Lower Churchill Hydroelectric Generation Project

At Muskrat Falls on the Lower Churchill River

Newfoundland and Labrador

Contract CH0007

Muskrat Falls Corporation/Astaldi Canada Inc.

Productivity Study – Phase 2

Assessment and Report

March 7, 2015

Dr. William Ibbs

The Ibbs Consulting Group

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EXECUTIVE SUMMARY

The Ibbs Consulting Group (IBBS) was asked by Muskrat Falls Corporation (MFC) and Astaldi Canada, Inc. (Astaldi), as joint stakeholders, to conduct a productivity study on the Lower Churchill Hydroelectric Generation Project at Muskrat Falls. The motivation for the study was very low craft productivity rates that have been achieved to-date on the project.

After reviewing the project, its documentation, and key managers, IBBS has developed a series of findings and recommendations that both MFC and Astaldi need to undertake:

1. Craft Labor Productivity
    a. Labor productivity is degraded on Muskrat Falls by is too much waiting time, too much rework, and not enough overall site coordination. See the table below for the statistics:

Productive?	Specific Category	Astaldi Current	Astaldi Target[1]
Productive	Direct	21%	51%
Productive	Prep	9%	9%
Productive	Tools & Equipment	1%	1%
Productive	Site inspection	2%	2%
Productive	Mat'l Handling	0%	6%
Unproductive	Waiting	29%	18%
Unproductive	Travel	6%	6%
Unproductive	Personal	2%	2%
Unproductive	Prolonged break	2%	0%
Unproductive	Rework/Poor planning	15%	3%
Unproductive	General site issue	10%	1%
Unproductive	Obstruction	2%	1%
	Total	100%	100%

    b. Productivity, at best, can probably be raised from 0.30 to 0.51 for the overall Project.
    c. Continue to collect and analyze craft labor productivity data.
    d. Even if productivity does improve, the project schedule is still at risk.

[1] "Astaldi Target" values are productivity data taken from project similar to the Lower Churchill Falls project that Ibbs Consulting has studied: $billion-plus powerplant projects in cold weather climates with union labor.

2. Project Management
    a. Create and use an Executive Dashboard.
    b. Start night shift immediately after end of day shift. This will save $8 million and 10 calendar days of schedule, by conservative estimate.
    c. Lengthen the "14 days on/ 7 days off" workforce rotation to a 20-on/10-off or 28-on/14-off schedule. The current 14/7 plan is disruptive to productivity.
3. Planning and Scheduling
    a. Use actual productivity data to build schedule durations and schedule logic.
    b. Thoroughly test the reasonableness of the number of workfaces that Astaldi plans to work during the summer months.
    c. Use Line of Balance scheduling technique to understand and improve work flow.
4. Design & Design Submittals
    a. Place a senior design authority onsite so that decisions and compromises can be made quicker and with fuller understanding of the underlying issues.
    b. Both Astaldi and MFC should prepare to add more engineers and investigate the possibility of reducing the number of required drawings and streamlining the required review time.
5. QC/QA and inspections:
    a. Track rework on the project: sources, areas, types of work, labor-hours. Reduce re-work.
    b. Speed Non Conformance Reviews (NCR).
    c. Sign off procedures take too long and holds up production, and the level of sign-off authority needs to "heightened".
6. Site layout & contractor coordination
    a. Realign haul road around maintenance shop and re-evaluate laydown areas.
7. Construction Equipment & Plant
    a. Dispose of wrong/ surplus equipment.
    b. Strengthen preventative maintenance program.
8. Procurement
    a. Implement and fine-tune the work flow that IBBS designed during its January site visit.
9. Field engineering
    a. Provide iPads or similar technology to field engineers.

b. Provide mentoring to the young field engineers.

10. Permanent power
    a. Remove the obstacles that are preventing Astaldi from moving off generator-supplied power and on to permanent construction power (e.g. the batch plant, power house and spillway). Over the past nine months there has been considerable waste in equipment rental costs, fuel costs and labor costs to set-up and maintain the generators.
11. Financial
    a. Investigate aging of accounts payable, resolve any problems.

IBBS has developed a scorecard (see below) to track the problems we have seen during our two site visits and our recommendations.

CH0007 - Project Critical Issues Scorecard					
Topic	Status as of			Score	
	December 2014 Visit	January 2015 Visit	Feb 17 2015 info	Astaldi	MFC
i. Craft labor direct loss of productivity	Severe issues existed. Project recognized issues and was moving to remedy issues.	Significant progress made toward craft labor productivity improvement. Many external blockers prevent such progress from yielding results.	We understand that most of the blockers still remain, thus preventing material productivity improvement.	Extreme Concern	Extreme Concern
ii. Project Management	New Astaldi PM team starting (Project Director, CMs, Procurement). Good enthusiasm	PM team has been intact for one month and conducted "reboot workshop". New equipment manager.	New personnel need to be supported by business process changes; e.g. faster procurement, more reliable scheduling and schedules.	Too Early	Too Early
iii. Planning and Scheduling	Severe and blocking deficiency. Project recognized severity of issue and committed to remedy.	No material progress. Issue still severe and blocking. Due to passage of precious time, issue is even more severe. Project no longer appears to acknowledge issue and mistakenly believes it is under control.	We understand that sentiment remains the same.	Extreme Concern	Extreme Concern
iv. Design and Design Submittal Issues	Unknown. Project did not think issues existed. No indication of proactive identification and resolution measures in place.	Evidence of some issues. Project did not acknowledge issues existed. No indication of proactive identification and resolution measures in place.	Additional evidence of issues. Recognition status unknown	Serious concern	Serious concern
v. QC/QA and inspections	Significant quality issue existed. Project severely under-resourced for QC/QA.	Marginal improvement in QC staffing. No indication of improvement of QA staffing. Common	Unknown	Serious concern	Serious concern

	Project aware of issue and committed to remedy.	complaint is that QC/QA is still severely under-resourced.			
vi. Site layout & contractor coordination	Significant site layout and coordination issues. Lack of properly detailed Integrated Master Schedule (IMS). Lack of detailed Master execution plan.	Same issues existed. No apparent progress. Project does not seem to acknowledge severity of issue and, as such, no detailed remediation plan is in effect.	Unknown	Concern	Concern when other contractors arrive.
vii. Construction Equipment & Plant	Severe and blocking issues. No structure for a real equipment department. Astaldi acknowledged issue and committed to remedy	Significant progress made toward remedying equipment department issues. Problem is still severe and blocking with many detrimental factors holding progress back. Astaldi acknowledged persistence of issue and committed to remedy	Unknown	Concern, but room for optimism	Concern
viii. Procurement	Severe and blocking issues. Astaldi acknowledged problem and committed to remedy.	Marginal progress was made. Problem remained severe and blocking. Astaldi acknowledged issues and accepted some workflow change suggestions.	We understand that changes are underway to streamline procurement processes	Improving	Concern
ix. Field engineering	Significant issues existed. Project aware of issues and committed to remedy.	Astaldi hired several young, enthusiastic field engineers. Tangible improvement.	Unknown	Improving	Improving
x. Permanent	Not investigated	Issue identified and	We understand that batch	Serious concern	Concern.

power		investigated. This is a severe and blocking issue. Astaldi is aware of issue and committed to remedy batch plant within 6 weeks (too long to start with), and the remainder of the project within the week.	plant permanent power is not currently contemplated due to excessive cost. Spillway permanent power is still a week away, and powerhouse permanent power is at least 3-4 weeks away.		
xi. Financial	Significant problems were emerging in progress payments to vendors and to Astaldi.	Parties acknowledged and committed to remedy.	Unknown	Serious concern	Concern
Overall	Many issues, some of which were critical blockers existed. Project acknowledged and committed to remedy.	3-4 weeks into the "reboot", project seems to have quickly lost its reboot momentum. Many of the same issues still existed and made worse through passage of time.	Exact extent unknown, but there are several issues that appear to indicate the continuing loss of momentum.	Extreme Concern	Extreme Concern

1 INTRODUCTION

The Lower Churchill Hydroelectric Generation Project consists of an intricate series of subprojects that deal with site preparation, dam construction, site remediation, and transmission lines. The contractor, Astaldi Canada has incurred very poor craft labor productivity on the project.

This study, which focuses on contract CH0007, includes the Intake & Powerhouse, Spillway and Transition Dams at Muskrat Falls. IBBS was asked by MFC Energy (the project owner) and Astaldi, as joint stakeholders, to conduct a productivity study aimed at evaluating current practices and providing recommendations for possible improvement.

IBBS concluded site visit for Phase 2 of the productivity study during January 2015, meeting with key Astaldi and MFC personnel and reviewing various information. This report memorializes our findings, offers recommendations, and recaps the actions already taken by both stakeholders based on our interaction with the project teams while on-site.

1.1 Purpose

As findings from the previous Phase 1 preliminary investigation phase indicated, craft labor productivity was significantly impacted on Muskrat Falls by multiple root causes that extended well beyond the direct causes readily identifiable with a simple time-motion study.

This Phase 2 focused on validation, detail investigation, analysis, and mitigation and risk reduction recommendations, of specific areas of concern with the highest potential of tangible improvements that have the potential of positively enhancing the project outcome.

1.2 Study Methodology

As a result from analysis of the earlier phase, IBBS set out to validate concerns and investigate the following:

- MFC's project management and controls processes,
- Astaldi's project management and controls processes,
- Astaldi's operations, and
- Astaldi's craft labor direct productivity.

Specific processes and operations that were further identified to cause the most impact and/or pose the most risk are:

1. Craft Labor Productivity
2. Project Management
3. Planning and Scheduling
4. Design and Design Submittals
5. QC/QA and inspections
6. Site layout & contractor coordination
7. Construction Equipment & Plant
8. Procurement
9. Field engineering
10. Permanent power
11. Financial

IBBS met and conducted work sessions with management, operation, and field personnel. IBBS also looked at procedures and processes. The IBBS team also conducted multiple tours of the project, attended meetings, and monitored full craft labor shifts for a variety of operations.

Where immediate feedback on issues was possible and actionable, it was communicated directly to management. That immediate feedback and other ideas developed after further reflection and review of the project data are contained in this report.

2 FINDINGS, RECOMMENDATIONS, ACTIONS TAKEN

2.1 Craft Labor Direct Loss of Productivity

2.1.1 Data Collection Methodology

As part of the project observation, IBBS collected actual detailed time-and-motion information from the field. The process involved a member from the IBBS team observing a number of crew members or a specific field task for a duration of time. It is important to note the following:

- The intent of the time-and-motion study was not to evaluate the work force. We were assured and assumed that the recent downsizing and hiring of many new staff in key positions provided a work force with the necessary skills and support to construct the project. Therefore, the focus of the study was instead on collecting the data to identify and ultimately address internal and external factors which may be negatively affecting field work.

- It is acknowledged that the field staff have undergone changes in personnel recently and is currently far below the anticipated warm weather head count.
- Noting issues and implementing positive changes is much easier to perform now on a smaller work force than it would be at a later date with a larger work force. With the field staff in a transition size, this is an optimal time to observe and collect data.

2.1.2 The Time-and-motion Study Template Form

IBBS utilized its own data collection procedure for this project (Appendix A). This procedure is now available to the Muskrat Falls project team to use in the future.

