Processing Line Data Resource Management

By

Joshua Peters

Submitted to
the Faculty of the Department of Information Technology
in Partial Fulfillment of the Requirements for
the Degree of Bachelor of Science
in Information Technology

University of Cincinnati
College of Education, Criminal Justice, and Human Services

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Russell E' McMahon
Professor Russell McMahon
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Abstract

Gallatin Steel Company (GSC) manufactures hot rolled steel coils. Due to the manufacturing process, several situations can arise where additional work is required after the coil is produced. This includes inspecting the surface of both sides of the coil to look for defects, cutting small samples to test that the coil matches the customer’s specifications, rewinding the coil because it became out of shape, and leveling the coil to ensure that it is flat. In addition, GSC is trying to expand its market share by targeting customers in higher quality markets, and in order to do so it must be able to ensure that each coil sent to the customer meets the agreed upon specifications. Previously, GSC had to send coils to other manufacturing companies in order to have this work completed. This resulted in numerous communications via fax, e-mail, and telephone calls, decreased visibility due to the product leaving GSC’s control, and increased frustrations due to inadequate computer systems. This was complicated by the fact that the other companies had limited resources to perform this work, so GSC could not perform this work on all of the coils that it would have liked.

Striving to produce higher quality steel, GSC constructed a facility that is capable of performing the previously stated work in-house. This allowed GSC to perform work on as many coils as it wanted, whenever it wanted, without losing visibility. From a computer systems perspective, GSC improved existing applications, reports, and physical processes as much as it could, and created new ones where necessary. This included modifying and creating applications using C++ and C#, using SQL to create tables, modify or drop triggers and stored procedures, and XML to create an ID tag that will go on the coil for positive identification. This also includes using SQL with IBM Cognos to create reports.
Processing Line Data Resource Management

1. Project Description and Intended Use

1.1 Statement of the Problem

Gallatin Steel Company (GSC) manufactures hot rolled steel coils. Due to the manufacturing process, several situations can arise where additional work is required after the coil is produced. This includes inspecting the surface of both sides of the coil to look for defects, cutting small samples to test that the coil matches the customer’s specifications, rewinding the coil because it became out of shape, and leveling the coil to ensure that it is flat. In addition, GSC is trying to expand its market share by targeting customers in higher quality markets, and in order to do so it must be able to ensure that each coil sent to the customer meets the agreed upon specifications.

When Gallatin Steel was constructed in 1995, it was not designed to handle these situations. In fact, there were no plans of doing any outside processing, so the system was not designed to do so. This led to business processes, and subsequently the system, being patched together piece by piece. It became an inefficient and error prone process that led to frustrations and non-value added work. GSC had to send coils to other manufacturing companies in order to have this work completed. This resulted in numerous communications via fax, e-mail, and telephone calls, decreased visibility due to the product leaving GSC’s control, and increased frustrations due to inadequate computer systems. To perform this work, they charged $500 per coil, which doesn’t include the cost of getting the coil to their location and back. This extra cost dug into the profit for each coil that needed to be processed. It was also complicated by the fact that the other companies had limited resources to perform this work, so GSC could not perform this work on all of the coils that it would have liked.
1.2 The Solution

Striving to produce higher quality steel, GSC constructed a facility that is capable of performing the previously stated work in-house. This allowed GSC to perform work on as many coils as it wanted, whenever it wanted, without losing visibility. From a computer systems perspective, GSC improved existing applications, reports, and physical processes as much as it could, and created new ones where necessary. This included modifying and creating applications using C++ and C#, using SQL to create tables, modify or drop triggers and stored procedures, and XML to create an ID tag that will go on the coil for positive identification. This also includes using SQL with IBM Cognos to create reports.

1.3 User Profiles

1.3.1 Quality

The quality department is who identifies which coils need work done, where the work will be performed, and any other instructions that are needed. They use the same application as they previously used but with a more detailed quality processing screen. This allows them to accurately record what needs to be done, rather than rely on e-mail and other communications that are outside of the system.

1.3.2 Shipping

The shipping department is responsible for determining when and where to send a coil. They tell the coil yard operators which rail car a particular coil should go on and where that rail car needs to go. The transfer management application was modified in order to accommodate the new quality processing data.
1.3.3 Material Handling

The Material Handling associates are responsible for moving coils from where they are in the main coil yard to the Processing Line. This includes loading coils to a rail car, moving the rail car to the Processing Line, moving rail cars from the Processing Line back to GSC, reweighing coils after they are taken off of the rail car, and putting the coil back into a main yard location. The Damaged Coil Tractor application and report were modified to accommodate the new tables for the Processing Line.

1.3.4 Commercial

The Commercial Department includes the outside processing team and the sales team. The outside processing team uses the reports to keep track of all coils that are not physically at GSC. The sales team uses the reports to determine the status of the coils for the customers and to make sure that they will ship to the customer on time.

