Project Ignition: Revving Up the Capacity Plan

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For the past two years, BNSF has announced record-breaking capacity expansion programs. Because of the complexity and magnitude involved in managing and ensuring on-time delivery of programs this size, BNSF’s Engineering Services developed a new project management process, called Project Ignition. To date, the team has efficiently completed more than 100 projects using Project Ignition processes.

To effectively plan and sequence all projects, Project Ignition was developed to strategically and proactively formalize processes and technology to ensure project scope, requirements, costs, communication and major obstacles are aligned and transparent for everyone involved. (Examples of project obstacles include land acquisitions, utility alignments, permitting, infrastructure needs and interactions with numerous public agencies.)

This paper provides a high-level perspective of Project Ignition, including an overview of processes that needed to be enhanced for multiple, complex project management, project deliverables, technology used to manage a team of more than 25 people located in seven states, the efficient management of millions of data points, reporting solutions, results to date, and the Engineering Services team’s conclusions.

Business Requirement
BNSF committed more than $5 billion in 2014 and 2015 for capacity expansion projects, and will continue to focus on the safest and most reliable infrastructure going forward. Undoubtedly, this amount of work requires streamlined processes to ensure visibility and frequent project status updates for each line expansion project, and for both internal and external BNSF clients and team members.

TABLE 1: Capital Expansion Trends

<table>
<thead>
<tr>
<th>Year</th>
<th>New Track Miles</th>
<th>Budget ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤2012</td>
<td>&lt;65</td>
<td>&lt;300,000,000</td>
</tr>
<tr>
<td>2013</td>
<td>71</td>
<td>345,000,000</td>
</tr>
<tr>
<td>2014</td>
<td>152</td>
<td>620,000,000</td>
</tr>
<tr>
<td>2015</td>
<td>266</td>
<td>907,000,000</td>
</tr>
</tbody>
</table>

As Table 1 displays, the acceleration of the capital expansion plan, with subsequent dollars and units installed, has dramatically increased year-over-year, for the last few years. While the future is yet to be carved in stone, the opportunity for a new style of project management and visibility has been created.
Enhanced communication between BNSF departments and public/private entities was an additional opportunity for an updated process. *Project Ignition* provides each of these capabilities (and more), for employees and members of the communities where BNSF operates.

**Project Deliverables**

The following screenshots illustrate examples of the deliverables submitted for *Project Ignition*.

**FIGURE 1: Cover Sheet**

The cover sheet includes the sheet index, scope of work, and general location information.
FIGURE 2: Design Consideration Matrix

The Design Consideration Matrix summarizes the alternatives analyzed and the selected option. This information allows the future design team to understand why the selected option was chosen and provides them alternative options as more detail becomes available in future design phases.
The Engineering Services team determined a new Executive Summary was critical to the success of Project Ignition. The summary provides a very high-level overview with pertinent information that can be quickly accessed by interested parties to fit project planning requirements.

The summery includes a basic overview of the following:

- Considered design alternatives
- Project permitting requirements
- Site challenges
- Right-of-way acquisition(s)
- DOT crossings
- Bridge and drainage structures
- Utility impacts
- Signal and wayside equipment
- Existing leases and easements
FIGURE 4: Track Chart Schematic

The Track Chart Schematic shows:

- Proposed improvements
- Scope of work

FIGURE 5: Aerial Concept Sheet

The Aerial Concept Sheet depicts the proposed improvements over an aerial photo. Details include:

- Existing and proposed rail centerline, including spiral curve information
- Existing infrastructure, utilities and wayside equipment
- Existing and proposed right-of-way
- Nearest station labels
- Geometry car data screenshots of potential challenges
FIGURE 6: Cost Estimate

The Cost Estimate screenshot above shows only a portion of cost estimates completed within Project Ignition. Costs are assigned for civil (including structures and land), track, and signal estimates, with the total project cost used as the preliminary budget for the long-range plan. The estimate worksheet is completed as part of Project Ignition and can be revised and used through final design.

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Process and Technology
Based on early discussions detailing BNSF needs, the overall project scope was ambitious. The project required more than 100 line expansion projects across the system be completed within nine months, using Project Ignition processes and technology.

Project included new sidings, existing siding extensions, yard expansions, building new interchange tracks, and additional main track projects. Because Project Ignition was new at the time, BNSF and Bartlett & West conducted pilots at two sites.

During the pilot programs, BNSF identified significant challenges:

1. Assembling a unique team that could complete more than 100 projects in nine months. The team had to be unique due to the wide range of technology used in the process and have knowledge of the rail industry and BNSF/AREMA standards.

2. Providing appropriate deliverables for the Ignition Packages without getting bogged down in details. The engineers and designers wanted to solve every problem and have all the answers for every project; however, at under a 10% design and without a true in-person site visit or survey, there was no way to have all the answers. It was going to be a constant balancing act of spending the right amount of time on an issue in order to provide BNSF the necessary information for a long-range plan.