Each line entry on the form represents a single activity observed between a specified start and stop time. After collection of all activity observations for the day, each activity observed was evaluated to be productive, non-productive, or impacted. Each activity observed was also further classified into the categories such as direct work, travelling, and waiting. Through the collection of enough data points, general trends in the observed operations could be ascertained.

2.1.3 Actual Data

The data collected from field observations can be found on the time-and-motion study forms in Appendix B. A total of 400+ data points were collected. Categorizing the observations results in the following Figure 2.

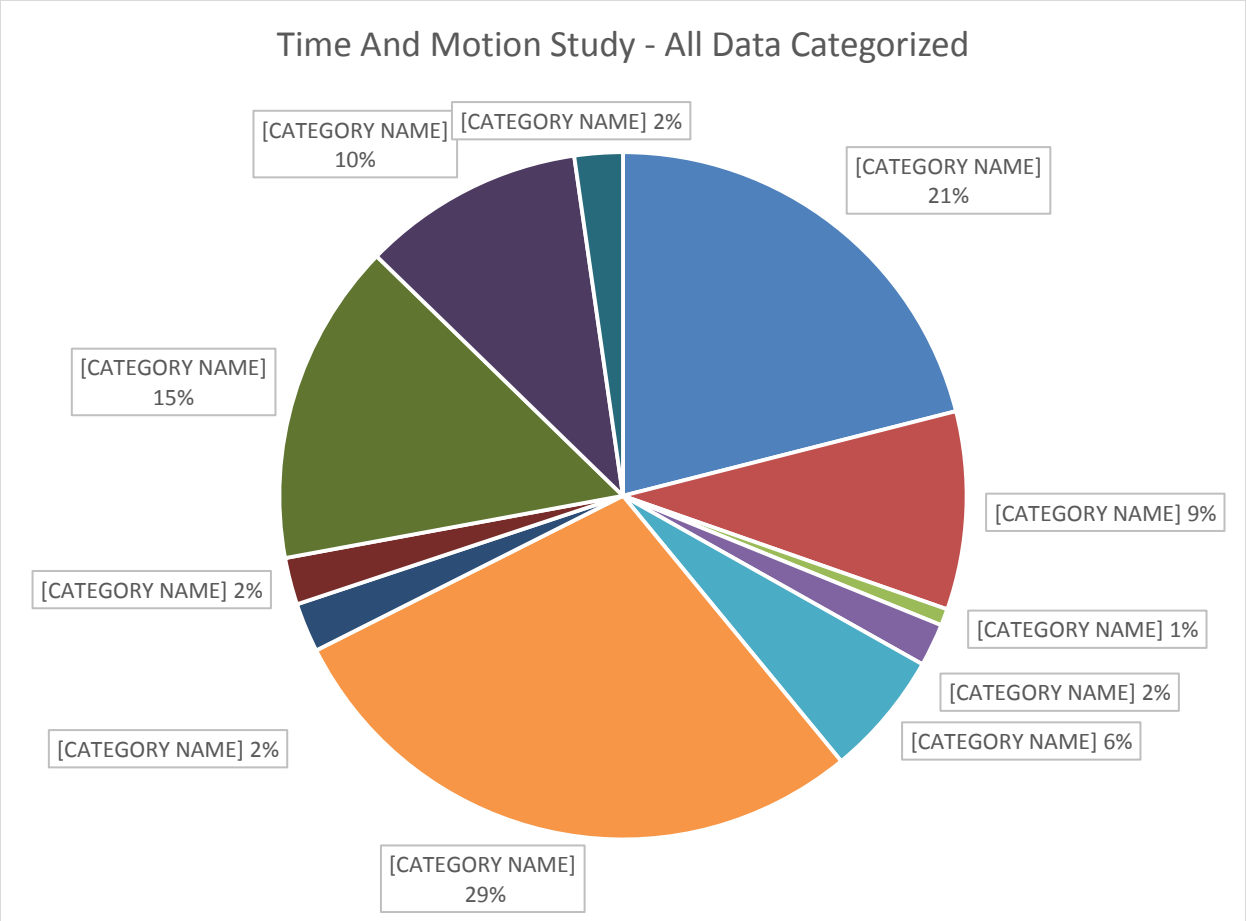


Figure 2: Astaldi's Current Situation on Muskrat Falls

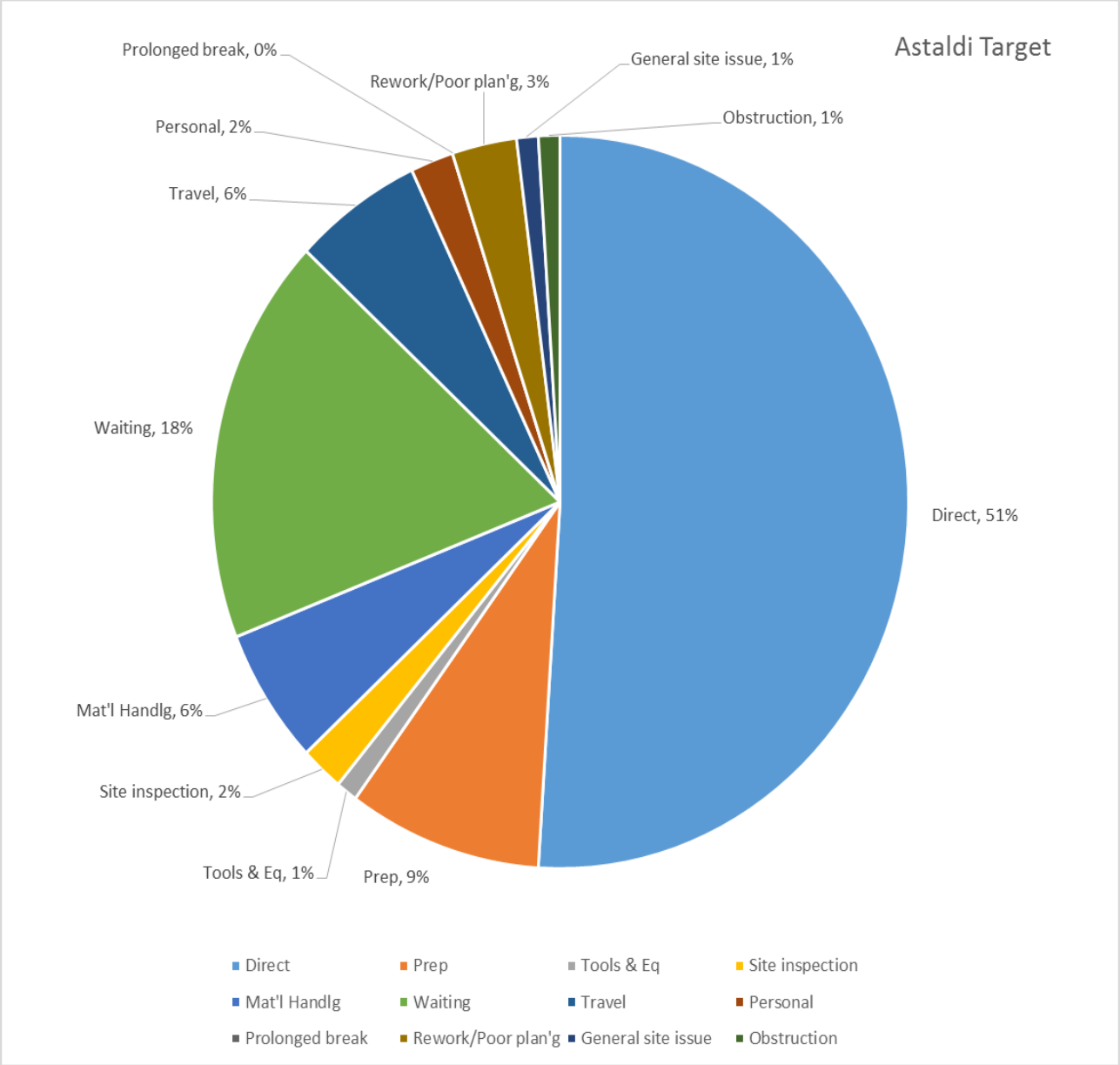


Figure 3: Astaldi Recommended Target

Figure 3 represents the historical average utilization of workforce time on projects IBBS has observed for other clients.

Table 1 summarizes this information in tabular form.

The numbers highlighted in red color indicate the areas of top concern, namely the Waiting time and the Rework. If these categories are improved, then the overall Direct Work category will improve.

Productive?	Specific Category	Astaldi Current	Astaldi Target
Productive	Direct	21%	51%
Productive	Prep	9%	9%
Productive	Tools & Equipment	1%	1%
Productive	Site inspection	2%	2%
Productive	Mat'l Handling	0%	6%
Unproductive	Waiting	29%	18%
Unproductive	Travel	6%	6%
Unproductive	Personal	2%	2%
Unproductive	Prolonged break	2%	0%
Unproductive	Rework/Poor planning	15%	3%
Unproductive	General site issue	10%	1%
Unproductive	Obstruction	2%	1%
	Total	100%	100%

Table 1: Astaldi Current vs. Target Work Time Allocation

Based on field observations, the following are recommendations which have been initially reviewed with field staff:

- Workers are spending too much time waiting – waiting for instructions, for crane lifting, for materials to be delivered to the site. Also included in this is using makeshift means and methods, materials (ripping 2 x 6's into 2 x4's), and makeshift tools.
- We saw extensive amount of time spent in the Rework & Poor Planning category which interfered with crew work flow and productivity. Astaldi needs to monitor rework via separate cost codes. It then should implement a feedback loop aimed at identifying people and causes for rework, and implementing corrective actions.
- Concrete pour operations were impacted by quality deficiencies (registered in the General Site Issue category) for several consecutive days. Utilization of a Failure Mode and Effects Analysis

(FMEA) for repetitive operations like the spillway pier processes would aid in mitigating risk and increase reliability.

- We observed that personnel are stopping work early on the night shift, and spending more time than necessary in the mud room. Astaldi needs to enforce that workers are to utilize all the shift time possible before heading to the mud room, and hold general foremen and foremen responsible if crews stop work earlier than required.

2.2 Project Management Issues

2.2.1 Executive Management Dashboard

Astaldi has developed and presented to MFC a one-page project management dashboard. That dashboard contains information that is useful to Astaldi and indirectly to MFC; e.g. weekly attendance, headcount. However, it does not convey to MFC the information MFC is most concerned about:

1. Will Astaldi meet the Spillway completion date?
2. Will Astaldi meet the "First Power" date?

IBBS recommended that Astaldi develop and provide a dashboard that would contain the following high-level information:

1. Production Schedule
    a. Schedule slippage halted/reversed
    b. Production rate accelerated
    c. Productivity increase
2. Subcontractor and Vendor Issues:
    a. Payment Status –reputation
    b. Reduce aging record of accounts payable
    c. Liens reduced/eliminated
3. Safety
    a. Incident rate improving – number of incidents decrease as well as severity.
4. Quality

a. NCR rate decreasing – NCR rate is going down and rework hours are decreasing.

5. Environment

   a. Incident rate improving – identify what are or is the key incident to be measured.

6. Responsiveness

   a. Weighted measure of process time for: Payment Certificates, Site Queries (RFIs), Correspondence, Change Request.

