
- 6. Cost of Non-Compliance
- 7. Confidence in the Equipment
- 8. Confidence in Protection and Rescue
- 9. Potential Profit & Gain from Actions
- **10. Role Models Accepting Risk**



Over estimating physical capability Agility

Strength





Over estimating experience



Familiarity with the Task (Complacency)



Voluntary Actions and Being in Control



Seriousness of the Outcome



Personal Experience with an Outcome

Cost of Non Compliance





Dave Fennell, Imperial Oil

Confidence in the Equipment



Potential Profit and Gain from Action



Confidence in Protection and Rescue



Role Models Accepting Risk

We need to create conversations about risk tolerance

What Could Go Wrong?

How Bad Could It Be?

What can we do about the of the second of th Do I have the right tools and equipment? • Do I clearly understand my task? • Use right procedure.







5108 & Think

. Use right tools. • Reduce risks.

· Make it safe.



Howie Dingle, VP Imperial 2001







When we become

"Twice as Safe"

we will become

"Twice as Productive"

Dave Fennell

Senior Safety Advisor – Imperial

Senior Technical Professional, Safety - ExxonMobil

dave.j.fennell@esso.ca After July 2015 djfsafe1@telus.net





Productivity

Productivity Improvement is Like Teenage Sex: EVERYONE TALKS ABOUT IT, NOBODY REALLY KNOWS HOW TO DO IT, **EVERYONE THINKS EVERYONE ELSE IS** DOING IT, SO EVERYONE CLAIMS THEY **ARE DOING IT**



Productivity

- 'If You Can't Measure It, You Can't Manage It'
- 'If You Can't Measure It, You Can't Control It'
- 'What You Can't Measure You Can't Improve'
- 'You Can't Improve What You Don't Measure'
- 'You Can't Manage What You Don't Measure'





Expectations of the Workshop





Contents

Duration

- COAA Productivity Committee
- Productivity
- Survey Results
- Productivity Puzzle
- Suncor Energy Fort Hills (Case Study)



Contents

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COAA Productivity Committee



Committee Portal COAA Library Contact Us Calendar

Input your search ... Q

ABOUT AWP&WFP BENCHMARKING PROJECT PRODUCTIVITY MODULARIZATION STRATEGY COMMITTEE HOME

Project Productivity

Project Productivity Working Committee Goal:

To develop the framework of what the Productivity Best Practice should look like, analyze past data and develop recommended practices to address the highest payoff areas within the framework. Explore what should be included in value add and non-value add time, establish Alberta units of effort where appropriate to move away from traditional Gulf Coast standards. Primary effort for 2012/13 will be to categorize industry-identified construction productivity problems, prioritize focus areas, interview stakeholders and develop a multi-year work plan.





WORK FORCE DEVELOPMENT BEST PRACTICES



CONTRACTS **BEST PRACTICES**



CONSTRUCTION PERFORMANCE



Contents

Duration

COAA Productivity Committee

Productivity

- Survey Results
- Productivity Puzzle
- Suncor Energy Fort Hills (Case Study)



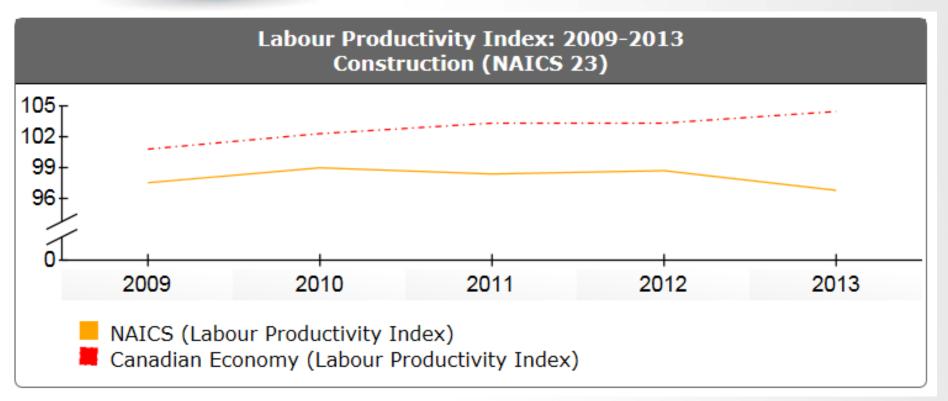
Safety vs Productivity







Construction (NAICS 23)



Source: Industry Canada



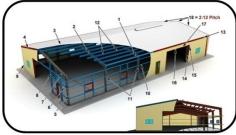
Why Focus on Productivity?

- Productivity is a ratio of production output to what is required to produce it (inputs).
 - What is our output? -> A more efficient project
 - What is your output? -> More efficient Lm, Tons, etc.
- However, "Productivity" is a complex issue in construction because of the interaction of labour, capital, materials and equipment in the output.
- We should all (owners, engineers, contractors and vendors) look for ways to improve construction productivity. It is better for business.



