

Southwest Calgary Ring Road:

How Owners/Engineers can use Agile, Technology, and Data
To Drive Progress, Mitigate Risk, & Deliver More with Less Resources



- **Project:** Southwest Calgary Ring Road 2016 - 2021
- **Scope:** 47 Bridges, 14 Interchanges, 31 km Highway, 2 River Realignments, Conveyance, Utilities, Wetlands,
- **Sector:** Public
- **Delivery:** P3 (DBFO),
- **Role:** Owner's Engineer Technical Advisor
- **Key Challenges:**
 - **Scale, Complexity, Risk**
 - **Transparency, Accountability**
 - **Disputes, Delays, and Claims**
 - Schedule critical
 - Highly public/political
 - Multiple workfronts 24/7
 - Multi-year + Staffing continuity (all parties)
 - Limited construction oversight resources

Solution & Technology Implementation Roadmap:

Problem-Fit, Solution-Fit, Business-Fit, Incremental Implementation, Continual Support & Improvement

1. Customer Digital Baseline, Gap Analysis, Technology Insights/Advice
2. Vendor Systems Assessment, Gaps/Opportunities, Recommendations
3. Data/Technology Roadmaps, strategies, guidelines, project specifications
4. Basic Solution Implementation
5. Enhanced Features & Project Customizations
6. New / Custom Solution Development
7. Software-as-a-Service
8. Work Instructions, Workshops, Pilot Project Administration
9. Develop & Administer Training / Feedback
10. Change Management & Implementation Through-Support
11. Program/Construction Data-quality Assessment/Auditing & Coaching

Starting here is a pitfall!

New Key Role:

Program/Construction Management
Solutions & Technology Lead

- Agile Practitioner
- Agile Product Owner
- Innovation Enablement
- Digital Transformation
- Knowledgeable of full project delivery workflow, job roles, and deliverables
- Knowledgeable of Solutions
- Understands the skills & needs to implement
- Relationships with Digital Market



What: Support the Job Functions & Deliverables of the Owner's Engineer
Provides: Information of Value from an Owners Risk/Needs Perspective
To: Drive Progress, Optimize Resources, Mitigate Risks, Reduce Impact of Claims

Used on SWCRR

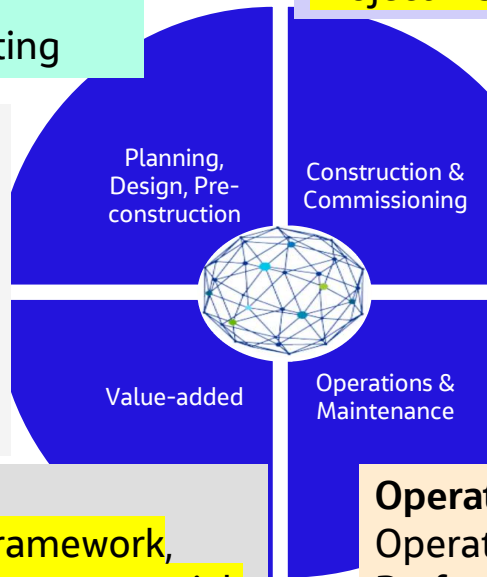
Site Assessment
 Asset Condition Reporting

Integrations*

AutoCAD, AutodeskBIM360, Sharepoint, Primavera, Field-wire, Gate3, Procore, Builterra, Bridgit, Prolog, e-builder, ProjectWise, Bluebeam, Machine Learning/AI

Over-arching

Customizable outputs, flexible framework, remote management, photo tours, geospatial visualizations, dashboards, automated deliverables, email notifications, Owner and contractor integration, ball-in-court



Coordination, Consistency, Timeliness, Accountability
 Daily Reports, Field Issue Tracker, RFI's, Submittals, NCR's, Project Risk/Issue Management, Compliance, Punchlist

Drive Progress & Accountability
 WBS Shadow Schedule/Observations, Progress forecasting, delay tracker, as-built schedule with issues/impacts overlay