The information needs to be crisply presented, visual, and targeted to MFC's needs. An example of schedule information that would be meaningful to MFC is schedule slippage as measured against some key target dates, such as "spillway available." See Figure 1:

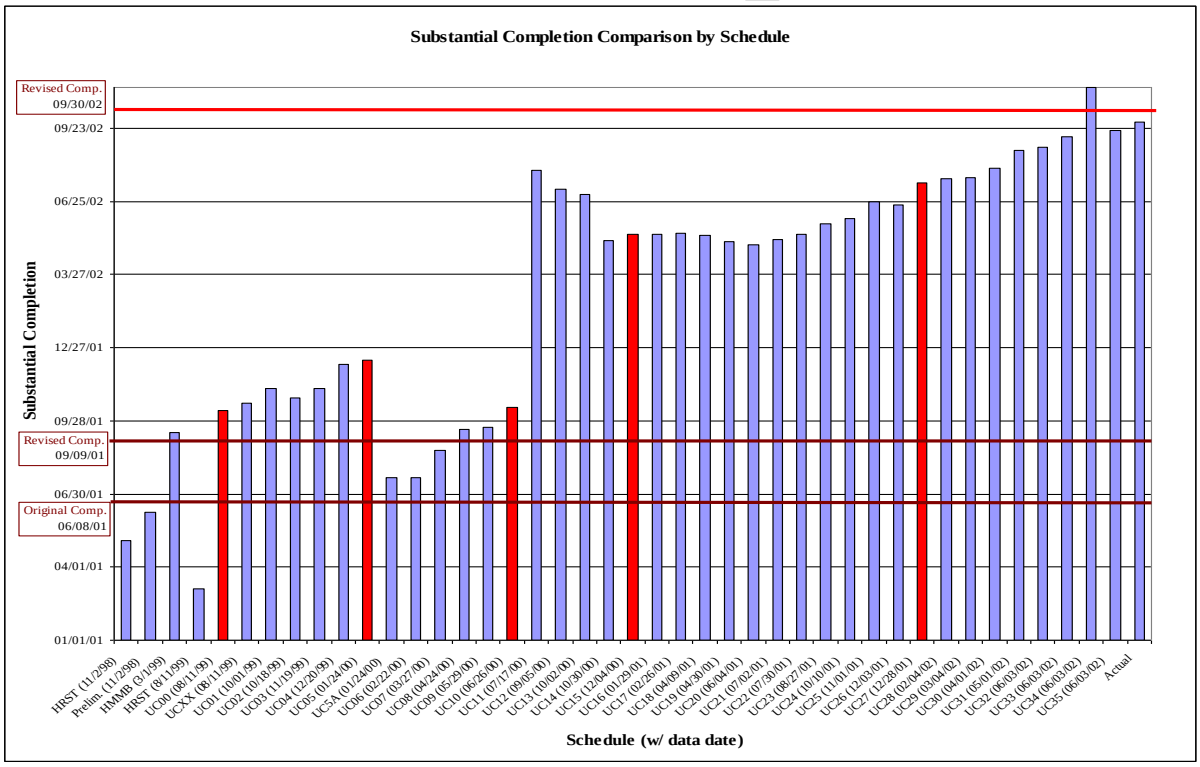


Figure 1: Example Dashboard Information – Slippage in Substantial Completion Date

2.2.2 Craft Labor Shifts and Rotation

Presently Astaldi is working two shifts, 7:00 am to 5:30 pm and 7:00 pm to 5:30 am. IBBS believes that the gap between the shifts should be changed. For example, 7:00 am to 5:30 pm and 5:30 pm to 4:00 am. This would have the advantages of:

- Reducing the number of bus trips per day;
- Providing a better hand-off between the end of the day shift and the start of the night shift;
- Reduce the amount of incidental, expensive overtime that the day shift is incurring;
- Provide more time for refueling, maintenance, etc.; and
- Allow the night shift to work in more daylight hours.

Our estimate is that this change would save Astaldi at least $8 million in direct costs and save at least 10 calendar days in the schedule.

There might be some disadvantages to this idea. One objection voiced is that there would be increased congestion at the brass alley, but that could be relieved by constructing another brass alley for a few thousand dollars.

Similarly, we recommend that the current 14 days-on/7 days-off rotation schedule be revised. Such frequent on-off cycles are damaging to labor productivity and lead to substantial travel expense. We recommend that at a minimum a 20/10 or possibly even a 28/14 day rotation cycle be implemented.

We believe that the advantages far outweigh the disadvantages, as shown in our quantitatively monetized analysis.

2.2.3 Organizational Issues

Between our December 2014 and January 2015 visits, Astaldi implemented a number of organizational changes; e.g. the hiring of area construction managers Bill Knox and Roy Collier, and a new equipment and plant manager. MFC, too, made some changes, particularly in the project controls area and onsite management.

It is too early to assess the impact of those changes, but we will continue to observe and support the companies and these individuals in our future work on the project. In the meantime we recommend

that each of the MFC and Astaldi's management monitor its organizational changes, and maintains it free from friction that would impact the teams' efficiency and effectiveness.

2.2.4 Meeting Room Whiteboards

Representatives from various departments gather twice a day to assess status and make necessary adjustments to ensure operations are continuing as required. The meetings occur in a large trailer conference room commonly known as the "War Room." Several large white boards have been placed around the conference room with each having been assigned to a certain department to display department information.

IBBS recommends (and has already made recommendations that have been adopted) regarding the information being displayed on those boards. The intent of the whiteboards to provide essential information from a designated department to all project participants is sound but in practice, many boards appear to contain copious amounts of information or information which may be considered more applicable for just the designated department of the board.

In general, many of the boards contain information which could benefit from:

- Condensing information;
- Using multiple colors;
- Improve the formatting; and
- Ensure the content is clear and important.

The intent would be for project personnel to review a board and have the essential information needed in a short period of time. Consider consolidating detailed information into a single white board "dashboard".

Due to the importance of the schedule, interaction occurred with the lead field engineer to modify the schedule whiteboard. Initially, the whiteboard displayed information in regards to when pours were anticipated to occur in noteworthy work areas. The anticipated pours were designated with an "X" in a box with most of the board left blank. Through collaboratively working with the lead field engineer, suggestions were made and the board display was modified within an hour to a new layout seen below. Figure 4 shows a photograph of the current, much-improved whiteboard.

Figure 4: White Board with IBBS Improvements

The important features of the new layout include:

- Multiple colors: The board utilized black, green, and red ink. The red is indicative of delayed operation and is easily identifiable by all who attend the meeting.
- Shading: The shaded areas represent days on the schedule prior to the data date whereas the unshaded boxes are activity days which have not yet occurred.

- Format: The new format displays the information on the anticipated duration of the series of tasks required to make a pour occur in a work area.
- Succinct: The purpose of the original board focused solely on the pour dates. While additional information could be added, the team did not try to modify the intent of the original board by added further detail such as durations of subtasks such as rebar, forming, curing, etc.

Further modification and improvement is possible but the intent was the emphasis of conciseness and ease of relevant information. Note that the day of the new schedule format resulted in a large number of meeting attendants congregating around the schedule board and providing positive feedback to the lead field engineer in regards to effectiveness.

2.3 Planning and Scheduling

The project has struggled, and continues to struggle, with planning of work, both short term and long term. IBBS believes that this project's planning and scheduling problems are inextricably intertwined with the project's loss of productivity. That is, the project's scheduling problems are both causing and resulting in poor productivity.

We firmly believe that there are still serious problems with CH007's project schedules (both the 120-day and the overall schedule), despite the "December-January reboot."

Accordingly, IBBS recommends that:

- the project immediately prioritize assignment of the necessary resources to develop a detailed end-to-end recovery schedule, with an immediate focus on the spillway and work to be completed in the 2015 optimum construction period.
- the obsolete resource loading currently required in the project schedule be bypassed in favor of a detailed linkage of the schedule to detailed forecasting that is maintained on a monthly basis. This will help maintain and produce the necessary accurate metrics for recovery progress monitoring and feedback.
- Astaldi and MFC should also use Line of Balance scheduling graphs so that work flow can be studied more accurately.

- Rescheduling of CH007 include MFC's project controls team so that it can incorporate the CH007 schedule changes into MFC's overall Integrated Master Schedule so that other components are properly coordinated.

2.4 Design and Design Submittal Issues

There are indications that design issues exist on the project. IBBS is concerned that both parties might be under-estimating such design issues, and the show-stopping effect they could have on the project. IBBS recommends that a proactive stance be taken to vet the design for early identification and resolution of issues. One specific step that should be taken is to place a senior design authority onsite so that decisions and compromises can be made quicker and with fuller understanding of the underlying issues.

Another issue of concern to us is the design review process. Namely, Astaldi has substantial schedule risk in terms of developing and processing detailed design information. There a consensus among project personnel somewhere between 25,000 and 30,000 engineering and shop drawings remain to be developed and submitted. Assume, for instance, that

- It requires an hour to develop each of the drawings (which may be light, but many of these drawings are repetitive or from template),
- There will only be one submittal cycle per drawing (no re-submittal), and
- the lower limit of the drawings of 25,000, and
- all drawings need to finish by February 2016.

Under these conditions we calculate that 12 full time engineers will be required to work exclusively on these drawing submittals. If the average is off by only a quarter hour, and the number of drawings is 30,000, then Astaldi would need 18 engineers instead of 12. Proportionately, MFC would need identical number of engineers to review, and another identical number of individuals (not sure if engineers) to process.

Based on interviews with the various personnel, there is concern that neither Astaldi nor MFC are prepared for such task. There was also concern about the quality of the submittals.

IBBS therefore recommends that both parties investigate the possibility of adding more engineers and streamlining the number of required drawings. These concepts were discussed with both parties and

received positive feedback. IBBS also recommends that MFC and Astaldi develop detailed resource plans and agree on a schedule for submittals and approvals.

2.5 QC/QA and Inspections

Both parties expressed deep concern that they are short-staffed for QC, QA, and inspections. Additionally, quality investigation confirmed the concerns. It takes time for new hires to ramp up and be productive. As the project ramps up, this function has the potential of hindering progress. IBBS recommends that Astaldi and MFC conduct a detailed assessment of their QC, QA, and inspection needs, and hire/train personnel immediately, so that they are ready for the anticipated steep power up in April.

We have the following observations and recommend changes in the following areas:

- Sign off procedures take too long and holds up production, and the level of sign-off authority needs to "heightened".
- Non Conformance Reviews (NCR) take too long and create a bottle neck in downstream processes.
- There is a lack of visible QA/QC metrics. More root cause analysis needs to be conducted, publicized and corrective actions taken.
- Rework costs and time have heretofore not been recorded. Going forward it is planned to capture and learn this data, and use it to reduce rework.

2.6 Site Layout and Contractor Coordination

Astaldi and its subcontractors are sprawled throughout the site. While the North Spur contract does not share access or laydown with this site, all the other contracts do. Upon investigation, IBBS found that significant planning and coordination effort is required. For instance, the maintenance shop layout and roads leading to it are congested and need to rationalized.

We are also concerned that MFC's overall Integrated Master Schedule (IMS) may not be incorporating all the delays and sequence changes occurring in the CH007 contract. We recommend that MFC review CH007 and the schedules of all components, and update its IMS as appropriate.