Productivity

Productivity is affected by many issues



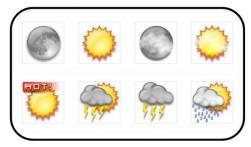
Technical Issues



Management Issues



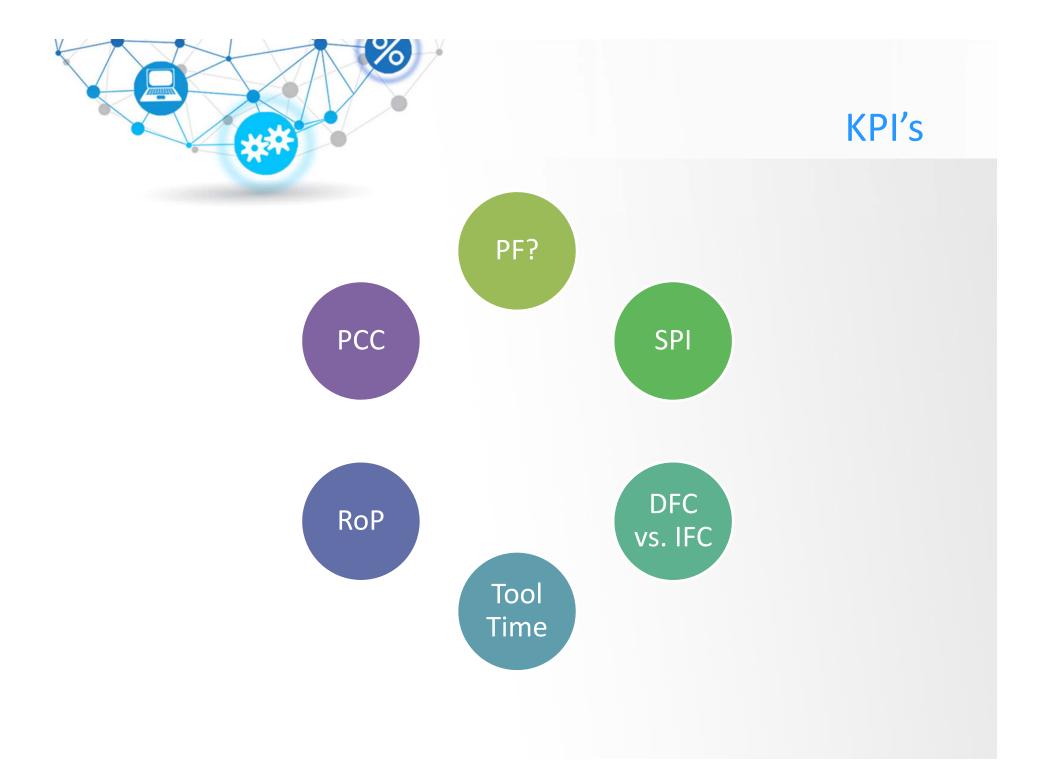
Human/Labour Issues



External Issues/factors



Market Conditions





T&M vs Hard Dollar

Contract Type	Owner		EPC		General Contractor	
	Cost	Schedule	Cost	Schedule	Cost	Schedule
Reimbursable	Direct Cost Saving	Indirect Cost Saving + Early Revenue	Direct Cost Saving	Indirect Cost Saving	Direct Cost Saving	Indirect Cost Saving
Lump Sum	N/A	Indirect Cost Saving + Early Revenue	Direct Cost Saving	Indirect Cost Saving	Direct Cost Saving	Indirect Cost Saving



Construction Productivity

$$Labour \ Productivity \ (P) = \frac{Input \ (I)}{Output \ (O)} = \frac{Labour \ (Number \ of \ Man \ Hours)}{Output}$$

$TFP = \frac{Labour + Material + Equipment + Capital Cost + Overe Heads}{Output}$



Common Causes

- Waiting or not having materials and equipment
- Not having the right materials
- Waiting for transportation
- Not having the right construction equipment
- Changes in design
- Not knowing their task, not being prepared
- Not knowing procedures (how to accomplish their tasks)
- Waiting for approvals



Effects

- Poor time on tools
- Standing / Waiting
- Moving crews to other work fronts
- Early quits / breaks
- Equipment and Materials being reallocated or reassigned
- Poor morale