Traffic Management
 lane closure request/approval/payment tracker, MS Outlook Calendar integration, traffic control plan management

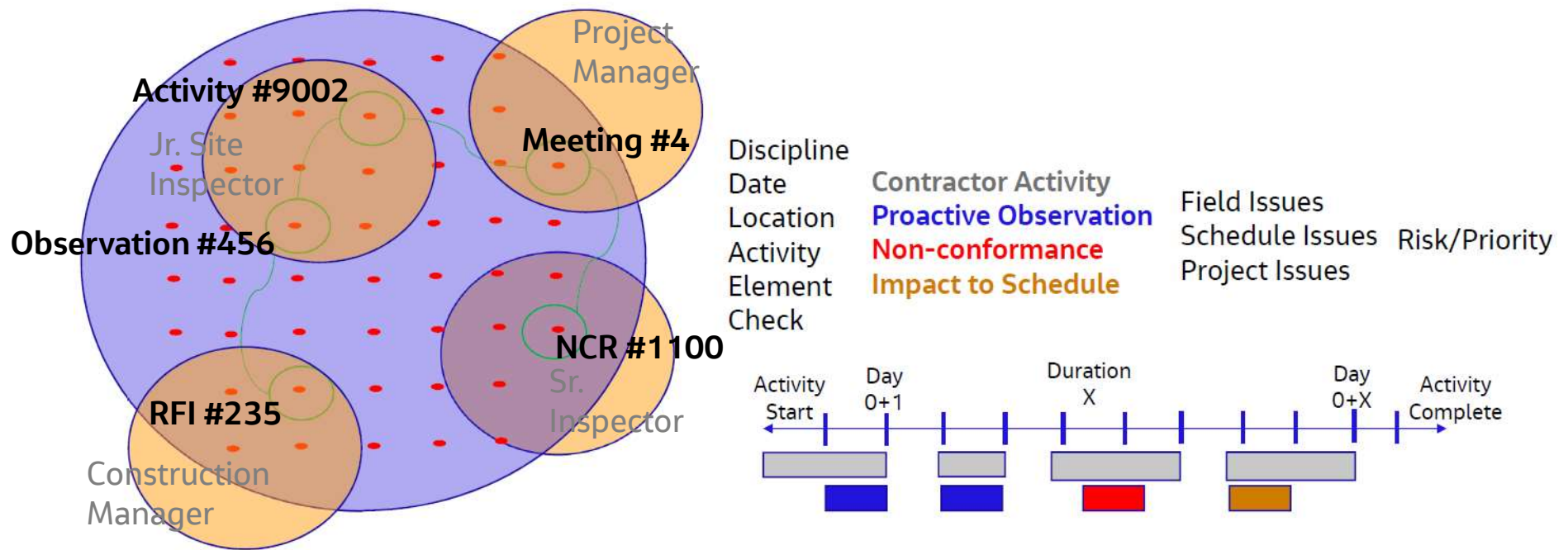
Operator Management
 Operations Contractor performance monitoring; Performance Audits; Variation Management; Integrated lane Closure Reporting; Maintenance Issue Notifications; Document Control; Payment Adjustments; Payment Management

Machine Learning Concepts (Clustering):

Connect complex information in a meaningful way

Higher probability of finding the information when you need it

Build a more complete story necessary to drive progress and accountability



Innovative Agile Approach to Construction Monitoring & Inspection: Data & Value driven, Probabilistic & Predictive Resource Optimization