2.7 Equipment

Another concern on this project is the structure and processes of the plant and equipment department. The project currently suffers from a variety of equipment-related issues such as:

- Many pieces of the wrong equipment in operation,
- Many pieces of wrong equipment not in operation, but already consumed equipment budget,
- Severe lack of preventive maintenance,
- Insufficient, or lack of necessary maintenance equipment,
- Trouble procuring vital material and parts due to a difficult procurement process and credit worthiness situation,
- Poor equipment fueling practices causing equipment to run out of fuel and freeze up, which taxes the already insufficient department resources even more,
- Lack of winterized equipment washing area necessary for proper equipment maintenance,
- Insufficient winterized servicing and storage areas,
- Lack of appropriate warehouse and warehousing procedures,
- Lack of structured lube service,
- Ill-structured equipment rental and purchase agreements, and
- Equipment sitting idle in the equipment yard that will not be used on this project and could be sold to raise cash for the project.

Appendix C contains a very detailed list of recommendations.

2.8 Procurement

Many of the project departments are suffering from a complicated and lengthy procurement cycle; e.g. operations, equipment maintenance, accounting. While it is understandable that Astaldi needs to exercise appropriate controls to combat corruption, the existing process has caused and will continue to cause numerous delays and disruptions that are felt at all levels of construction. Streamlining the procurement process will translate into substantial productivity improvements across all department.

Appendix D details our observations and opportunities for improvement.

2.9 Field Engineering

As part of Phase 1 of this study, it was recommended that more field engineers be hired to support superintendents for materials ordering, pre-QC, and feedback purposes for planning & scheduling. As of the end of January 2015, multiple field engineers and a lead engineer have recently been added to the field staff. New staff members are eager and capable but it is noted that the majority of the new engineers are very early in their careers, with Muskrat Falls being their first hydroelectric power plant project. Based upon discussions with Astaldi, multiple additional field engineering positions have been identified for which candidates are still being interviewed. We recommend Astaldi focus on finding individuals with at least 3-5 years of experience on similar scale projects for remaining field engineering positions. An in-depth analysis can be found in Appendix E.

2.10 Permanent Power

When asked, MFC maintained that they had provided permanent power to Astaldi. Upon closer examination, we found that Astaldi is not to this date connected to permanent power with the exception of its main office complex and laydown area.. Apparently they have not satisfied MFC's requirements (electrical submittals and cure of some deficiencies) and is, as such, operating on generator power practically across the board. Concerns were also expressed during our interviews with electrical grounding issues at the project.

The batch plant, for instance, has been operating on generator power, and it appears will continue to do so for the foreseeable future. There does not appear to be any solid plan on how the new batch plant will bypass temporary generator power, and there are too many generators in the spillway work area. In addition to the fuel and equipment maintenance enormous expense and inefficiency, equipment, which is required to run 24/7 in order not to freeze up, is continually breaking down and causing delays and disruptions. This situation is also taxing an equipment department that has its own issues to start with.

Based on a count of the generators on site and the reported fuel consumption it is estimated that Astaldi is spending up to $1 million a month to provide construction power. The more serious issue is the lack of reliability of generator power and the multiple interruptions which have a direct impact on production. This should be a major concern with the batch plant if Astaldi expects to be able to maintain a level of production of up to 35,000 cubmic meters of concrete per month.

2.11 Financial

IBBS Consulting's initial investigation indicated there are many instances of slow payments to vendors and subcontractors. This affects the willingness of those vendors to cooperate with Astaldi, leading to slow deliveries, and delays and disruptions to the project flow in general, and to craft productivity in particular.

We did not have time to investigate this in detail, and recommend that this be investigated further in a future site visit.

3 SUMMARY

IBBS Consulting was retained to investigate the reasons for poor craft labor productivity on the Muskrat Falls project and to offer a series of recommendations. We have developed a series of such observations and recommendations based on two visits to the site, interviews with dozens of people, and review of project documentation. This report summarizes such.

The productivity on this project can be improved substantially by taking the steps we recommend. However, it is unlikely that the productivity can be improved to a point that meets original estimate. This means that the project schedule is in jeopardy, which of course has ramifications to the other components and to MFC's ability to meet its commercial commitments.

Since our February visit, Astaldi has rebooted its project schedules (120-day and overall). However recently-received weekly reports lead us to believe that the even the rebooted schedules are overly optimistic. We believe there still are serious problems with the work flow and the project schedule and we urge that we conduct a series of monthly follow-up visits to the project.

4 APPENDIX A: DATA COLLECTION FORM

Labor and Equipment Data Collection														
Client:	Muskrat Falls Corporation and Astaldi Canada Inc.													
Project:	Construction of Intake and Powerhouse Spillway and Transition Dams													
Contract #:	CH0007													
Project Location:	Lower reaches of the Churchill River approximately 35 km west of Happy Valley - Goose Bay													
Project LNTP:	24-Sep-13		**Project Scheduled Final Completion:**			29-Sep-18								
Date:			**Day:**			**Shift:**				**Data Set:**				
Temp:			**Weather:**											
Location:			**Location Condition:**											
Safety Issues:						**Obstructions:**								
Notes:										**Collected By:**				
Equipment:														

Area	Crew		Sample Observed			Equipment	Period	Start	Stop	Hours /Min.	Evaluation			Notes
	Type	Size	Craft	Level	#						Productive	Non-Productive	Impacted	

Labor and Equipment Data Collection (cont.)											Data Set:			
Area	Crew		Sample Observed			Equipment	Period	Start	Stop	Hours /Min.	Evaluation			Notes
	Type	Size	Craft	Level	#						Productive	Non-Productive	Impacted	

Key:

Data Set	Unique identification of the specific dataset collected
Location Condition	Observation of location organization, cleanliness, lighting, etc.
Crew Type	Ex: Forming, Erecting, etc…
Level	F/J/A
#	Number of persons in the recorded line item
Equipment	Type and model of equipment observed
Period	Startup, Pre-1st Break, 1st Break, 1st Break, After 1st Break, Lunch, After Lunch, etc…
Start	Start time
Stop	Stop Time
Evaluation:	
Productive	Direct Work, Prep Work, Tools/Equipment, Material Handling
Non-Productive	Waiting, Travel, Personal
Impacted	Obstructions, Safety, Poor Planning, etc.

5 APPENDIX B: COLLECTED DATA

Partial Sample of the spreadsheet:

Date	Area	Type	Size	Craft	Level	#	Equipment	Period	Start	Stop	Mins.	Productive	Non-Productive	Impacted	Category	Notes
150123	Break Room	Carpenter	5	Carpenter	JM	1	N/A	Startup	07:00	07:19	19	X			Preparation Work	Morning crew safety meeting
150123	Break Room	Carpenter	5	Carpenter	JM	1	N/A	Startup	07:19	07:23	4		X		Travel	Walk from trailer to work area
150123	Power House	Carpenter	5	Carpenter	JM	1	N/A	Pre-1st Break	07:23	07:30	7	X			Preparation Work	FLRA and general day prep
150123	Power House	Carpenter	5	Carpenter	JM	1	N/A	Pre-1st Break	07:30	08:04	34			X	General Site Issue	Added additional steps to scaffolding stairs to address irregular vertical distance between 1st tread and ground
150123	Power House	Carpenter	5	Carpenter	JM	1	N/A	Pre-1st Break	08:04	08:24	20			X	General Site Issue	Delineate load out zone of ongoing excavation operation occurring adjacent
150123	Power House	Carpenter	5	Carpenter	JM	1	N/A	Pre-1st Break	08:24	08:48	24	X			Direct Work	Prepping forms and form materials
150123	Power House	Carpenter	5	Carpenter	JM	1	N/A	Pre-1st Break	08:48	09:20	32			X	General Site Issue	Assist scaffolding crew
150123	Power House	Carpenter	5	Carpenter	JM	1	N/A	Pre-1st Break	09:20	09:23	3		X		Travel	Walk from work area to trailer
150123	Break Room	Carpenter	5	Carpenter	JM	1	N/A	1st Break	09:23	09:38	15	1ST BREAK			Break	Break Room
150123	Break Room	Carpenter	5	Carpenter	JM	1	N/A	Post 1st Break	09:38	09:48	10		X		Prolonged Break	Break beyond designated duration
150123	Break Room	Carpenter	5	Carpenter	JM	1	N/A	Post-1st Break	09:48	09:51	3		X		Travel	Walk from trailer to work area
150123	Power House	Carpenter	5	Carpenter	JM	1	N/A	Post-1st Break	09:51	10:05	14			X	Obstruction	Time spent clearing snow from 2x4's and plywood
150123	Power House	Carpenter	5	Carpenter	JM	1	N/A	Post-1st Break	10:05	10:58	53	X			Direct Work	Prepping forms and form materials
150123	PH Sump Area	Carpenter	5	Carpenter	JM	1	N/A	Post-1st Break	10:58	11:55	57			X	Rework/Poor Planning	A second unanticipated lower tarp determined as necessary due to height of intitial hoarding. Tarps being sowed for lower tarp placement.
150123	Power House	Carpenter	5	Carpenter	JM	1	N/A	Post-1st Break	11:55	11:58	3		X		Travel	Walk from work area to trailer
150123	Break Room	Carpenter	5	Carpenter	JM	1	N/A	Lunch	11:58	12:28	30	LUNCH				At Break Room
150123	Break Room	Carpenter	5	Carpenter	JM	1	N/A	Post Lunch	12:28	12:35	7		X		Prolonged Break	Break beyond designated duration
150123	Break Room	Carpenter	5	Carpenter	JM	1	N/A	Post Lunch	12:35	12:38	3		X		Travel	Walk from trailer to work area
150123	Power House	Carpenter	5	Carpenter	JM	1	N/A	Post Lunch	12:38	13:05	27			X	Rework/Poor Planning	Tarps being sowed for additional lower tarp placement.
150123	Power House	Carpenter	5	Carpenter	JM	1	N/A	Post Lunch	13:05	13:10	5			X	Rework/Poor Planning	Transport sowed tarps to work area
150123	PH Sump Area	Carpenter	5	Carpenter	JM	1	N/A	Post Lunch	13:10	13:16	6		X		Waiting	Await direction
150123	PH Sump Area	Carpenter	5	Carpenter	JM	1	N/A	Post Lunch	13:16	13:47	31	X			Direct Work	Prepping forms and form materials
150123	PH Sump Area	Carpenter	5	Carpenter	JM	1	N/A	Post Lunch	13:47	13:52	5		X		Personal	Personal conversations
150123	PH Sump Area	Carpenter	5	Carpenter	JM	1	N/A	Post Lunch	13:52	14:50	58				Direct Work	Prepping forms and form materials
150123	PH Sump Area	Carpenter	5	Carpenter	JM	1	N/A	Post Lunch	14:50	14:55	5		X		Travel	Walk to trailer; Access cut off so crews took a detour and walked up a hill to get to the trailers
150123	Break Room	Carpenter	5	Carpenter	JM	1	N/A	2nd Break	14:55	15:10	15	2ND BREAK				2nd Break
150123	Break Room	Carpenter	5	Carpenter	JM	1	N/A	Post 2nd Break	15:10	15:15	5		X		Prolonged Break	Extended break time
150123	Mud Room	Carpenter	5	Carpenter	JM	1	N/A	Post 2nd Break	15:15	17:05	110			X	General Site Issue	Setup heaters at mudrooms to enable crew to change in heated area; Clean mudrooms
150123	Mud Room	Carpenter	5	Carpenter	JM	1	N/A	Post 2nd Break	17:05	17:14	9	X			Preparation Work	Crew in mud rooms

6 APPENDIX C: EQUIPMENT OBSERVATIONS/OPPORTUNITIES

Equipment part and consumables ordering process requires a process that is too lengthy (9 days on average to process a material requisition and 14 days to actually process a purchase order).