Industry Survey

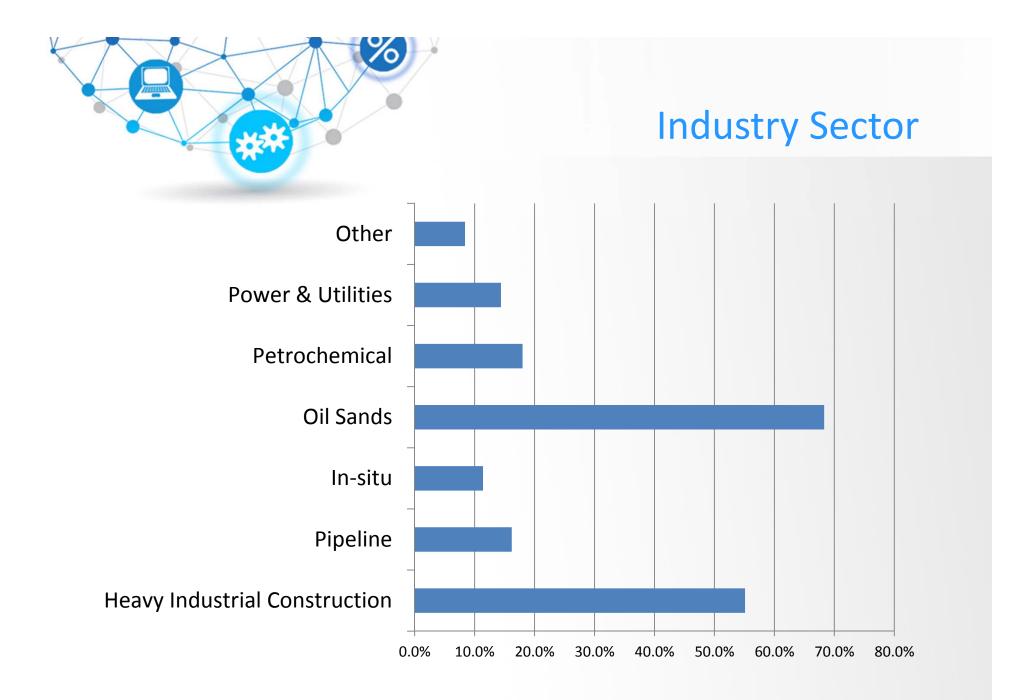
Duration

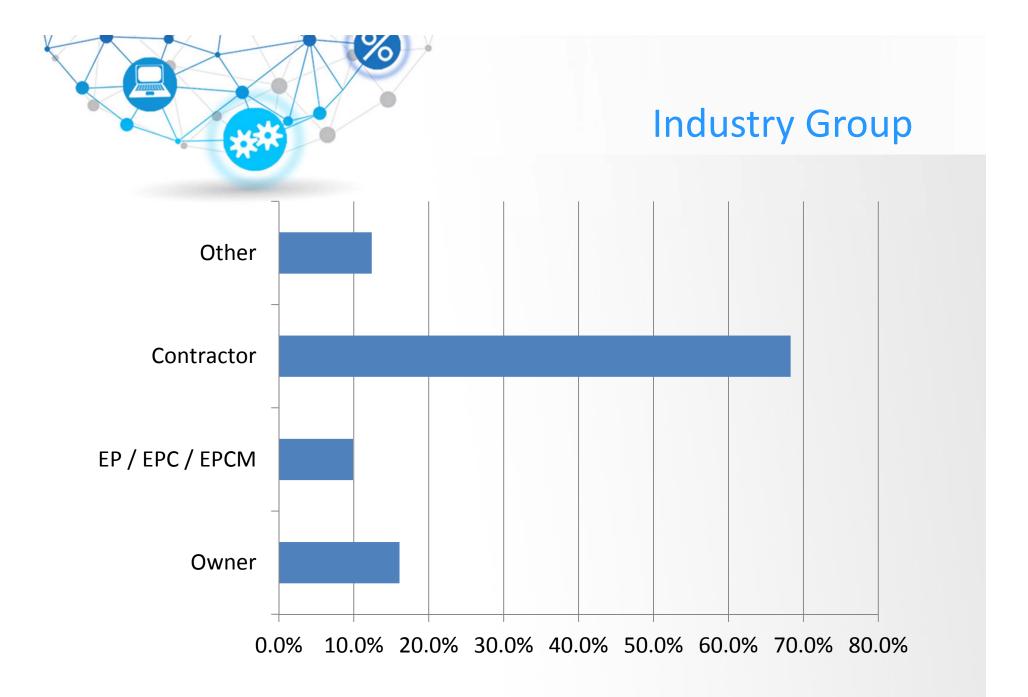
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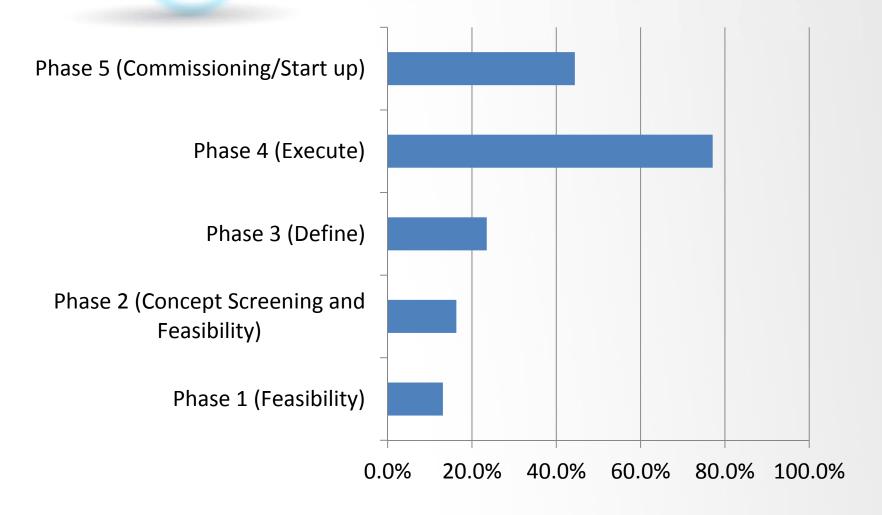
Survey Design

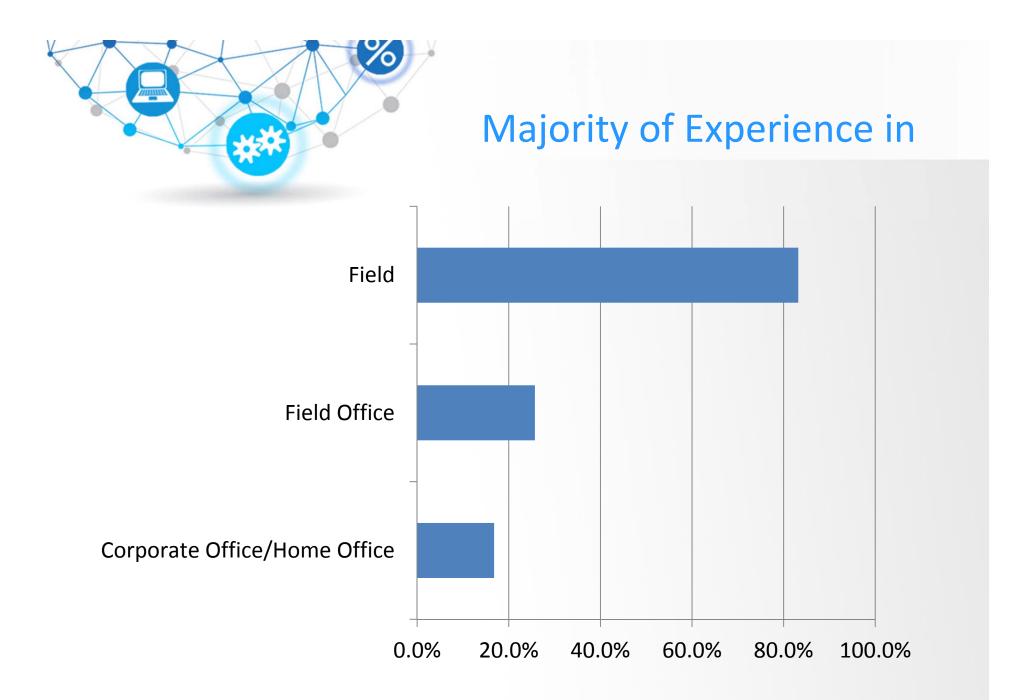
- Please list below the tools, techniques and processes used for increasing efficiency by you or your organization?
- What is not working well in regards to productivity (Hinders productivity)?
- What is working well to increase productivity, how and why?
- If you could change anything that would increase your productivity what would you do?





