The start of something

October 10th, 2017

Innovation, Technology & Capabilities for Access
Agenda

• Introductions
• BrandSafway Info
• AWP/WFP Journey
• Our Approach
  - BrandNet, in-house tool
  - Challenges, current processes
  - Work Face Planning (WFP) / Adv. Work Pkg. (AWP)
  - Modeling / Laser scanning
  - Sample uses and illustrations
In-depth policies, systems and programs designed to engage the entire workforce in the delivery of safe work on all projects.

Field employee behavioral-based safety program, voluntary, incentivized, “Kaizen” method

Proactive ownership and accountability, focused on supervisor level, peer to peer, leader development tool...

Management by “Go See”, safety process and field observation based, requirement of all management

In-depth review of site’s safety management system and processes, multi-level

State-of-the-art web-based Learning Management System for compliance, regulatory, craft and career path training

Repeatable and effective as demonstrated by the improved performance of our international operations.
Integrated Service Offerings

Specialized Industrial Services

- System Scaffolds
- Inventory Mgmt.
- In-House Engineering
- Labor
- Industry leading design & planning software
- Rope Access

- Asbestos
- Lead
- Licensed
- Certified
- Containments

- Shop and Field
- Brick, Castable, Pumped
- API 936 Certified
- Asset Management
- FCCU Leaders

- Hot Tapping
- Line Isolation / Stops
- Stud Removal / Disintegration
- LDAR
- Composites
- Bolting / Torqueing
- Field Machining
- Heat Treating

- Cementitious
- Intumescent
- Specialty Equipment
- Vendor Certified
- CUF Programs

- Coatings
- Access
- Insulation
- Linings
- API
- Automated Surface Prep.
- Documentation

- Engineering
- Design
- Installation
- Testing
- Monitoring

- Capital project focused
- Encapsulation/shelters
- Civil / Earthwork
- Concrete: foundations, structures
- Restoration

Programs

- 3E Energy Appraisals
- Thermography Studies
- Insulation Optimization & Maintenance
- CUI Support & Development

- Surveys
- Programs
- Coatings Lifecycle Optimization
- Corrosion Management Programs & Approaches

- Vertical & Horizontal Formwork
- Alum & Steel Shoring
- Custom Engineering
- On-Site Technical Direction
- Pre-Assembly

Infrastructure Services

- Forming / Shoring

- Vertical & Horizontal Formwork
- Alum & Steel Shoring
- Custom Engineering
- On-Site Technical Direction
- Pre-Assembly

Broader Suite of Specialized Industrial Services
What were doing...

Some Key Items

- Primary focus, Energy & Industrial
- Applications in Refining, Chemical, Power and more....
- Scaffold budget issues (2X, 3X) that we can help solve....
- Using BrandNet, 3d Models, Laser Scanning to apply AWP/WFP concepts
- 3 Key Areas:
  - Identifying strategy constructability improvements
  - Integrated planning opportunities, reducing modifications, rebuilds
  - Construction Management opportunities to pre-kit, better plans, improve performance directly
- Reducing overall hour spends, improving access users performance directly and indirectly
Let’s Do Something Together

AWP/WFP Journey
Challenges, issues, approaches
Work to Date on AWP/WFP

Some Key Items

- COAA, AWP/WFP Conference, Committee Work...couple of decades now...
- Behind the scenes, learning the leading software packages, systems, making sure we can integrate...
- Internal training, resource development...
- Software, hardware, development...
- Pursuing clients to engage us in the process, learning, teaching others...
Overview

- Challenges for a soft craft provider are many trying to work in the AWP environment....
- Requires substantial investments: systems; people; learning curve; etc..
- Variability in application of AWP approaches project to project, client to client...
- Investment direction hard to determine...
- Most clients and EPCs are still early in the maturity model of adoption of AWP, even WFP....focus is on metal crafts, not others...
## AWP Model

### Discipline Budget/Plan

<table>
<thead>
<tr>
<th>Craft</th>
<th>Hours</th>
<th>% Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piping</td>
<td>575,000</td>
<td>36.1%</td>
</tr>
<tr>
<td>Electrical</td>
<td>225,000</td>
<td>14.1%</td>
</tr>
<tr>
<td>Equipment</td>
<td>100,000</td>
<td></td>
</tr>
<tr>
<td>Structural</td>
<td>150,000</td>
<td>9.4%</td>
</tr>
<tr>
<td>Insulation / EHT</td>
<td>100,000</td>
<td></td>
</tr>
<tr>
<td>Scaffold</td>
<td>242,500</td>
<td></td>
</tr>
<tr>
<td>Fireproofing</td>
<td>100,000</td>
<td></td>
</tr>
<tr>
<td>All Other</td>
<td>100,000</td>
<td></td>
</tr>
</tbody>
</table>