- Current procedure (Note: following provides a rough sense of procedure but may vary slightly -some staff indicated a total of 9 signatures were required indicating further steps in addition to the following)
  - Part or consumable in need identified by mechanics
  - Purchase Requisition put together by equipment department staff
  - Signature required by equipment department superintendent
  - Signature required by plant and equipment manager
  - Warehouse staff places product code on purchase requisition (may potentially sign)
  - Purchase requisition signed/reviewed by project management staff
  - Project management signed/reviewed purchase requisition enables procurement department to find a competitive price. Price listed on requisition.
  - Purchase requisition signed/reviewed by project management staff (this time with price)
  - Procurement department is enabled to issue a PO/contract to purchase necessary items.
  - Contract execution
  - Product procurement by vendor and order fulfillment.
- Required items can take as much as 2 months to arrive for needed equipment (anticipated largely due to bottlenecks in the signature process.
- Regardless of required item price ($2.00 vs $2,000,000), the same procedure is required.
- Difficult to forecast equipment repair completion and tracking of ordered item as procurement department is in control of the item ordering and vendor coordination.
- Essential items are significantly delayed and impact ability to maintain fleet. Hydraulic oil on hand is not enough to perform required preventative maintenance (replace hydraulic fluids) on multiple pieces of equipment. Multiple pieces of

equipment have returned to service without hydraulic fluid being replaced as the whole stock of hydraulic fluid would be insufficient to replace the hydraulic needs for one of these machines.

    - Requisition for hydraulic oil placed in December 25 still has not yielded an order.

- Open PO's and Contracts
    - Currently there appears to be challenges in issuing open PO's/contracts. Many items could warrant an open PO/contract and would greatly reduce staff workload each time these items were required. Such examples include:
        - Tires
        - Glass & windshield repair
        - Air conditioning servicing
        - Hydraulic oil restocking
        - Hydraulic hoses
    - A previous staff member in a higher position managed to setup an oxygen acetylene & propane contract with great effort greatly aiding the welders which are a part of the equipment department. It appears possible to issue open PO's but no progress has been made on these regularly needed items despite efforts being made.
- Pre-operational inspection checklist submissions
    - Pre-operational checklists contain information in regards to equipment usage (hours), mileage, damage, and general information. The equipment department relies on the information to determine what equipment requires servicing.
    - There is a failure in consistently turning in pre-operational checklists resulting in incomplete information in the equipment database and a drain of equipment office and field staff resources in trying to obtain the information.
    - Consider making the submission of this mandatory and make the procedure of submission uniform for all employees.
- Equipment tracking
    - Astaldi previously developed an internal equipment tracking web-based interface called EAM (believed to stand for Equipment Asset Management). Astaldi provided access to Astaldi Canada for it to be used as it should integrate with other finance interfaces and automate the tracking process.

- Investigation required in regards to obstacles of EAM use:
  - General slow response time of EAM – inefficient when attempting to update equipment fleet's information every day.
- Equipment preventative maintenance is determined through manual spreadsheet input rather than automated system (like EAM).

- Failure to perform preventative maintenance
  - With reduced staff (3 mechanics, 1 mechanic apprentice, 1 laborer, 1 welder), department is unable to keep up with equipment needs. List of equipment requiring preventative maintenance and repairs continues to grow daily since reduction.
  - Every 250 hours (approx. 11 days), all equipment running 24 hours a day requires servicing which includes: light towers, generators, heaters, etc.). Current list of uncompleted preventative maintenance equipment items is anticipated to grow in the next couple weeks.
  - Jurisdiction of tower crane maintenance was in limbo (due to union involvement?) for much time. Crane appears to not have been serviced resulting in breakdown on 1/24/2015.
  - Motor vehicle buses semi-annual inspections occur in April and September. Preventative maintenance on buses did not occur on all buses (unclear whether an outside service or internal forces performing work).
- Equipment parts inventory
  - Review adequacy of existing inventory which may not adequately meet anticipated needs with upcoming work.
  - Develop automated system of reordering items for replenishment as taken as opposed to placing order when items are running out.
- Resource considerations
  - Mechanics currently appear to service all equipment with grease/lube. Investigate whether a dedicated lube man would be beneficial.
  - Mechanics currently complete a FLRA for every repair assignment whether in the shop or field and appear to rewrite very similar hazards and resolutions. Consider working with safety department to develop basic prefilled-out FLRA's which can be added to. Based on observations each FLRA took 5-7 minutes, was similar (or

identical), and it is anticipated FLRA's could take as much as an hour a day if numerous tasks are completed each day.

- Bulk oil tote & pump
  - Hydraulic oil currently arrives in buckets which is labor intensive. Attempts to install a hydraulic oil tote and pump would more efficiently service the large scale fleet and more easily be replenished by outside services. The department has been unable to make this change occur.

- Batch Plant
  - Batch Plant was not constructed as a drive through design and as such the time to fill is increased.
  - Lack of Batch Plant TPM (Total Preventative Maintenance) Program.
    - Equipment dirty.
    - Lack of lubrication schedule.
    - Lack of 5s.
    - Lack of maintenance daily check list.
    - Electrical issues with power generators running out of fuel on a regular basis.
    - Lack of permanent power.
  - Lack of detailed planning with second batch plant.
    - Second batch plant mirrors the first.
  - Ice house built incorrectly – Lack of insulation that allows the ice to stay consistent. Current process has the ice melting from the heat of the equipment which forms a very hard ice layer.
  - Crushing operation is producing too many fines and the crews are having to manipulate the loads in order to reach the proper fines per truck load.

7 APPENDIX D: PROCUREMENT & MATERIAL MANAGEMENT OBSERVATIONS/OPPORTUNITIES

- Four signatures are required by a requester to get PO Request (PR) entered into the system. A redundant 4 signatures (same signatures) are required after buyer completes PO Packet before the PO can be placed. Long signature wait time is not tracked on the last signing cycle. The first signing cycle averages 9 days with a range from 1-53. At the time we inspected the system, there were 68 "second signings" waiting in 2nd signature queue, 15 days is the avg. as of COB today current range =’s 4 – 49 days and still counting. The average dollar of these outstanding PO’s is $41K with one PO for $1.9M. With this PO removed the average amount per PO is $11.5K. 10 PO’s or 15% need 4 signatures, 39 PO’s or 58% need 3 signatures, and all 68 PO’s or 100% need 2 signatures.
- 90% of the Purchase Request are made by employees that have to drive 2 Kilometers from the job site to the main office to start the PR process. Plus, they have to make numerous trips to complete all PR signatures.
- 3 Quotes are required by requester to get PO Request entered into the system. A redundant 3 quotes are required from the Buyer in order to build the PO Packet.
- No-one in the procurement team is trained in the system "BAAN" – PO Request is handled manually, along with PO manipulation trigger points. A PO Log is kept manually in Excel. PO Request are scanned into the S-drive so the buyers can request quotes by email. Quotes are entered manually into a spreadsheet for comparison. Orders are entered into BAAN; however the hard copy is scanned, placed in S-drive waiting for the hard copy to receive its 4 signatures before the electronic copy can be emailed to the vendor as a way to place the order. There is no order confirmation received, just a delivered outlook message and an occasional email back from the vendor.
- Warehouse is using a paper system to track who is picking up what item. They use a manual list to know what is in stock. The paper that is created to memorialize the transaction goes to the office to be scanned into the system. They are backed up since December as they do not have a clerk to enter them.
- Delivery trucks with experienced drivers are waiting at the gate for a teamster to transport them on site. Today it was witnessed with the delivery of Lumber.

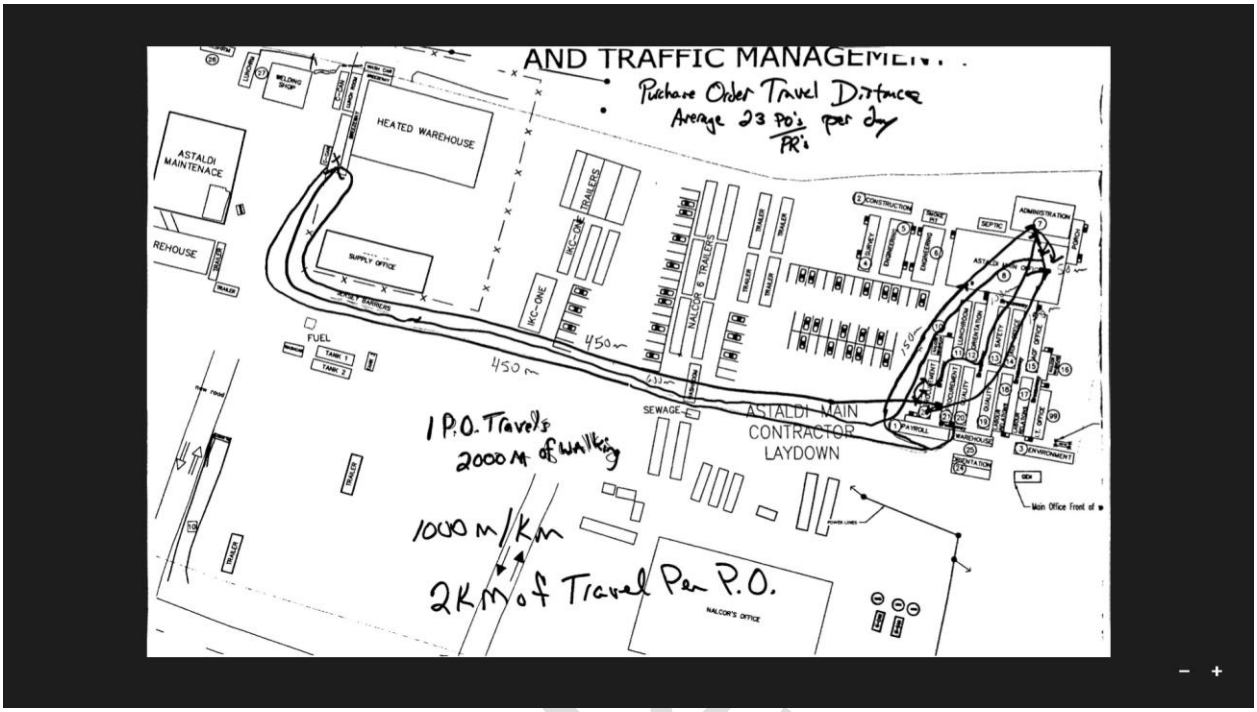
- Vendor's requesting payment for items more than 30 days old before they will ship items to the site (Finance tries to pay in 30-45 days). Acklands Grangers St. Johns – holding up safety equipment as an example.
- Vendors are only paid for complete PO's; there are no provisions for splitting PO's (Partials).
- No metrics on good vs. poor suppliers. No Metrics on OTD to projected material due dates. No metrics on 2nd signature time-to-sign.
- Lack of good PO Quote Process – Vendors shipping $600k+ worth of items on a RFQ not a PO. Astaldi warehouse picked up parts that were not ordered – Would cost a lot to return items (Est. said by Procurement is $60K) – a second event happened today as well. Rumor is the PR and PO numbers all start with 3 and look similar.
- Lack of communication between warehouse and procurement. Warehouse communication is manual.
- Warehouse has no clear way of tracking who picked up supplies. If they can't verify they can't close it out of the system and pay vendor
- Lack of total supply chain management nor do they have leadership. Silo'd
- Safety over reporting – heard that Policy states any unreported safety event (including first aid) is punishable by loss of job and escort from the site.
- Lack of site planning for what materials are needed and when (Project Scheduling) – Everything is urgent (another contributor could be lack of supply chain turnaround time)
- $9-10M in equipment that is unusable for its intended purpose. Sitting un-maintained and unprotected in the weather.