What phase of construction do you work in?





Tools, Techniques and Processes

Rigging Manpower Hiring Checklist Reviews Purchase Material Wrenches Management Increased Efficiency JOD Skilled Planning Practices TOOIS Welding Safety Zoom Boom Construction Workforce Communication Bobcat Training Happy Trades Mentorship Team Analysis



Hinders Productivity

Attitude Little Language Barriers Conditions Hiring Standards Start Not Following JOb Common Sense POOR Efficient Way Planning Cheap Workers Cold Weather Materials Not Organized Communication Facilities Field Commissioning Late Line Speak English Support Work Fronts Turnover



What is Working Well

Hard Work Technologies Employees Causes Communication Ground Tools Listening Construction Positive Attitudes Workers Fabrication Job Incentive Planning Weather Productivity Hiring Field Happy Training Teamwork Team Flight Trades Contracts



Issues Progress Improve Involvement Team Brings Materials Flat Hire OWNER Productivity Clear Communication Training CLAC Workers AWP Tools Items Planning Amount Construction Correct Pay Opportunity Meeting Receive Staff Shift Tools and Techniques and Process

Optimal Path of Construction Constructability

Workforce Development Strategy

Construction Readiness-Mobilization Checklists

Contract Management Plan



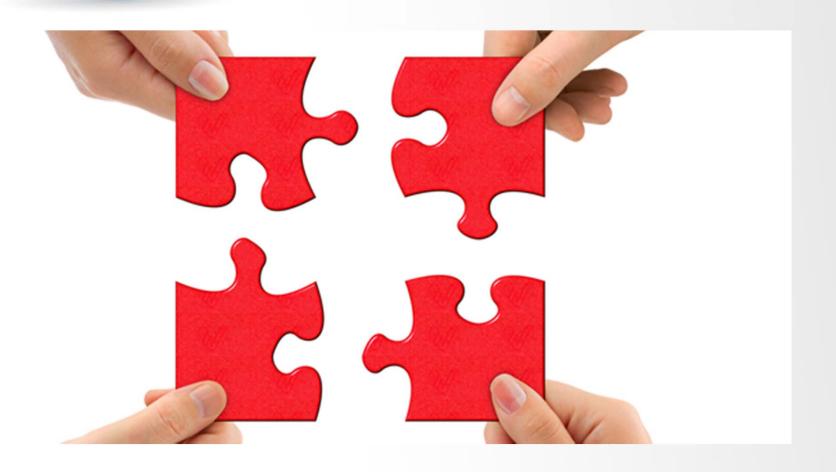
Productivity Puzzle

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- Suncor Energy Fort Hills (Case Study)



Productivity Puzzle





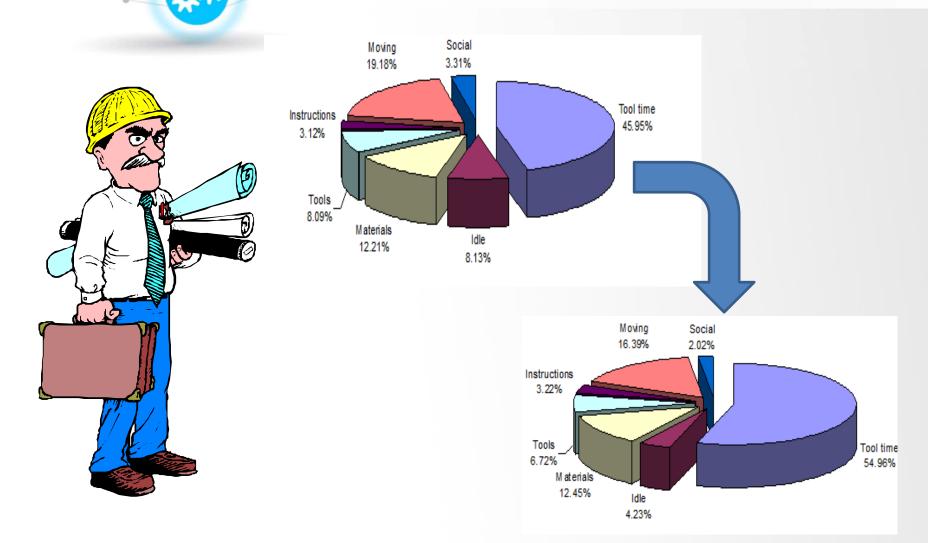


Time & Motion Study

- What is Tool Time?
- The amount of time that workers spend in producing tangible outputs
- Tool time contributes directly to productivity

- Non-Tool Time
- Supporting Time: discussions, toolbox meetings, safety etc.
- Ineffective Time: idle time, extra-socializing, searching for tools and materials

Work Sampling



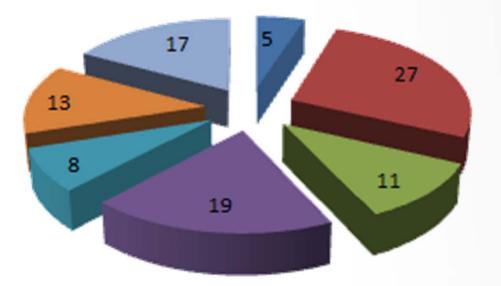
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CII RT 252

Activity Percentage

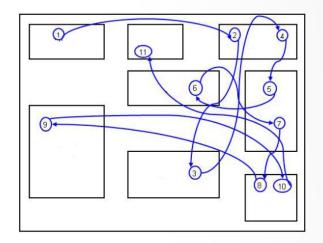


- Personal
- Direct Work
- Preparatory Work
- Tools and Equipment
- Material Handling
- Waiting
- Travel



Root Cause Analysis











Contact Details

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Never Waste a Perfectly Good Crisis: Improving Productivity When Uncertainty is High