**Target Hours** 1,592,500 100.0%

- % Aligned with Company's AWP Systems, Processes, Tools: 59.7%
- % Other: 40.3%

Positioning to facilitate our client’s ability to AWP/WFP more services

Some projects experience Scaffold DFL% >30%
IWP

1. Cover page
2. Table of contents
3. Sign off sheets – review and completion
4. Constraint list & verification of constraint mitigation
5. WorkFace Planner’s report:
   • Scope
   • Interdependencies
   • Task list (detailed)
   • Resource requirements
   • Man hour allocation
   • Specialty tool requirements form
   • Equipment requirements form
   • Scaffold request form
   • Bill of Materials
6. QC documents and requirements
7. HSE requirements and documentation

Scaffold is a constraint.....but required in most scopes
High level overview, today’s topic

AWP/WFP leveraging BrandNet, Models, 3d Scans

BrandNet

3d Model Integration

Laser Scanning

Work Packages

Access Optimization

Virtual Planning
Let’s Do Something Together

BrandNet
Program Basics
Scaffold Design

- Supports numerous systems, flexible
- Designs with simple parameter inputs, 2d/3d outputs
- Accommodates any configuration, design/change...deck levels, guardrails, ladders, toe-boards, cages at various heights

Estimation / Planning / Model Integration

- Detailed Material and Labor costing estimates at project and scaffold Level, work packaging
- Tie designs to budgets, same system (labor and materials)
- Standalone planning capability or integrate with Primavera
- Integrated offering with Smart3D™ & Navisworks FEED and Execution opportunities

Materials Management Support

- Materials management tied to designs, budgets and plans.
- Material forecasting, based on FEED, validated through execution, control, time phased...
Core Areas

- Customer (Basic info.)
- Project (CWA’s, WBS, Hierarchy)
- Project Resources (Classifications, Rates, Equip.)
- Defaults for build practices, rate schedules, etc.
- Designs, enter basic data
  - 2D
  - 3D
  - Simple
  - Complex
- Reporting customization, package reports
  - Data
  - Drawings
  - Work Packaging
- Planning
Let’s Do Something Together

Access Optimization
BrandNet, Laser Scanning, Managed Access Program
Access Cost Drivers / Issues

- Access Provider Can’t Overcome Alone
- Access Costs Rising
- Multiple Scaffolds, Excessive Modifications
- Multiple Disciplines, Multiple Plans
- Access Plan and Request Processes
- Craft Discipline Accountability
- Historical Basis Baseline (% of DFL)
Earlier / Improved Engagement

Typical Subcontractor Engagement Timeline - Capital

- Feasibility
  - Concept
    - Mature
    - Early
  - Strategy / Constructability
    - 5%-10%
    - Mature
    - Early

- FEED
  - Workface Planning Approach
    - 10%-20%

- Contract
  - Construction Mgt. / Execution
    - 5%-10%
  - Award
    - Mature
    - Strategy

- Field
  - Plan
    - Work
  - Work

Earlier engagement versus current approach

Our Solution, using technology and capabilities, 3 Key Areas we impact

- Strategy / Constructability
- Workface Planning Approach
- Construction Mgt. / Execution
Access Optimization Process

Typical Process

• Documented process for developing a robust project baseline for access
• From initial strategy review, to scope documentation, work package creation and review, to plan approval
• Leverage 3d models to interface with key project stakeholders
• Carry process and results into execution
Workface Planning/ Work Packaging

Translated, What We’re Doing

• Strategy / Constructability
  • Better or innovative ways to accomplish
  • Improve Safety, Quality, Productivity
  • Reduce hours, # of Access required

• WFP/Planning
  • Align access users needs at workface
  • Reduce modifications, re-builds
  • Reduce waste/stand-by, improve user’s productivity

• Construction Mgt. / Execution
  • Visual work package
  • Reduce waste, crew stand-by
  • Allow for planning prior to workface
  • Pre-kit materials
  • Improve safety, quality, & productivity
Detailed Scope Id. / Capture

Identifying and Optimizing the Access Example

- Typical access by access process
- Identify areas where multiple scaffolds can be combined
- Areas where small scaffolds can be customized to meet multiple user needs
- Access that can be re-sized to meet multiple users needs

**Typical Activity by Activity**

<table>
<thead>
<tr>
<th>Item</th>
<th>%</th>
<th>Hrs</th>
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<tbody>
<tr>
<td>Tool Time</td>
<td>50%</td>
<td>75</td>
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</tr>
<tr>
<td>Travel</td>
<td>10%</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Logistics</td>
<td>20%</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td>10%</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>All Other</td>
<td>10%</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Total Time</td>
<td>100%</td>
<td>150</td>
<td></td>
</tr>
</tbody>
</table>