Contributed Improvements from IBBS Efforts

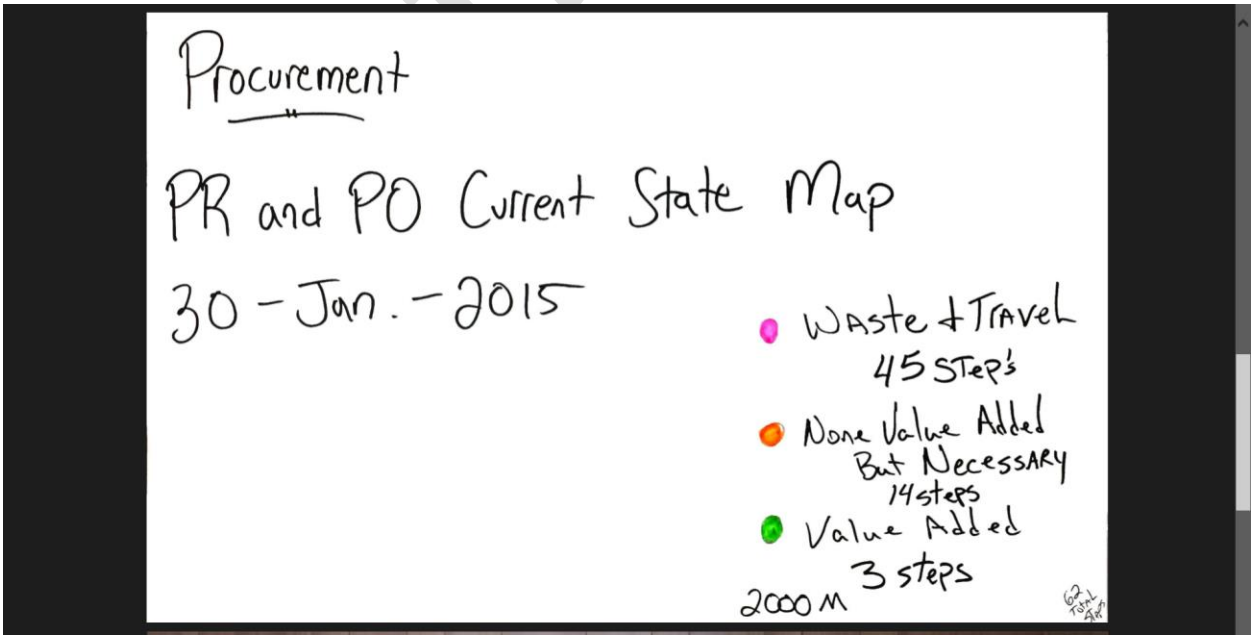
- Reduce the travel time for a PO from 2 KM per PO to 309 m or an 85% improvement. Through implementing an electronic Purchase Request (PR). Along with other improvements. These actions can be implemented by Close of Business (COB) on Tuesday. This 85% reduction of travel time used on 10 trips a day (Average of 23 PO's per day) equates to $140K of man hours (Based on a burdened rate of $45/hour; however some of this travel is completed by Superintendents and General Forman).
- Reduce 100% the travel time of the field personnel requesting PR's by changing the system to 100% electronic.

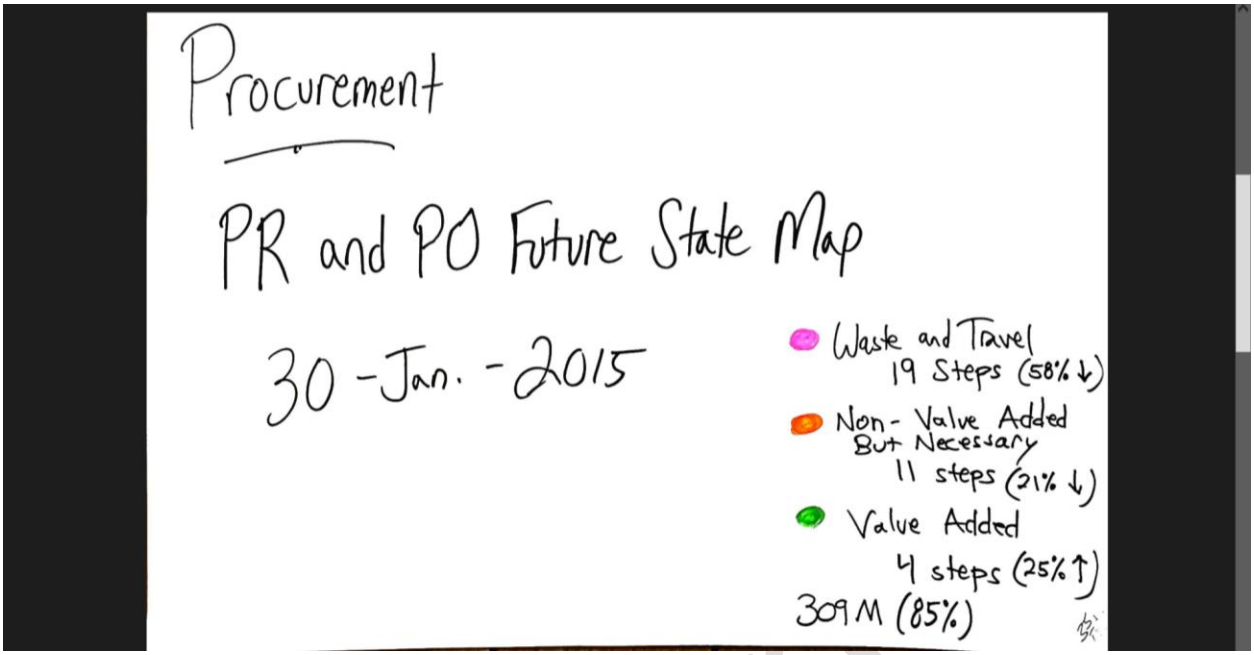
- Reduce process time for PO's to be placed with vendors after request is started from any average of 20 days (as high as 55+ days) to an average of less than 5 days.

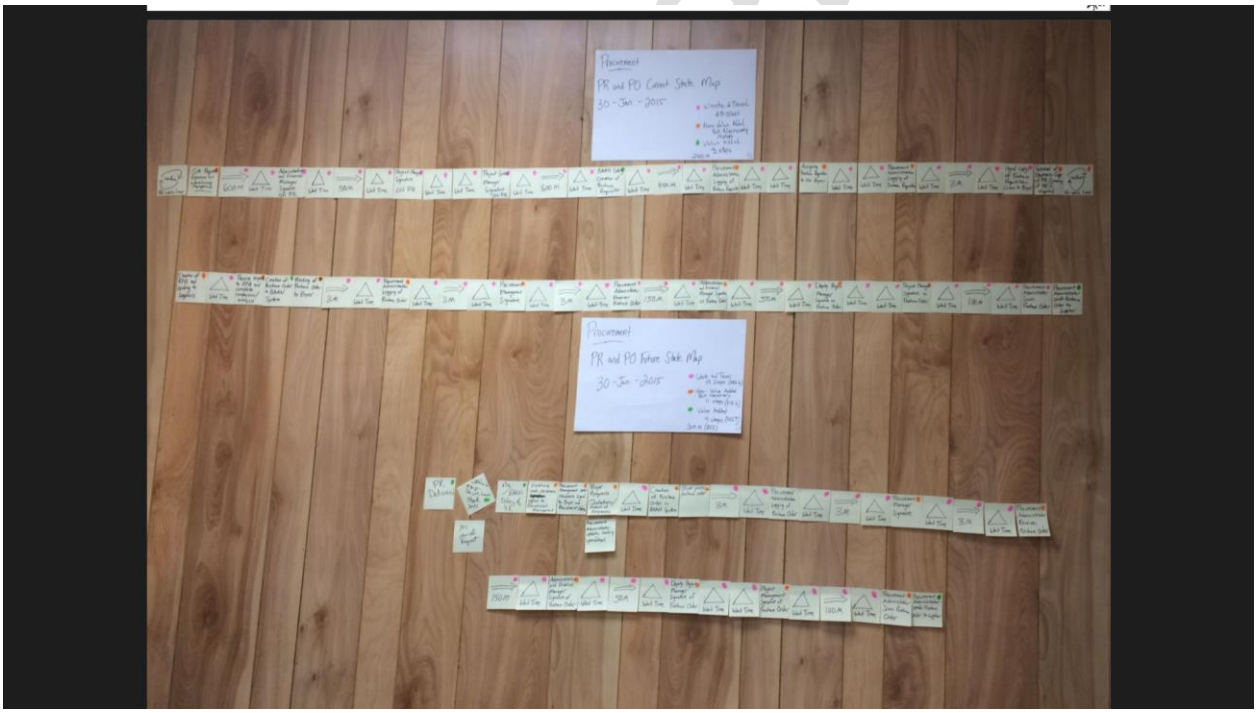
- **PR and PO Travel Process Spaghetti Diagram**



- **Purchase Request and Purchase Order Travel Process Current State**




Procurement
PR and PO Future State Map
30-Jan.-2015
Waste and Travel
19 Steps (58% ↓)
Non-Value Added But Necessary
11 steps (21% ↓)
Value Added
4 steps (25% ↑)
309 M (85%)



Implementation of Future State – February 2nd 2015 – Go-live Date

February 2nd 2015 we went live with the new Electronic Purchase Request System (PR). The New Electronic form and the Standard Work documents are listed at the end of this report section.