COAA Best Practices Conference XXIII 13 May 2015







Introductions

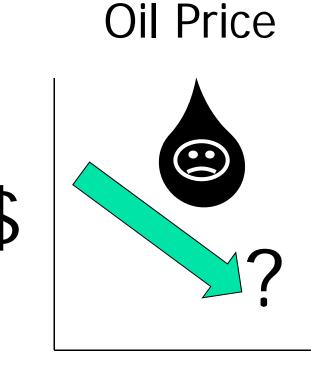
Lori Schmidt, CEO, GO Productivity

Framing the issue

Dr. George F. Jergeas Peng Professor of Project Management University of Calgary

We are fast approaching a crisis in Alberta





Time

Statoil here the value of Canadian heavy crude of a more shelf of the repeated delays and the repeated of Canadian heavy crude of the shelf of the value of Canadian heavy crude of the shelf of the value of Canadian heavy crude of the value of Canadian heavy crude of Canadi and the repeated delays in new export pipelin boost the value of Canadian heavy crude oil shell halts work on Pierre River oil sands mine in Loss on Canada Oil-Sands Project northern Alberta

Total shelves \$11-billion

Alberta oil sands mine

The Josium oil sands mine has been shelved

Indefinitely, a result of rising industry costs that

March 28 (Bloomberg) -- Total SA, Europe's third-biggest oil company, will book a \$1.65 billion loss in the first quarter on the canceled **Voyageur Upgrader project** in Canada's oil sands after selling its stake to Suncor Energy Inc.

Statoil halts multibillion

dollar Alberta oll sands

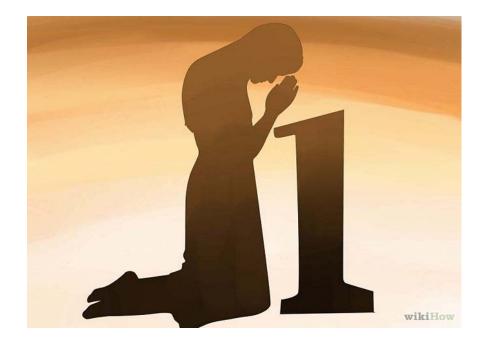
Cut Costs or Face Death Spiral

- "The made in Fort McMurray" cost of doing business has risen too quickly and must end.
- Oil sands producers were making three times the profit in 2004 when a barrel of oil cost about \$40(US) than it did when price hit close to \$100 in 2013.
- The rising costs from suppliers, and not world oil prices, were the reason that CNRL and others could no longer produce the profits it once did.
- .. Oil sands can only avoid collapse if the people in the room contractors and service industry representative – begin to cut costs.
- An opportunity for every part of industry to cut costs and eliminate inefficiencies that were allowed to creep in when business was booming." Steve Laut President of CNRL

Globe and Mail, February 19, 2015, by Peter Scowen

Confession

- We all got it wrong!
 - Academics and industry
- We focus on the wrong issues!!!



Mega Oil Sands Projects

- No major problems re quality and we are getting better at safety
- Projects running in excess of design capacity
- Hardworking people
- No unskilled or unprofessional conduct
- Proud of Alberta's achievements

Mega Oil Sands Projects



- Size and interfaces
- Technological complexity

Mega Oil Sands Projects

Typical project cost allocation:

- Engineering: 8 15%
- Equipment: 32 35%
- Construction: 50 60%

Engineering is the smallest % with the biggest impact.

Warning Signs that we are repeating the same mistakes

- 1. Project delivery model/Gated process
- 2. The four planes of decision process
- 3. Fast-tracking
- 4. Delays in engineering
- 5. Huge number of changes and project reestimates
- 6. Contingencies and allowances

1. Project Delivery Model

AFE/FID							
PHASE 1 IDENTIFY & Assess Opportunities	PHASE 2 SELECT from Alternatives	2 PHASE 3 DEVELOP Preferred Alternative	🖌 PHASE 4 🚿	4 PHASE 5 OPERATE & Evaluate			
Determine Project Feasibility and Alignment with Business Strategy	Select the Preferred Project Development Option	Finalize Project Scope, Cost and Schedule and Get the Project Funded ~25 % Engng.	Produce an Operating Asset Consistent with Scope, Cost and Schedule	Evaluate Asset to Ensure Performance to Specification s and Maximum Return to the Shareholders			

-Start-Up

- Perf'm Testing

- De-bottleneck

-FEED -Long-Leads

- Reg. Approval

-DBM

- Application

-Feasibility

- Fabrication -Construction

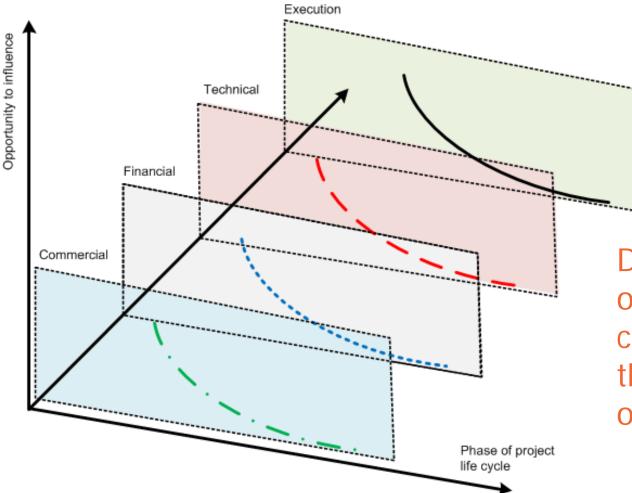
- Detailed Design

- Procurement

-Commissioning

25% engineering is not enough to provide the required accuracy in the AFE budget!!!