**WFP Approach**

<table>
<thead>
<tr>
<th>Item</th>
<th>%</th>
<th>Hrs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool Time</td>
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<td>67.5</td>
<td></td>
</tr>
<tr>
<td>Travel</td>
<td>5%</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>Logistics</td>
<td>10%</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td>5%</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>All Other</td>
<td>5%</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>Total Time</td>
<td>100%</td>
<td>90</td>
<td></td>
</tr>
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</table>
Workface Planning, MAP Approach

Leveraging Planning/Execution

• Productivity versus historical baseline
• Cost of that productivity in terms of crew rate / crew mix
• Quality/Waste Metric in terms of Scaffold Modifications, illustrating implementation of weekly workface planning...

As-Is Process

WFP Process

Productivity

Cost of Productivity

Quality

Productivity Index WTD / JTD (E/A Hrs)

Labor Rate WTD / JTD
Integration Samples – 3d Models

Baseline Planning for AFE, Budget, Control
Access Optimization Process

Baseline Planning – Case Study

• New unit build, early FEED
• Reviewed current model, current scopes with key construction and engineering stakeholders
• AFE was supported by process, ultimate RFQ for this service as well
• Known scopes clearly documented, process for contingencies

Work Pkg. Cover

Materials Data

Drawings

Detail Views
Integration Samples – 3d Models

Baseline Planning for AFE, Budget, Control
Scope Import, Design, Plan, Pre-kit

1. Field Scoping Process
   - Align with Import Format

2. Leverage BrandNet Import Process
   - Imported Scopes, Review, Adjust as required for specific variables

3. Quick Design multiple scaffolds, 100+ at a time

4. Reports and Package
   - Distribute, schedule

5. Pre-kit, 1st job of day, more
   - Improve tool-time

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BRAND SAFFWAY
BRAND INDUSTRIAL SERVICES
Integrated Mapping, Visualization

GPS / Map Views

- Key georeferenced visualizations to support project teams:
  - Planning
  - Material Logistics
  - Work Packaging
- Use geo-referencing to identify:
  - General layout
  - Access by status (Scoped, Planned, Estimated, Built, Dismantle, etc.)
- Entry via scaffold design or as import
Laser Scanning Basics

Broad Variety and Access to Data

Scanner

Field

Model, System Data

- Calculate X, Y & Z for each Point.
- Captures 1 Million Pts. per second
- 3 Minutes per scan (round)
- Scan typical unit in 3 Days (size, density, purpose).
- Up 180 meters in Range.
- +/- 2 mm Precision
- Tied to real geographical coordinates
- Data is neutral, manage with a variety of software options

Dedicated team for survey, capture, processing and making project centric
Laser Scanning – The Point Cloud

Scan Locations
Laser Scanning – 2d Pano. Images

Visuals:
- Safety
- Planning
- Productivity
- More....

Bubble View:
- 2.5D
- 3D Data

Uses:
- Virtual Planning
- Measure
- Volumes
- Mark-up/Meta Data
Critical Scope Planning – Case Study

TA Critical Path Scope

- Critical Mechanical scope for Exchanger rebuilds
- Laser scanned small exchanger unit, provided CAD overlay for initial GC meetings on event
- Additional overlays as required
- Scaffolds designed, budgeted, sequenced/scheduled
- Visual work packages for GC review, modify as required
- Reduce costly delays, leverage design overlays for reverse engineering, critical clearances, work packaging and more.
Laser Scanning – 2d Pano. w/Geometry

TA Project:
• 2D Image
• 3D Geometry
• Scaffold
Critical Scope Planning – Case Study

Critical Path Scope

- Critical Mechanical scope for Exchanger rebuilds
- Laser scanned small exchanger unit, provided CAD overlay for client’s initial GC meetings on event
- 2D panoramic images with 3D data associated.
- Visual work packages, create annotations and information for our teams and others
- Applications: TA’s, CUI, general safety, general facility layout, planning and more

[Image of industrial facility with annotations]
### Path Forward

**Enhanced Scoping Process**
- Leverage intrinsically safe device to capture scope parameters, Spatial info, image, sketches, notes