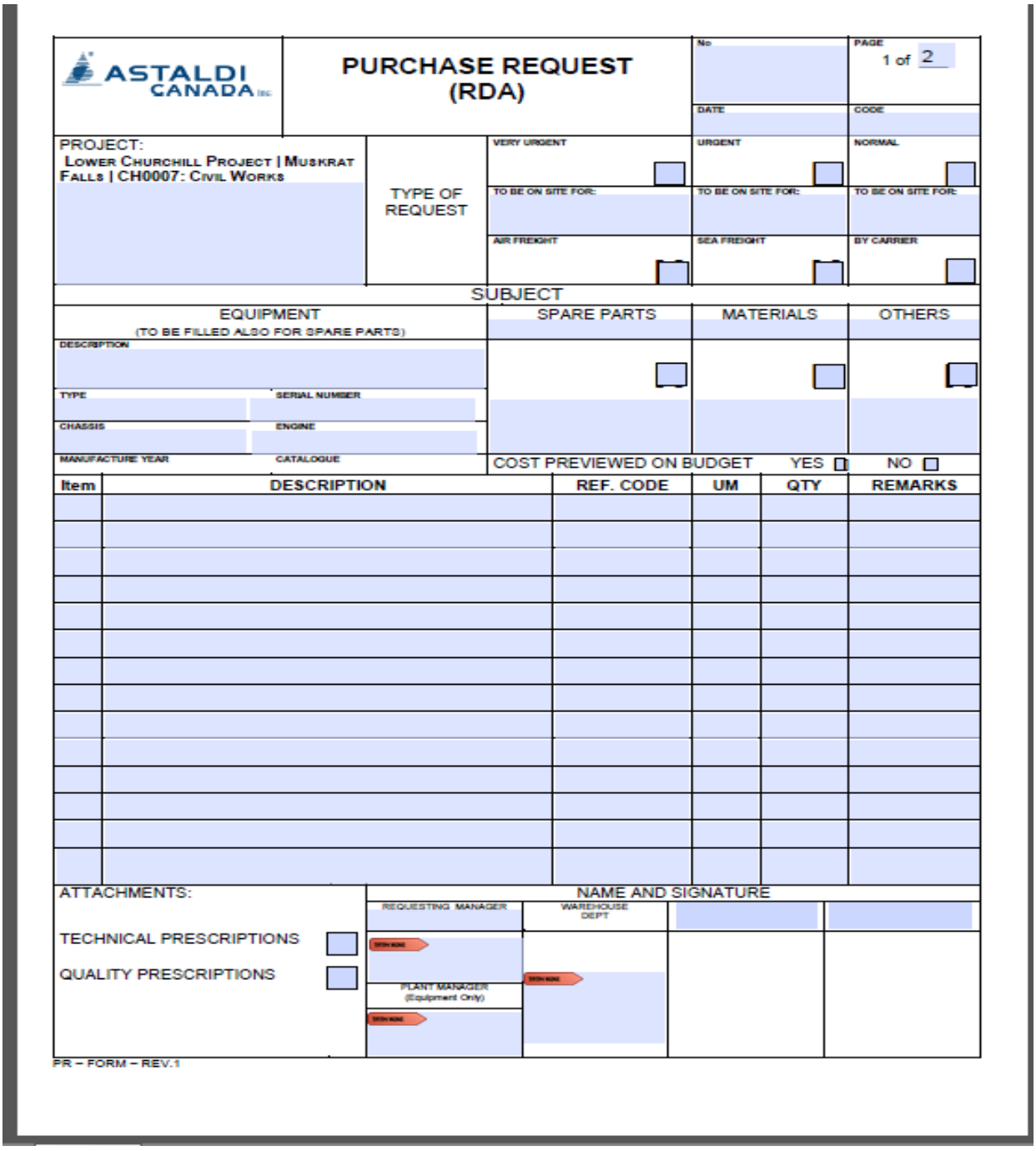
We announced the new document and process at the 6:15am meeting with Bill Knox. The reaction from the team was extremely positive.

This new process will reduce 100% of the travel from the Field Engineers and Superintendents; 2KM just to drive from the Dam site to Astaldi headquarters and then the PR Process takes anywhere from 1 day to 44 days to complete with the person owning the PR having to chase down signatures and quote prices before completing the process.

After the 6:15 meeting Symone ran a couple of test runs to insure the infrastructure was working. Then we gave the template electronic PR form to a couple of superintendents to further test the system. They mailed the Electronic PR Request to the new email distribution channel PRMF@Astaldi.com or otherwise known as Purchase Request Muskrat Falls. The first submission was cancelled by the warehouse manager as it was for items that had been ordered in excess early this month with a pending delivery later this week. The Warehouse Manager immediately responded back to the submitter with the information and was thanked for his quick response. If this new system was not in place then the submitter would have had to call for quotes, drive 2km to the administration office, chase down 4 signatures (Walking a min of another 2km according to the current state map), and generally waste time and money.

The second PR was created using the process and submitted to the Warehouse Manager. The Warehouse manager checked the Electronic PR Form for completeness and correctness and once he was satisfied it was filled out correctly he digitally signed the form. Once signed he filled out the order in "BAAN" and sent the documents to Dario via the new email distribution channel "PROMF@Astaldi.com" or also known as Procurement Muskrat Falls. This PR Form went to Dario, he saw it and forwarded it to the buyer he selected to receive it. The system worked great. Now the team has to finish cleaning out the items stuck in the manual process.

Purchase Request Electronic Form



ASTALDI CANADA Inc

PURCHASE REQUEST (RDA)

No | PAGE 1 of 2

DATE | CODE

PROJECT: LOWER CHURCHILL PROJECT | MUSKRAT FALLS | CH0007: CIVIL WORKS

TYPE OF REQUEST

VERY URGENT	URGENT	NORMAL
TO BE ON SITE FOR:	TO BE ON SITE FOR:	TO BE ON SITE FOR:
AIR FREIGHT	SEA FREIGHT	BY CARRIER

SUBJECT

EQUIPMENT (TO BE FILLED ALSO FOR SPARE PARTS)	SPARE PARTS	MATERIALS	OTHERS

DESCRIPTION | TYPE | SERIAL NUMBER | CHASSIS | ENGINE | MANUFACTURE YEAR | CATALOGUE

COST PREVIEWED ON BUDGET YES ☐ NO ☐

Item	DESCRIPTION	REF. CODE	UM	QTY	REMARKS

ATTACHMENTS:

TECHNICAL PRESCRIPTIONS ☐

QUALITY PRESCRIPTIONS ☐

NAME AND SIGNATURE

REQUESTING MANAGER | WAREHOUSE DEPT | PLANT MANAGER (Equipment Only)

PR – FORM – REV.1

How the New Electronic Purchase Request System Works

1) Open the New Purchase Request (PR) Template.

2) Fill out the Electronic PR form by typing your information in the designated areas.
3) Digitally Sign the Electronic PR Form in the appropriate signature location. If you do not currently have an electronic signature the software will walk you through creating one. Directions to create the digital signature are listed below along with screenshots of the process.
4) Saving the File - Once digitally signed, the software will ask you to save it. It is suggested you create a specific folder where you keep your signed PR Request. Ex. "Your Name" signed PR and change the name of the file to "Your Department" Signed PR "The Current Date".
5) Once saved you will forward your signed PR to the next level of signature. required. If you are the signing authority manager then proceed to the next step.
6) Send your Digitally Signed PR to PRMF@Astaldi.com. This email address will forward your request to the appropriate Warehouse Manager for review. If they have questions they will contact you for clarification. Once they have confirmed all areas of the PR have been completed they will digitally sign the PR and the document will become read only. No other changes can be made after this signing.
7) The Warehouse Manager will then place the PR in "BAAN" and forward the BAAN information and the signed Electronic PR form. To PROMF@Astaldi.com. This email address will forward the correct documentation to the procurement team to start the procurement process.

Process Map of Electronically Sign the PR Process

How to Electronically Sign the PR

Reader lets you sign PDFs and incorporate that signature into the file. If you are viewing a PDF on the web, download the PDF first before you sign it.

How to create a Digital ID and sign a document with the Digital ID.

In Reader, if you don't have a digital ID, the onscreen instructions help you create one. For more information, see Digital IDs.

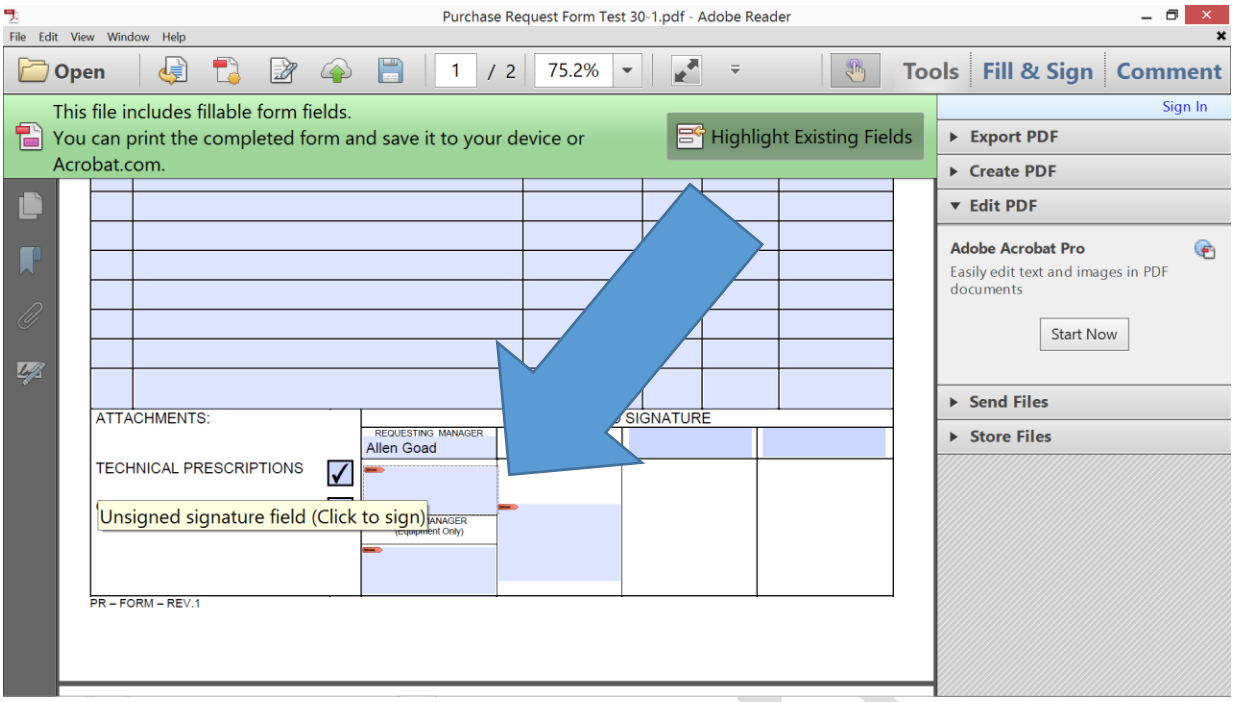
1. Open the PDF you want to sign.
2. Do one of the following:

   For a digital signature field

   If a form contains a digital signature field, double click the field to open the Sign Document dialog box.

3. If no digital signatures are configured, the Add digital ID dialog box displays. Follow the onscreen instructions to create a signature. Screen Shot's listed below.
4. In the Sign Document dialog box, do the following:
   - Choose a Signature from the Sign As menu.
   - Enter the Password for the selected digital signature
5. Click Sign to place the digital signature on the PDF.