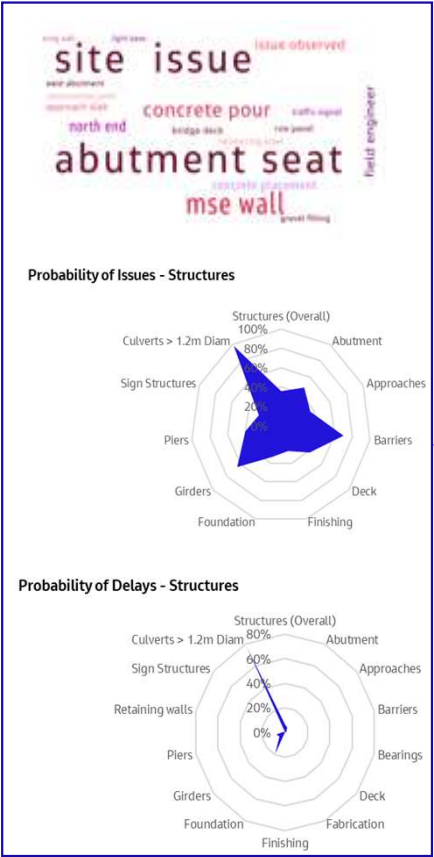
ORACLE®
PRIMAVERA

Analytics Lead

ICCON
INTEGRATED CONSTRUCTION COMMUNICATION NETWORK

Discipline
Date Contractor Activity Field Issues
Location Proactive Observation Schedule Issues Risk/Priority
Activity Non-conformance
Element Impact to Schedule Project Issues
Check

- > \$1.4B+ Construction Data
- >30,000 Photos
- >12,000 Activities
- >17,000 Issues



Prioritize Resources:

- New Upcoming Activities
- Critical Path
- Trending +/-
- Probability of Issues
- Probability of Delays
- Issues to look out for
- How were these resolved

The Right People, at the Right Place, at the Right Time

Earlier Detection & Timelier Resolution

Information of High Value based on Probability of Need

Centralized Knowledge On-Demand:

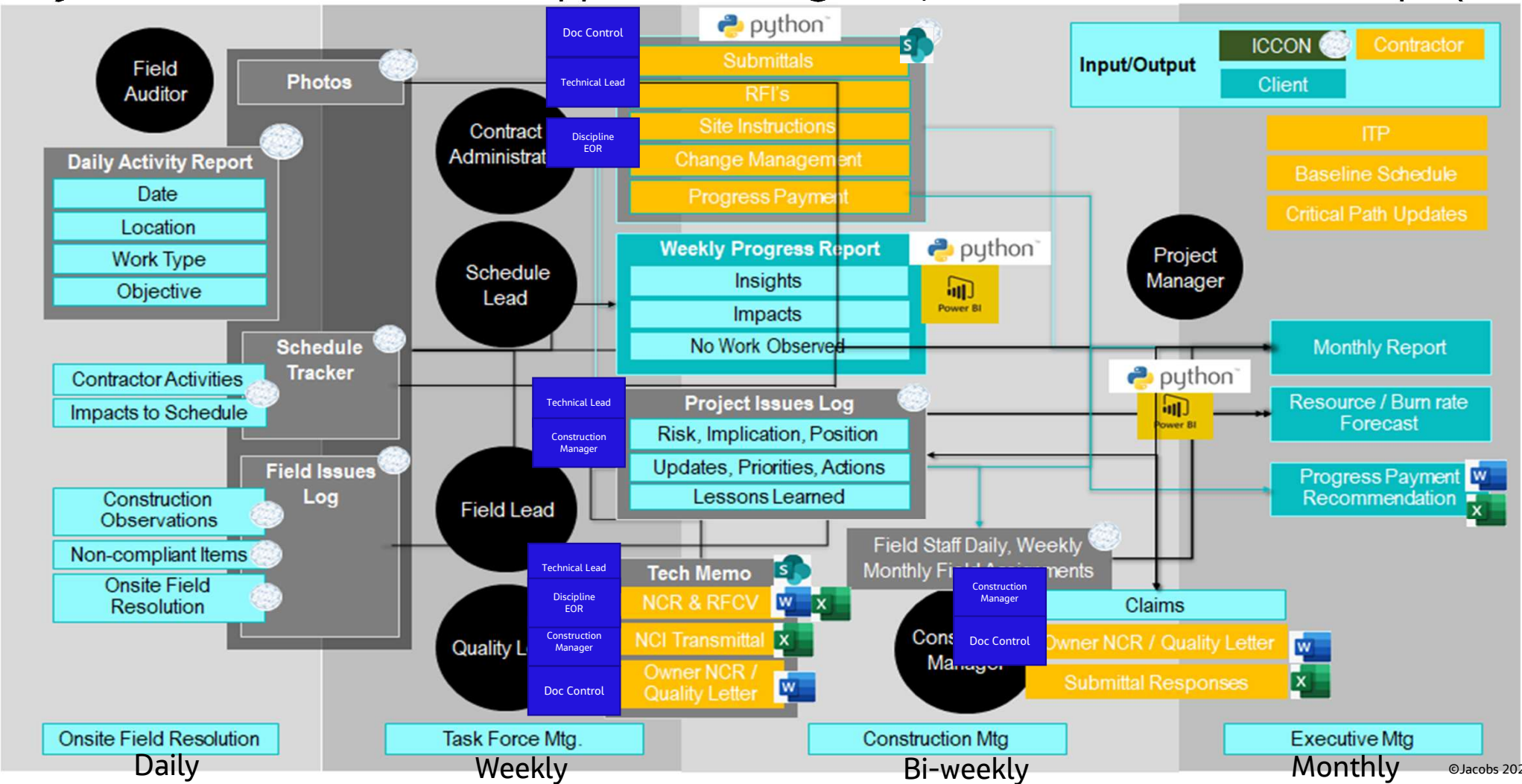
Understand what matters most, Improve consistency, Empower and accelerate the next-generation