2. The Four Planes of Decision Process

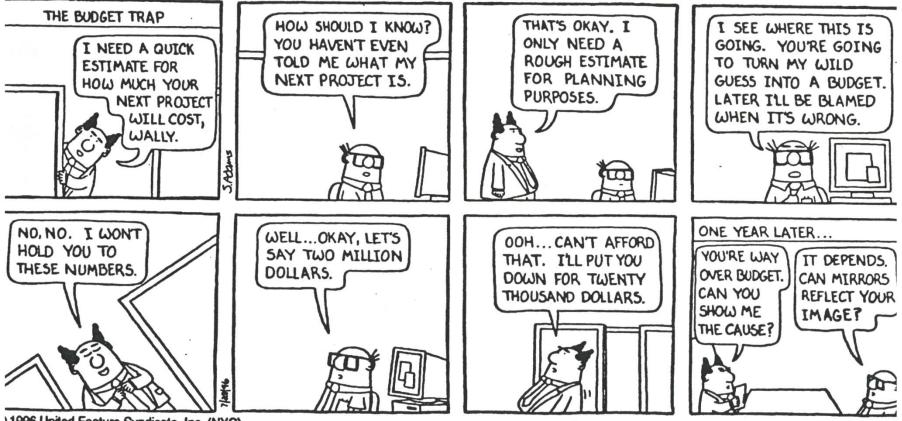


Decisions made in one plane without consideration of the impact on the other plane

2. The Four Planes of Decision Process: Examples

- Decision to fabricate in Korea
- Pipeline company accepts unrealistic completion deadline
- Business units impose unreasonable budget number or completion date.

Example: Unrealistic Cost Estimates



1996 United Feature Syndicate, Inc. (NYC)

3. Project Fast-tracking

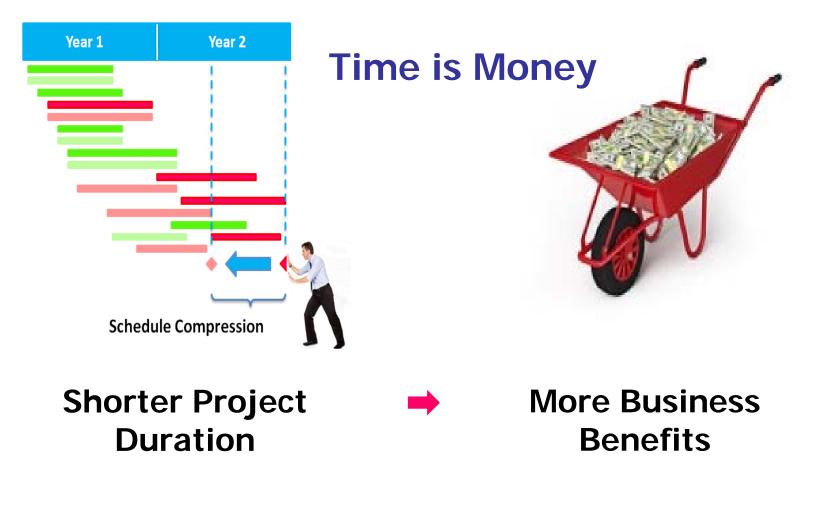
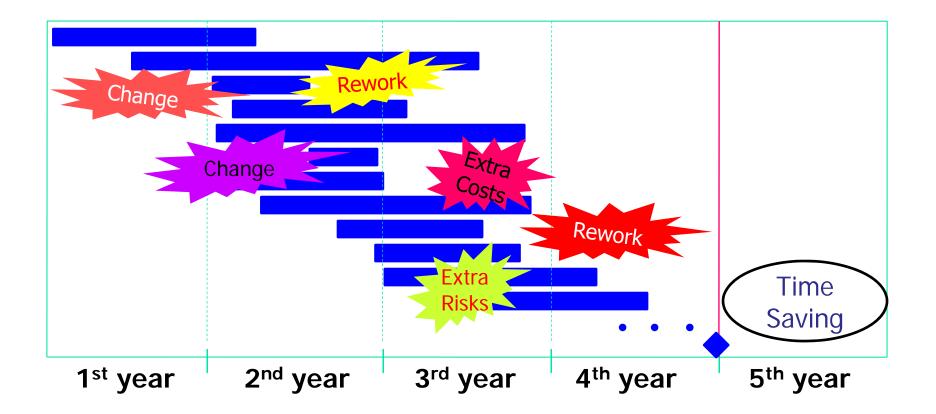


Photo: colourbox.com

3. Project Fast-tracking

Very costly!!



3. Project Fast-tracking

Fast tracking results in:

- Poor/incomplete scope definition
- Underestimation/under appreciation of project complexity
- Unrealistic expectations re cost and schedule
- Inadequate plan of execution
- Changing customer requirements
- Lack of understanding the costs of changes
- Little constructability input
- Cost reimbursable contracts
- Lower than anticipated labour productivity.

4. Delays in Engineering

Delays in achieving early key engineering milestones:

- Substantial Completion of Engineering
- Freezing Process Flow Diagram's (PFD's)
- P&ID issued for design

What happens to the final completion date?

5. Changes and Project Reestimates

- Huge number of changes and extras
- Project re-estimates after AFE

What happens to the final completion date?