1.3.5 Processing Line

The Processing Line Department includes all associates that work at the Processing Line. This includes the program that allows them to schedule what work needs to be done, the coil yard applications that allow them to keep track of their inventory, allows the Level 3 system to communicate with the machines, and reports for data analysis.
1.4 Use Case Diagram

![Use Case Diagram](image)

**Figure 1: Use Case**
2. **Design Protocols**

Gallatin Steel used its existing applications wherever possible. It attempted to change as little to the design of existing applications as possible, except where major efficiency improvements were made by modifying the application. The system was previously designed to allow for additional processing only at other companies. To limit design changes, GSC chose to treat the Processing Line as an outside processor from a system perspective. This meant that it had to create separate tables, applications, and reports.

An additional Coil Yard Management application had to be developed for the Processing Line. Its design was meant to look, feel, and function like the existing application for the main coil yard. Users’ are able to add and remove coils, move coils between locations within the yard, and look up information on a selected coil. They also are able to load and unload coils to the rail cars with ease.

Several applications were created to control what values a user can select from in the existing applications. These applications followed the design of applications with similar functionality. Users must be able to add, edit, and delete records. The “created by” and “updated by” columns are populated by the system and are not editable by the user.

The Processing Line Coil Yard Location Maintenance Application allows users to add/edit/remove coil yard locations. The application follows GSC’s existing design protocols allowing users to sort and filter by certain columns. It allows users to expand the column record and see all of the rows that are associated with that column. The created and updated columns are system generated and cannot be edited.
Reports were created in Cognos that followed the design protocols of existing reports. The user can filter by certain columns. The user can select which department to run the report for, and based off of that value the report will determine what data to include.

3. Objectives of the Project (Deliverables)

3.1 Specific deliverables:

The main objective of this project was to provide a system that is fully capable of capturing the physical processes while using as much of the existing system as possible. Secondary objectives included improving quality outside processing, capturing accurate data, and to make the system so easy to use that it will require minimal training. In order to accomplish this, GSC made several additions and modifications to its system.

3.2 Specific deliverables:

- Created a new processor called Gallatin Steel Processing Line
- Allowed the quality department to accurately record what work it is that they need to be done
- Created applications that can manage what work the quality department can choose from
- Created a data structure for a new coil yard with applications to manage locations and inventory
- Created new applications to allow the Processing Line employees to manage a schedule
- Created reports for the Processing Line that will be used by numerous departments
- Created a coil identification label
- Help Documentation
4. **Project Planning**

4.1 **Budget**

The budget for the senior project was $0. GSC did not have to buy any new hardware or software for this portion of the overall project. They used existing systems for which they already had licensure for. Gallatin Steel’s budget for the overall project is $2 million, but it was spent on things that are out of the scope of this senior project.

4.2 **Project Timeline:**

The timeline of this project ran from October 8\textsuperscript{th}, 2012, to April 30\textsuperscript{th}, 2013. This includes just less than one month of support and review once the code was released into production on April 2\textsuperscript{nd}, 2013.

Aside from creating the project schedule, the first thing that was done was to review the processes and applications that were in place at that time. This required the Information Systems team to meet with every department to see their processes. The IS team then had to analyze how this fit in with the system and where the system was lacking. They then met with every department again to develop the most efficient and simple way to accommodate what was physically changing and to accurately record what data needed to be recorded.

Once all of the business analysis was complete, the IS team had to perform a technical review. GSC does not employ any full time developers, but rather hires contractors to perform development work. They often do not know the data structure, the applications, or how GSC actually operates. In order to get the developers up to speed, a technical review is performed. This involves meeting with the developers to show how the system works. They also discussed what the desired future state was and how this could be accomplished technically. Once the
developers knew the expectations and what work they needed to do, the team moved into the development phase.

Gallatin Steel uses a hybrid approach to software development. It attempts to plan and design the system up front, similar to the Waterfall Method, but rarely knows all of the requirements up front. In this project, GSC had an idea of what it wanted, but the details needed to be determined after the development started. Once the original specifications were developed, GSC turned to more of an Agile Methodology approach. They worked with the developers on a daily basis to produce iterations of the project. After each iteration, the team met with users and determined what additional features they would like to include. This continued until the system satisfied all of the user’s needs.

Once development was finished, the team moved on to testing. The testing was performed by the IS team until it could no longer find any problems. During this testing, the IS team created test scripts to ensure that all bugs would get fixed. This also was created to help in the creation of the help documentation. Once the IS testing was complete, user testing began. They spent several days going through every scenario that they could think of, documenting where the system did not perform ideally. This information was given to the developers, who would fix the code as quickly as possible. It would then be given back to IS, and the cycle would start over again. This was done until everyone was satisfied with the system and no bugs existed.