To view and sign the document in a static and secure state, use Preview Document Mode. Dynamic content such as multimedia and JavaScript are blocked. For more information


Purchase Request Form Test 30-1.pdf - Adobe Reader
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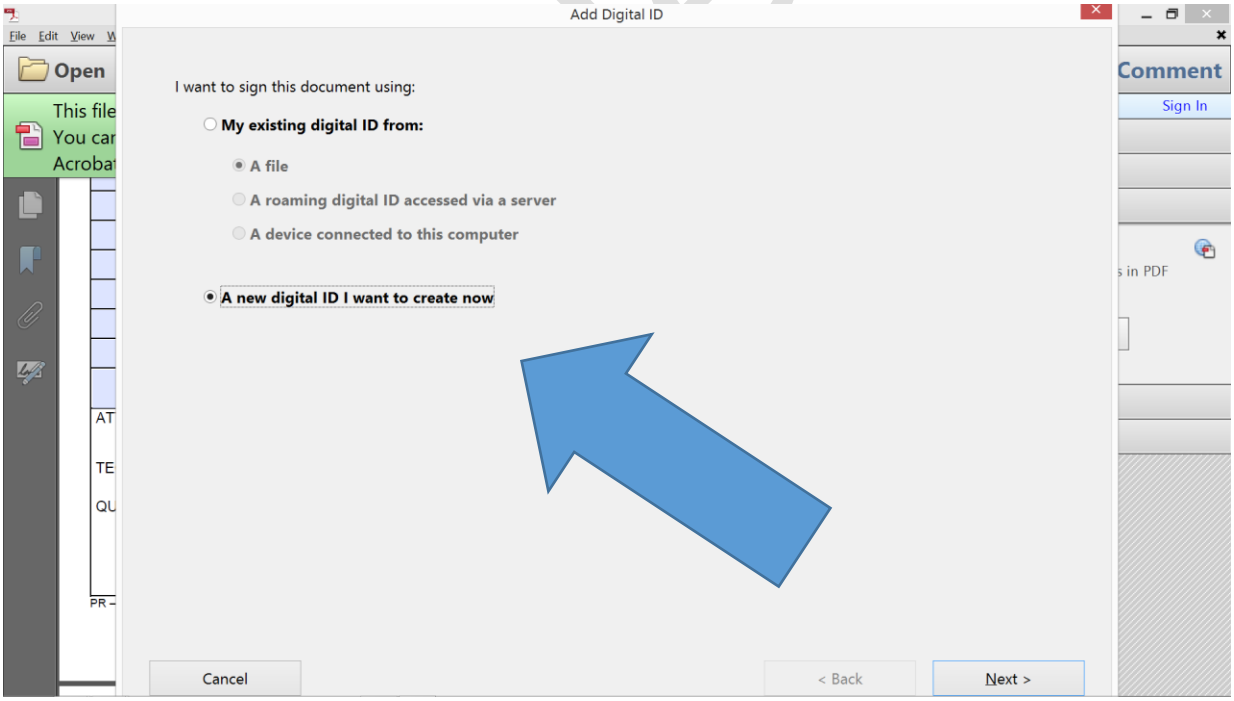
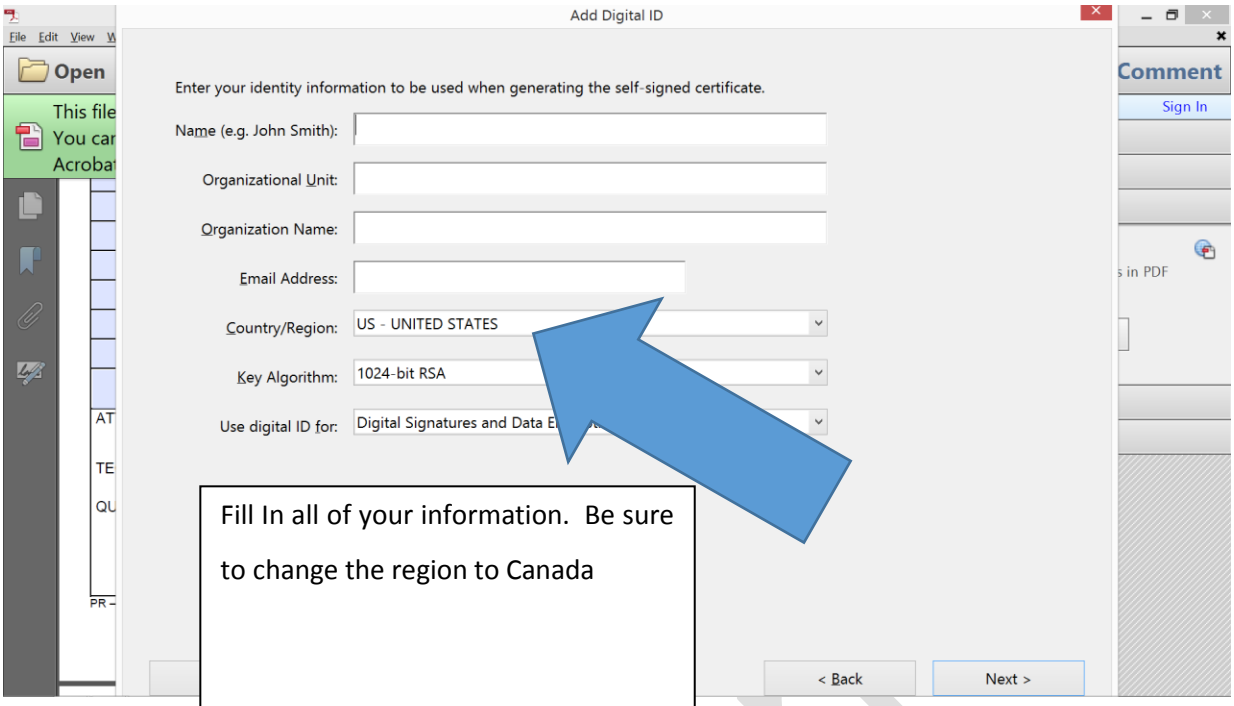
Tools
Fill & Sign
Comment
This file includes fillable form fields.
You can print the completed form and save it to your device or Acrobat.com.
Highlight Existing Fields
Sign In
Export PDF
Create PDF
Edit PDF
Adobe Acrobat Pro
Easily edit text and images in PDF documents
Start Now
Send Files
Store Files
ATTACHMENTS:
TECHNICAL PRESCRIPTIONS
REQUESTING MANAGER
Allen Goad
SIGNATURE
Unsigned signature field (Click to sign)
PR – FORM – REV.1


Add Digital ID
I want to sign this document using:
My existing digital ID from:
A file
A roaming digital ID accessed via a server
A device connected to this computer
A new digital ID I want to create now
Cancel
< Back
Next >



Material Management

i) Observation/Opportunities

- Material receipts are manual and hard to track.
- Material is sometime picked up by requesting party before reaching warehouse.
- Material is sometimes picked up by the wrong department.
- PR/PO process is so long that the requesters add lots of material in order to compensate.
- Requisition process arduous – See Procurement Section
- Logistics is cumbersome as they have picked up none ordered material and delivered it onto site.
- Lack of communication/Lack of Timely Communication.
- Manual process.
- Lack of viable metrics, visible scoreboard.

8 APPENDIX E: FIELD ENGINEERING

As part of Phase 1 of the project study, it was recommended that more field engineers be hired to support superintendents for materials ordering, pre-QC, and feedback purposes for planning & scheduling. As of the end of January 2015, multiple field engineers and a lead engineer have recently been added to the field staff. New staff members are eager and capable but it is noted that the majority of the new engineers are very early in their careers, with Muskrat Falls being their first hydroelectric power plant project.

Based upon discussions with Astaldi, multiple additional field engineering positions have been identified for which candidates are still being interviewed. We recommend Astaldi focus on finding individuals with at least 3-5 years of experience on similar scale projects for remaining field engineering positions.

Production Goals & the Field Level Production Accountability Loop

Field management staff, superintendents & general foremen, foremen, and engineers are aware of the need to prioritize field production to ensure both budget and schedule are being achieved but the support framework and staff interaction required to enable field staff to achieve production goals could benefit from review. The following recommendations are being made:

1) Current cost codes lack detail, which prevents field level staff from adequately tracking field production and determining relevant man-hour factor goal for various work tasks. It is recommended a more detailed cost code system be implemented.
2) The following field level production loop process, shown in Figure 5, highlights the important interaction between the superintendent, the general foreman & foremen, and the field engineers. With a new cost code system forthcoming, the following process highlights the required accountability between field level production staff needed for the team to collaboratively achieve production goals.

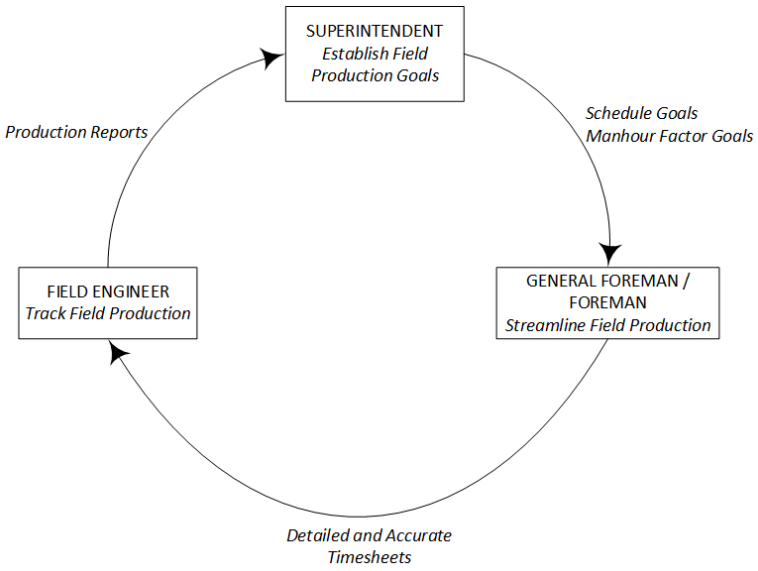


Figure 5 - Field Level Production Accountability Loop

3) It is recommended the field level production accountability loop be discussed during a morning or afternoon staff meeting. Currently, superintendents have been informed they will be held accountable for attaining required production but the roles of all personnel in achieving production goals has not been elaborated. It is important all field staff understand their role in the process.

Standard job duty description

A lack of standard job duties was identified amongst the field engineers. In order to provide uniformity of duties and ensure new field engineer staff are oriented in regards to their duties, the following list of field engineer duties was established based on needs, staff observation, and discussions:

1) Production tracking and reports
2) Material ordering and long-term material planning (collaboratively with superintendent)
3) Daily reports
4) QC walks
5) Review timesheets

6) Work plans
7) Scheduling/planning

Currently the following items are handled by other departments on site.

1) Site queries
2) Quantity tracking

As field engineers need to be knowledgeable of quantities and are partially involved in initiating site queries, the benefits of adding these items to the field engineer duties should be evaluated.

Coaching Field Engineer Staff

Due to the new field engineer staff being placed in pivotal roles as spillway field engineers and as the project field engineer, multiple members of the IBBS Consulting Group team spent time providing general coaching. As this was limited to 1-2 days during the most recent visit, team members focused on providing staff members with a context of their position including: duties, establishing goals, and methods in which to excel.

Use of Technology

The field staff currently perform work through the use of paper hard copies and computers back in the office in the form of a desktop or laptop computer. On similar scale projects, it is common industry practice to leverage technology to increase the sharing of information and increase the ability of staff to electronically complete work while both in the office and field. The use of tablets and project wide network access (including while in the field), could lead to increased field staff efficiency. Below are just a few uses:

1) Foremen could capture and transmit photos of issues directly to field engineers and GF/superintendents for resolution.
2) Timesheets could be performed electronically by the foremen. This would eliminate time needed and reduce errors in translating information to an electronic format by the payroll department. Review times by field office staff would be reduced as well.

3) Field engineers could perform daily reports with integrated field photos while in the field resulting in more comprehensive reports & record keeping.
4) A daily updated file of the plans could be accessed in an electronic format. With all individuals utilizing the same updated plan set, construction based off of outdated information can be avoided.

Specifically, substantial benefits from the use of a tablet could be gained by the foremen, general foremen, superintendents, and field engineers.

9 APPENDIX E: THE IBBS CONSULTING GROUP

This report was prepared by Dr. William Ibbs and three of his associates: Mr. Farid Saddik, Mr. George Goad, and Mr. Hiten Magudia.

The Ibbs Consulting Group is a consulting firm specializing in construction and design related problems, including project management, cost estimating, scheduling, productivity analysis, and project controls. The assistance of various Astaldi and Nalcor personnel is gratefully appreciated.