6. Contingencies & Allowances

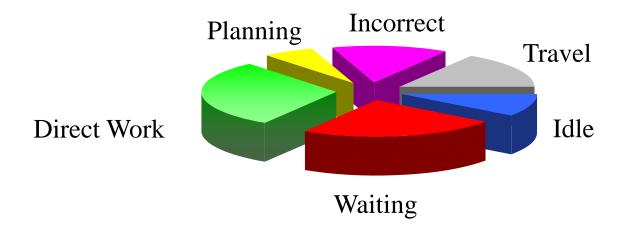
Contingencies and Allowances consumed quickly

• Proving to be inadequate

Warning signal to the PM that events are not evolving as expected

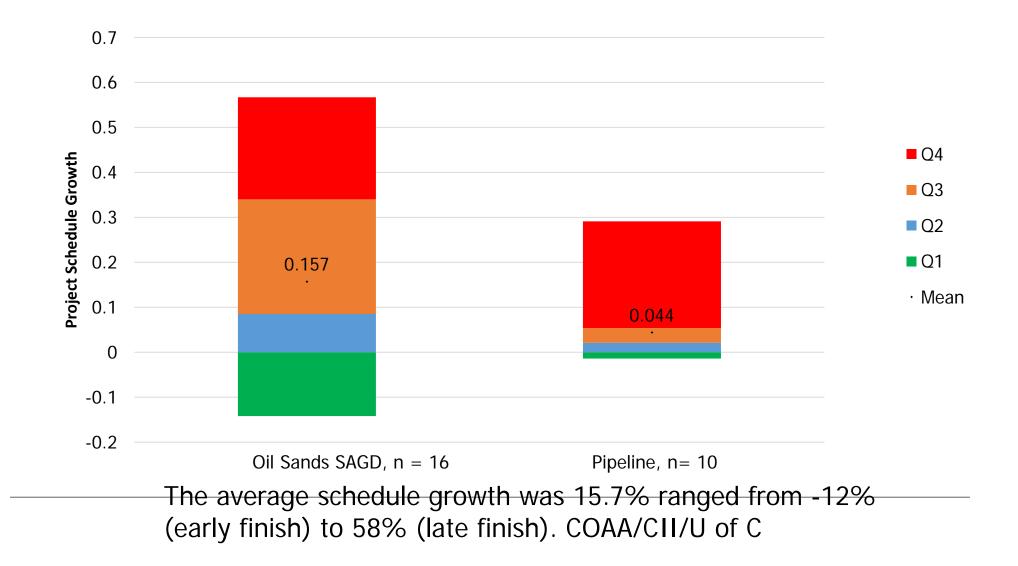
Consequences: Labour Productivity

30% of work day in direct work ... or 3 hrs / 10 are on real stuff

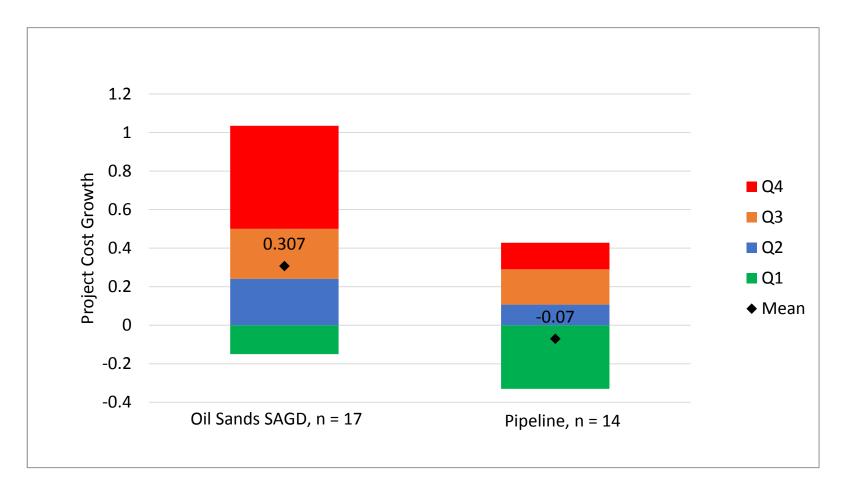


Blame unfairly placed on workers

Project Schedule Growth Oil Sands SAGD and Pineline Projects

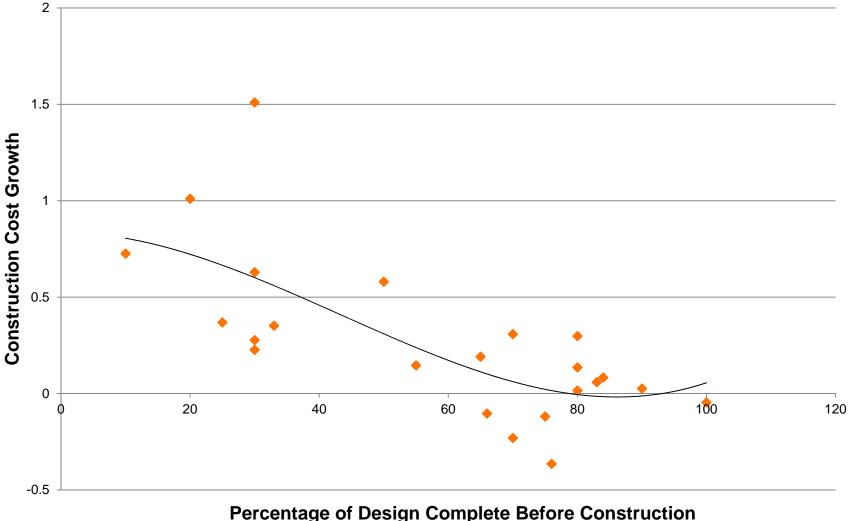


Project Cost Growth Oil Sands SAGD and Pipeline Projects



The average cost growth was 30.7%. Ranged from -18% (under budget) to 105% (over budget). COAA/CII/U of C

Construction Cost Growth and Percentage of Design Complete Before the Start of Construction



More Consequences

- 1. Cost reimbursable contracts
- 2. Myopic risk allocation and management
- 3. Outsourcing engineering and fabrication
- 4. Owner's don't plan for the future but react to present cash flow
 - Stop or delay projects then speedup!
- 5. Owners now requiring their contractors and suppliers to reduce costs!!!
 - Market Intervention

Any Connection

Insanity: doing the same

thing over and over again

and expecting different results. ~Albert Einstein





Findings of a New Study

 "Performance Challenges Of Mega Capital Projects", a report to GO Productivity Alberta, George Jergeas and Jim Lozon, November 2014.