The team then moved on to user training. This involved creating training material and working with users to explain how the system works. Time was spent with each department to teach them how to use the system and answer any questions. The training material was sent to the department file shares for future use.
After user training, “dry runs” began. Dry runs can be defined as test coils that were physically moved to the Processing Line and ran through the actual line several times. This included coils that were at the maximum limits of the machine in order to verify that it can process what the contract said it could. While they were doing this, they used the system as they would with real coils. This was done in the test environment, which was updated with all of the changes that were being made.

After ensuring that the machine, and system, could operate effectively, the Gallatin Steel Processing Line went live. This included releasing the software changes to the production environment as well as putting real coils into the machine. The IS department spent the next 26 days supporting the users and finishing documentation. In the end of April 2013, the project was closed.

![Gantt Chart]

Figure 2: Gantt Chart
5. Proof of Design

5.1 Database Structure

Below is a high level view of Gallatin Steel’s level 3 database structure. Highlighted in yellow are the tables that were added for this project. There were also several stored procedures and triggers that were modified, and lots of data that was inserted into the database.

![Figure 3: Table Structure](image_url)
5.2 Process Flow

One major improvement that was made in this project was simplicity. GSC’s system was originally not designed to accommodate any type of quality processing. It was patched together over the years which led to a very inefficient and complicated process. The goal of this project was not only to make the system efficient and easy to use, but also to improve the physical processes. Below is a diagram that shows the previous steps that were taken in and out of the system to get this work done. Note that one thing that you cannot see from this diagram is the lack of data that was generated. Once the work was completed, there was no way to report off of what happened because of the way the system was put together. In the new process flow, everything is recorded which enables much better reporting. Another thing that is not apparent is the lack of visibility in the old process. When it would go to the outside processor, Gallatin Steel had no idea what the status of the coil was. The only way that GSC could check on a coil was to call the outside processor, who would then go physically looking for it. In the new process, there is visibility at all times and no time has to be wasted looking for the status of a particular coil.

The obvious thing that jumps out when you look at the old and new process flow is the difference in the number of steps. Thirty four steps were identified in the old process, which was reduced to 20 steps in the new process. This is a testament to how much GSC simplified its process by performing quality processing internally.
Previous Process Flow for Quality Processing

1. I-Coded
   Quality

2. New Line Item Created
   System

3. Release Inside Sales Hold
   ISR

4. Look at Coils For Inspection report
   OP

5. Email Kristin from ST coil numbers for next day
   OP

6. Build load
   Shipping

7. Send Email with switch order to back
   Shipping

8. Print out switch order and hand to loco operator
   Back Scale House

9. Bring cars up front
   Loco

10. Load rail cars
    Coil Yard

11. Send Email with switch order to back
    Shipping

12. Ship load out of Gate Management
    Shipping

13. Print out switch order and hand to/radio loco operator
    Back Scale House

14. Move Coils to Steel Tech
    Loco

15. Receive at STX in their System
    Inspection Coil in system

16. Setup as Inspection Coil in system
    Steel Tech

17. Schedule Coil for Inspection
    Steel Tech

18. Perform Inspection
    Quality

19. EDI records inspection, updates OTC
    System

20. Send Email to Gail/ISR’s with Inspection Results
    Quality

21. Update disposition
    Quality

22. Coil is taken off order
    ISR

23. coil prime?
   No

24. Email Kristin to release back to Gallatin
    OP

25. Released back to Gallatin
    Steel Tech

26. Send Email with switch order to back
    Shipping

27. Print out switch order and hand to loco operator
    Back Scale House

28. Bring cars to Steel Tech
    Loco

29. Load rail cars
    Coil Yard

30. Coil transferred back to Gallatin
    Loco

31. Return to Gallatin in Inventory Maintenance
    Shipping

32. Put in Coil Location
    Coil Yard

33. Release Hold
    Shipping

34. Coil becomes ready to ship
    System

Figure 4: Old Process Flow
New Process Flow for Quality Processing

1. Coil is flagged for processing
2. New Line Item Created
3. Coils that have been flagged will show up in a new Schedule app Processing Line
4. Build load Shipping
5. Load rail cars Coil Yard
6. Ship load out of Gate Management Shipping
7. Move string of Rail cars to Processing Line Loco
8.Unload coil, put in coil yard location Coil Yard
9. Load coils to Processing Line Coil Yard
10. Perform Process Quality/Processing Line
11. Receive end time and record process Processing Line
12. Unload coil Processing Line
13. Move to coil yard location Coil Yard
14. Update disposition Quality
15. **Coil is put on hold and ISR determines what to do next**
   - Is coil prime?
   - No
   - Yes
16. **Coil becomes ready to transfer back to GSC**
   - Yes
   - No
17. Email ISR of processing results Inspector PL Coil Yard
18. Move string of Rail Cars back to Gallatin Loco
19. Unload, Weigh, and put in location Coil Yard
20. **Coil becomes ready to ship**
   - Yes
   - No

**Figure 5: New Process Flow**
5.3  **Coil Yard Management Application**

This application was designed to look, feel, and function similar to the existing application for the main coil yard. New tables were created in order for this program to work. The primary purpose of this application is to allow users to track where they move coils to within the coil yard.