3. Ensuring quality and consistency from a national team—more than 25 members from various geographical locations and time zones.

Identifying the problem is the first step in determining the best <what type> solution. BNSF’s approach relied on a solid team, Bartlett & West’s creative use of technology, 25 years of working knowledge about BNSF’s data and processes, a thorough quality control plan, and consistent communication.

THE TEAM
BNSF’s Engineering Services team built a team that had a good mix of the following competencies:

- Rail design
- GIS
- Microstation
- Inroads
- Database management and development
- Program and workflow management
- Environmental permitting
- Railroad corridor real estate

A real estate subconsultant researched adjacent property ownership to determine potential challenges associated with property acquisition. An environmental subconsultant researched state and federal permitting needs to identify those that could negatively impact the overall project schedule.

The addition of the subconsultants and their necessary processes, their importance in the critical path completion of the projects, and the need to include significant subconsultant generated data into the plan required building a process and communication flow that accommodated all parties.
The team’s goal was to complete an individual site within four weeks of starting. To accomplish this goal, major milestones were established each week and the workflow was designed around meeting those deadlines.

**Week 1: 3% BNSF Review**
This was a vital step in process. BNSF examined rail operations, existing infrastructure, terrain, right-of-way, environmental constraints, and developed a basic approach to each site at the 3% BNSF review stage. Multiple options were identified with different advantages and disadvantages.

BNSF then provided input and approval. This step was important for efficiency, as it helped to avoid major redesigns later in the process.

The result of the 3% BNSF review was their direction to move forward with one of the proposed options. Once that direction was received, it was shared with the sub-consultants so they could complete their research tasks. It was critical to provide them with the information as early as possible to assure meeting the scheduled four week goal.

**Week 2: Alignment Development/Approval**
The project leads developed and created alignments using Microstation InRoads. The alignments would then be reviewed by the engineer assigned to each project. Engineers reviewed for compliance with BNSF/AREMA standards and maintained a goal to minimize operational impacts during construction.

A significant number of sites also required complex work to the rail, including realigning, shifting, reconnecting, constructing, removing, and upgrading the rail.

**Week 2: Internal Review/ Cost Estimate**
The team allowed a week for the review and corrections portion of the process, given the complexity involved.
Week 4: Submit to BNSF
The projects were submitted via Newforma transmittals with the sheet set, track charts, cost estimate, executive summary spreadsheets, and the information provided by the sub-consultants. Using Newforma allowed Engineering Services to accurately record submissions without concern about file size.

Outside of the major milestones, the most important aspect of the process was to ensure quality controls were built into multiple stages throughout the process. Because of the possibility of errors and tight schedules, the Engineering Services team had to ensure quality work was produced during each project phase. Conducting quality control throughout the process was a major reason the Engineering Services team avoided large problems when approaching project completion.

COMMUNICATE, COMMUNICATE, COMMUNICATE
Project Ignition was successful because the team consistently and proactively communicated about the more than 100 line expansion projects along the way. Examples of communications include:

- Project kickoff meeting – All stakeholders met to discuss BNSF needs, expected deliverables, challenges and high-level processes
- Ignition Process workshop -- This two-day workshop evaluated the overall project process, potential challenges and consistency standards
- Weekly conference calls – These routine conversations with sub-consultants were brief, but ensured timely delivery of their portions of the project
- Bi-weekly conference calls – During these conference calls between BNSF and Bartlett & West, the Engineering Services team discussed the status of ongoing projects, estimated completion dates, and discussed outstanding project questions
- Monthly team meetings – These meetings included all team members to discuss project understanding, process and consistency
- Daily project communication – Teams communicated daily by phone, video chat, InstantMessenger and email to keep projects moving forward.

TECHNOLOGY
The following technology was used to ensure project efficiency:

STI Data
STI data is linearly referenced geometry car video data. This data allowed BNSF’s Engineering Services team to leverage existing BNSF data and conduct virtual site visits. Virtual site visits allowed us the team to reduce travel expenses and work out the logistics of physically visiting every site. Screenshots of STI data were also placed on aerial sheets within the Ignition Packages.

Custom Scripting
Project base data script
A team member enters the line segment, milepost, and project number, and the script will identify the state plane projection, clip out the identified features within the project range, transform them to the correct state plane projection, and export them to shape files in the project folder. This script currently gathers and exports 22 feature types from seven data sources including right-of-way information, utilities, roads and wetlands.

Labeling and annotation script
With a completed InRoads alignment, the script identifies all line and point features in proximity to the alignment, and populates a table that is included in the executive summary sheet with the stationing and other attributes available in the original data. It also produces formatted aerial concept labels. Using the script guarantees the labels match the information in the executive summary, and that nothing is missed, double-entered, etc. It eliminates opportunities for human error and increases the quality of the final product.
**Workflow Manager**
ESRI Workflow Manager helped the team track the status of each project and the overall program. Each project was entered into Workflow Manager with all of its request data—date, location, project type.