Issue Description	Sub Location	Project Priority Level	Quality Risk	Clalm Risk	Impact to Schedule
Deck Joint Installation	Deck	High	High	Low	Possible
Quality Concerns Leading upto Deck Pour (Bearings, Shearblocks, Deck Thickness)	Deck	Low			No
Overall Deck Construction Concerns Resulting Low Deck Rebar Cover or Deck Thickness	Deck	High	High	Low	No
Anticipated Tolerance Noncompliance for Finger Plate Deck Joints	Deck	Low	High	Low	Possible
Haunch Repairs	Deck	Low	Medium	Low	No
Bridge Deck Post Placement Quality	Deck	Low	Low	Low	No
Bridge Deck Waterproofing	Deck	Low			No

Issue	Resolution	Lesson Learned - Future Mitigation
Finger joint nelson studs conflict with corbel reinforcing steel and backwall construction joint elevation	Reinforcing steel cut at select locations, backwall demolished down to elevation to suit	Lower backwall construction joint, reduce corbel congestion or allowance for % bar removals

End-in-mind Systems & Data Driven Process:

All job-roles and deliverables supported & integrated; all data collected serves a purpose



Conclusions:

- 1) Agile, technology, and construction data enables Owners/Engineers to avoid risk & deliver with less
- 2) Centralized data is key to accelerating growth of next generation

Predictive Risk Mitigation →
Direct Cost Savings = \$1.5 Million
(Avoided engineering costs)

Field Resource Optimization →
Direct Cost Savings = \$6.1 Million
(Fewer resources required)

Direct Time Saved = 5,625 hrs
(Reduced site trips, efficient reporting, recall,

Direct Value-add = \$ 690,000
(Reduced "zero-value" time, eg: searching for information, site travel, etc)

- **With 30%-50% Less Resources:**
 - 12500+ activities recorded
 - 9000+ progress impact hours recorded
 - 6000+ punch-list items recorded to resolution
 - 2200+ field-level issues recorded to resolution
 - 1000+ Issues Closed without need of NCR
 - 750+ impacts to schedule recorded
 - 150+ Project-level issues tracked & lessons learned collected
 - 70% issues resolved at field level by less experienced staff
- **Enabling Solutions:**
 - Jacobs S&T Advisor for Digital Construction Delivery
 - Jacobs ICCON Construction Data Environment
 - Agile/Dynamic ITP & Procedures
 - Mobil Devices
 - Integrations with Bluebeam & SharePoint
 - Real-time data collection & data driven insights
 - Geospatial visualization
 - Proactive/Predictive Risk Mitigation
 - Predictive Resource Optimization
 - Workflow & Deliverable Automations