### Summary Data

<table>
<thead>
<tr>
<th>Task ID</th>
<th>Description</th>
<th>Material</th>
<th>ScaffoldType</th>
</tr>
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<tbody>
<tr>
<td>05EI0005.1000</td>
<td>Access for J-box, coupling guard, and coupling. (05M-041) north west.</td>
<td>TOPPER</td>
<td>Rectangular</td>
</tr>
<tr>
<td>05EI0008.1000</td>
<td>Access J-box, coupling guard, coupling (.05M-040) north west #5 topper south side of the motor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14CC0027.1000</td>
<td>Access 6” check valve north end U-14. By DMV-316A.</td>
<td></td>
<td>Rectangular</td>
</tr>
<tr>
<td>14CC0028.1000</td>
<td>Access 16” check valve on top wet gas FCCU compressor.</td>
<td></td>
<td>Rectangular</td>
</tr>
<tr>
<td>14EX0662.1000</td>
<td>Blind point west side E-662</td>
<td></td>
<td>Rectangular</td>
</tr>
<tr>
<td>14TR0252.1010</td>
<td>Blind point 10” nozzle west side 65’ up</td>
<td></td>
<td>Rectangular</td>
</tr>
<tr>
<td>14VS0120.1000</td>
<td>Blind point 16” nozzle north east</td>
<td></td>
<td>Rectangular</td>
</tr>
<tr>
<td>14VS.1000-B</td>
<td>Blind point 8” nozzle north side</td>
<td></td>
<td>Rectangular</td>
</tr>
<tr>
<td>10VS0330.1000</td>
<td>Blind point east side 6” nozzle</td>
<td></td>
<td>Rectangular</td>
</tr>
<tr>
<td>10VS0330.1010</td>
<td>Blind point bottom V-330</td>
<td></td>
<td>Rectangular</td>
</tr>
<tr>
<td>23</td>
<td>Add on 2” side bracket for ladder access 1/2. Way</td>
<td></td>
<td>Rectangular</td>
</tr>
<tr>
<td>29.3741960171884</td>
<td>Hot equipment</td>
<td></td>
<td>Rectangular</td>
</tr>
<tr>
<td>29.3741064146435</td>
<td>Difficult factor. B</td>
<td></td>
<td>Rectangular</td>
</tr>
<tr>
<td>29.3740304746007</td>
<td>Difficult factor. A (.wood boards required)</td>
<td></td>
<td>Rectangular</td>
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<td>Difficult factor. (.wood boards required)</td>
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<td>Rectangular</td>
</tr>
</tbody>
</table>

### All Data Exported (.csv, pics, sketches)

![Image of Scope Package](image-url)

### Scope Package - sample

**Enhanced Scoping Process**
- Leverage intrinsically safe device to capture scope parameters, Spatial info, image, sketches, notes

**Path Forward**

- Field
- Tablet Data Capture
- Login
- Dashboard
- Project
- Summary Data

**Scope Package (e)**

**All Data Exported (.csv, pics, sketches)**
Work Package - sample

Location Data

Scaffold Data

Image

Sketch

Standalone or Enhanced Scope Development Process

Scaffold in Workface

Location in Plant

Material Data

Design Data

Enhanced Scope and aligned Work Package
Case Study – Critical Scope

From Concept to Field Execution

- Google map, Virtual Construction / WFP Approach, Field Execution

Client Request, Google Map

Laser Scanned, Initial Concept

WFP, Refined Concept

WFP, Layout/Impact

Challenge...

Critical TA Activities

Hoist/Lift to support tray work

Leg layout in unit area

WFP, Clash Detection Grating

WFP, Clash Detection Insulation/AA

WFP, Clash Detection Logistics/ Crane

WFP Scan, CAD, Work Pkg.
SoCal DCU Unit – Recent project
SoCal DCU Unit – Sample Work Pack

Cover Sheet

As-built Visual, Summary Data

Resources

Materials, Labor

Drawings

Construction Support
Alky Unit – Laser Scan / WFP

General Area

Point Cloud – Density View

Point Cloud - Topography

Point Cloud – Navis Review / WFP
SLC Alky Unit – Sample Work Packs

Work Pkg. 12

Work Pkg. 15
Photogrammetry, Lidar

Piloting – Use Cases

- Using as aerial survey, photogrammetry, LIDAR
- Photogrammetry is the use of photography in surveying and mapping to measure distances between objects.
- LIDAR – Light Detection and Ranging, fast....
- Software, hardware, use our technologies...
- GIS, Point Clouds, Imagery
- Range 3 miles, Alt.: 8000’, Payload: varies
BrandNet, Drones, Photogrammetry

Point Cloud, Mesh, Model from Drone

Scaffold Design, Integration (Navis)
Next steps...questions...

Future for our team…

- Making WFP the Norm, AWP capabilities…
- Continued use of Photogrammetry, LIDAR, Drones
- Adding additional services to the process, Insulation, Coatings and more

Questions, Follow-ups

- Questions
- Actions
- Information