This system allowed for easier tracking of project status and completion percentage. A customized interface to store requests was also created. Each team member was assigned to a group in the system to easily follow who was working on which project and who had availability. This system allowed BNSF’s Engineering Services team to produce weekly reports, maps and cover sheets.

**Bentley Software**
All sheet sets were created using a combination of MicroStation, InRoads, Map and Decartes. From cover sheet to the final aerial concept sheet, Bentley software proved vital to the efficient completion of the ignition packages.

**ARCGIS**
ARCGIS proved to be a critical tool to provide location maps for the cover sheet, and assist the custom scripting to automate a few critical subtasks within the overall process.

**Pictometry**
Pictometry is a form of aerial photography that provides an increased level of resolution and the ability to measure both horizontal and vertical dimensions in some locations throughout BNSF system. This aerial data supplemented the STI data to aid in the virtual site visits.

**BUSINESS AND PLANNING IMPACTS**
In summary, *Project Ignition* will continue to serve as a viable process for attaining actual project scopes, engineered cost estimates, visibility of potential red flags within a project feasibility and a planning tool for communicating BNSF needs and expectations to the internal and external clients it supports and affects. Table 2 below displays the true value in this process, highlighting the enhanced exposure of critical items which the Capacity Plan interacts.

**TABLE 2: Summary of Impact**

<table>
<thead>
<tr>
<th>Impact Item</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Projects</td>
<td>100</td>
</tr>
<tr>
<td>Track Miles</td>
<td>404 New; 103 Potential Upgrade</td>
</tr>
<tr>
<td>Turnouts</td>
<td>317</td>
</tr>
<tr>
<td>DOT Crossings</td>
<td>536</td>
</tr>
<tr>
<td>Utilities</td>
<td>2,472</td>
</tr>
<tr>
<td>R/W Acquisition Acres</td>
<td>145 Acres; 303 Parcels</td>
</tr>
<tr>
<td>Environmental Permits</td>
<td>913</td>
</tr>
<tr>
<td>Structures</td>
<td>1,477</td>
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Moving forward, the Ignition Packages and data therein will continue to unfold and be leveraged as planning tools and processes. Currently in progress is the creation of Subdivision Schematics across the system, which will leverage the information known on the Long Range Plan, in addition to other known project types and relevant project data, to more realistically paint the picture of operations and scope changes planned for all subdivisions. Overall, the information generated will create a consistent delivery of important and priority data to best leverage and navigate the impacts which expansion efforts inherently affect, for an end goal delivery of the Capacity Plan to be on time, within budget, and with minimal surprises. Such process helps to ensure a smoother process for not just BNSF Railway, but additionally the communities, entities and agencies with which the company interacts.
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Figure 2: Design Consideration Matrix
Figure 3: Executive Summary
Figure 4: Track Chart Schematic
Figure 5: Aerial Concept Sheet
Figure 6: Cost Estimate
Figure 7: Workflow
Table 2: Summary of Impact

BIOGRAPHICAL SKETCH

Ben Williams is a Manager Engineering Support for BNSF in Kansas City, Kans. His primary focus is on initiation and facilitation of processes, tools, standards and training for Engineering Services. Ben holds a bachelor’s degree in civil engineering from the University of Missouri.

Jeff Jones is a professional engineer and Engineering Solutions Manager for Bartlett & West in Topeka, Kans. Jeff oversees railroad, municipality and private-development civil engineering projects. Ben has a bachelor’s degree in civil engineering from the University of Kansas, masters of business administration from the University of Phoenix and is a professional engineer (P.E.) in Kansas, Missouri, Louisiana, Georgia, Mississippi and Wyoming.
Project Ignition

Rewing up the Capacity Plan
What is Project Ignition?

Project Ignition:
• Is a strategic planning tool for upcoming project needs.
• Includes proactively reviewing long-range expansion projects.
• Is a systematic process that helps identify major obstacles, opportunities, costs and the overall project scope for many projects at once.
• Ensures consistent communication between internal BNSF departments and external BNSF agencies/entities.

Project Ignition Deliverables:
• 10% Designs
• Cover Sheet
• Design Consideration Matrix
• Executive Summary
• Track Chart Schematic
• Aerial Concept Sheets
• Cost Estimate

Design Consideration Matrix

Executive Summary

Track Chart Schematic

Aerial Sheets
Challenges

- 100 projects in 9 months
- Quest for perfection
- Deliverable consistency

Process

Communication

- Kickoff meeting
- Project Ignition process workshops
- Weekly conference calls
- Biweekly conference calls
- Monthly team meetings
- Communicator, Lync, Skype, whatever you call it?

Technology

- STI data – virtual site visits
- Custom scripting
- Bentley suite
- ARCGIS
- Workflow manager

What we have

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More to Come

- Subdivision Schematics
- Project Rating System
- Marketing – Project Ignition
- Economic Development – Project Ignition