Table 9: Factors that affect Proje	ct Performance (references)		
Factors that affect project performance	Reference		
 Insufficient/incomplete front end planning, cutting corners 	1, 2, 5, 19, 28, 33, 50, 52, 57, 59, 61		
 Inaccurate/unreal estimates/economics, optimistic bias, aggressive targets 	2, 16, 19, 25, 39, 50, 55, 57, 61, 79, 86		
3. Poor risk assessment/management, uncertainty, poor risk sharing	2, 6, 25, 42, 50, 52, 57, 61, 78, 79		
4. Poor governance, oversight, support,	2, 5, 9, 28, 36, 37, 55, 57, 86		
business/project/strategy management	Table 10: Categories of Factors that affect Project Performance		
5. Team conflict, turnover, lack of			
integration, lack of continuity, poor interface management	Project Planning	AFE	Project Implementation
 6. Unclear scope/objectives, late scope changes, scope creep 7. Changes, slow/poor decision making 	Large project sizeLessons learned ignored		Poor project management skills Slow decision making
8. Contract strategy, responsibilities, slow payment, lump sum barriers	Unclear scope/objectivesPoor scope management		Uncontrolled scope creep Incomplete engineering design
 Unmet stakeholder requirements, poor stakeholder/user engagement 	 Incomplete front end planning Inaccurate/unreal estimates 	•	Complex new technology Low contingencies
10. Poor monitoring/control, lack of control 11. Incomplete contingency plan, low	Compressed/aggressive schedule		Rework and changes
contingencies	Incomplete contracting strategy		Risk averse behaviour
12. Inexperienced, lack of project management skills	Inadequate procurement strategyInadequate risk assessment		Lack of innovation Poor monitoring and control
 Underestimating complexity and magnitude of the project 	 Incomplete project execution plan Poor governance, oversight, support 		Mishandled claims and disputes Team conflict
 Incomplete engineering design before construction start 	Inadequate staffing	•	Insufficient modularization
15. Compressed and aggressive schedule, fast tracking	 Unsatisfactory contractor selection Onerous legal contracts 	•ا	Unsatisfactory productivity Unmet stakeholder requirements
16. Poor communication	 Poor communication 		Poor communication
17. Procurement strategy (global/local), late material/equipment delivery	Deceptive low biddingBiased risk management		Poor construction management Late material delivery
18. People (limited resources), labour,	 Incomplete contingency plan 		High worker turnover
engineering, construction management	Distrustful project culture		Poor monitoring and control
19. Engineering/construction productivity	 Incomplete transfer of information 		Undefined lines of authority
20. Technology	 Poor stakeholder engagement 		Poor interface management
21. Insufficient modularization, pre- fabrication		•	

3) What can we do tomorrow?

The researchers and professional organizations offered many ideas as to what we could do to improve our capital projects including: (a) actions to improve project performance, (b) executive oversight, (c) systems thinking, (d) leading indicators (early warnings) and (e) benchmarking programs. 23. Board of Directors oversight (see

(a) Actions to Improve Project Performance

			2.,00
Table 11: Actions to improve Project	Performance (refere	26. Use Best Practices (CII and others)	7, 72
		27. Develop dispute avoidance/resolution	13, 52
Actions to improve Project Performance	Reference		
1. Leadership, governance (see Executive	16, 33, 36, 38, 39, 42,	28. Focus on Project Management best	14, 52
Oversight questions below)	86	practices (skills training)	
2. Stakeholder input/communication/	17, 21, 30, 38, 43, 57,	29. Apply lessons learned	14, 72
alignment	14 10 10 10 50 54	30. Early focus on supply and contract	18, 52
3. Strong risk management program (share	14, 18, 42, 43, 52, 54,	optimization	
risks) 4. Comprehensive front end planning (get it	15, 33, 45, 46, 57, 58	31. Clear communications	18, 33
right)	15, 33, 45, 46, 57, 56	32. Complete constructability reviews	20, 33
5. Clear roles and responsibilities	18, 21, 41, 42, 52, 54	33. Develop long term relationships	52, 78
6. Strong cost and schedule monitoring and	41, 43, 46, 49, 52, 66	34. Optimize scarce talent	52, 82
control (stick to the plan)	41, 40, 40, 43, 52, 00	35. Select appropriate project delivery system	42
7. Interface management	18, 19, 21, 40, 80	36. Less fast tracking	66
8. Manage engineering (do not fast track	16, 33, 49, 52, 57	37. Near term thinking	36
engineering)	10,00, 10,02,01	38. Early contractor involvement	4
9. Clear scope definition	21, 55, 57, 72	39.10-4 construction site work schedule	7
10. Assign project team early (adequate	42, 55, 57, 58	40. High quality FEED	9
staffing)	,,,	41. Complete the project execution plan	9
11. Restrict changes (e.g. after	4, 7, 9, 72	42. Incremental design optimization	78
constructability review)		43. Develop construction plan early	9
12. Manage changes	21, 41, 43, 52	44. Local versus global sourcing	49
13. Higher modularization and offsite	7, 19, 33, 49	45. Monitor and control global sourcing	11
fabrication		46. Select better projects	14
14. Develop contracting strategy early	9, 21, 33, 52	47. Manage cash flow	14
15. Realistic cost and schedule estimates	14, 42, 43, 66	48. Trim project portfolio (less projects	16
16. Strong construction contract management	15, 19, 33, 52	simultaneously)	
17. Standardize designs and work processes	18, 55, 57, 78	49. Independent peer reviews	17
18. Integrated project team	46, 58, 63	50. Benchmark projects	17
19. Reduce project complexity/size	41, 49, 61	51. Capture risk history	27
20. Manage key suppliers/logistics	18, 19, 41	52. Review risks at 30% review	27
21. Align expectations/team	28, 57, 72	53. Manage political influence	33
22. Strong construction labour relations	33, 49, 52	54. Continuous improvement culture	72
(incentives, schedules, site, size)		55. Accelerate operational readiness	82

57,86

55,66

27,66

Executive Oversight questions below)

24. Cost driven not schedule driven

25. Risk assessment before estimates