![Coil Yard Management Application](image)

**Figure 6: Coil Yard Management - Main**
Figure 7: Coil Yard Management - Inbound

This screen shows every coil that has left GSC’s main yard and has not yet been put into a location at the Processing Line. The user highlights the coil that he/she is physically taking off of the rail car and clicks “Unloaded.” This prompts the “Move Coil” screen which is the same screen that the users use to move a coil within the yard. Once the “Save” button is pressed, the coil’s status changes from “In Transit” to “at GSC Processing Line.”
The “Outbound” screen shows all coils that need to be returned to GSC’s main coil yard. It functions must like the “Inbound” screen, with the exception that the “Loaded” button moves the coil to RR-1 automatically rather than showing the “Move Coil” screen.
The “Show Coil” button prompts a screen that allows users to type in a coil number and the system will show its location.

![Image of Show Coil Location window](image1.png)

**Figure 10: Coil Yard Management - Show Coil**

The “Lost” button loads a screen that shows coils that are at the Processing Line but do not have a coil yard location.

![Image of Lost window](image2.png)

**Figure 11: Coil Yard Management - Lost**
The “Coil Info” button shows various pieces of information about the selected coil that the operators can use to make decisions.

![Coil Info for Coil 1141452-](image)

**Figure 12: Coil Yard Management - Coil Info**

All of the above screens look and feel very similar to the application that was already in place for GSC’s main coil yard.
5.4 Settings Applications

Three applications were created to allow managers to control what values a user can select in the disposition application. The first application allows users to add, edit, and remove reasons for why a coil as rewound.

![Figure 13: Rewind Reasons](image)

*Figure 13: Rewind Reasons*
The next screen allows users to add, edit, and remove reasons for why a sample is needed.

![Sample Reasons Table]

**Figure 14: Sample Reasons**
The third application allows users to add, edit, and remove what disposition is allowed to be entered.

Figure 15: Rolling Mill Dispositions

All three of these applications follow standards of existing applications.
5.5 Scheduling Applications

The two schedule screens are what allow the users to prioritize the work that needs to be done. Users can drag and drop between the two screens to change the schedule as desired. They can use the two screens on two separate monitors or on the same monitor. If a coil contains multiple processes to be completed, the user can expand the selection to see all processes involved. The screens use tables that were created for this project as well as tables that previously existed.

![Figure 16: Scheduling]

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<table>
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<th>Special Instructions</th>
<th>Prioritized Date</th>
<th>Material Thickness</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>1146015</td>
<td>Multiple</td>
<td></td>
<td>3/2/2013</td>
<td>9.219</td>
<td>54.660</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sequence #</th>
<th>Process</th>
<th>Special Instructions</th>
<th>Prioritized Date</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sample</td>
<td></td>
<td>3/15/2013</td>
<td>9.219</td>
<td>54.660</td>
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</table>
```

---

![Figure 16: Scheduling]

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<td>9.219</td>
<td>54.660</td>
</tr>
</tbody>
</table>
```
5.6 IL Coil Yard Location application

The IL Coil Yard Location application allows users to add/edit/remove coil yard locations. It allows users to expand the column record and see all of the rows that are associated with that column. This is what determines what can be chosen in the coil yard management application that was previously discussed. It does not allow the user to delete certain columns that are critical in other applications.

![Figure 17: Coil Yard Locations](image-url)
5.7 Reports

Reports were created in Cognos that followed the design protocols of existing reports. The user can filter by a number of columns. The user can select which department to run the report for, and based off of that value the report will determine what data to include.

Below is the filter screen.

![Figure 18: Report Filter](image-url)
Figure 19: Shipping Report

Figure 20: Processing Line Report
Figure 21: Commercial Report
5.8 **Quality Outside Processing**

The quality department is who determines whether a coil needs extra work done or not. Using the new screen pictured below, they will have the flexibility to accurately record what needs to be done and where it needs to be done at. This screen allows for a coil to receive multiple processes at one or more locations. This was not possible with the previous system and will be a major improvement with reporting and data analysis.

![Quality Outside Processing](image)

**Figure 22: Quality OP**
5.9  **Coil ID tag**

When a steel coil is produced, there are two ways in which GSC identifies it with a number. First, the coil gets a metal ID tag welded onto the side by a machine. This happens right after it gets rolled up into a coil and before a set of bands is placed on it by another machine to keep it from springing open. Once the coil gets set outside by a coil yard tractor, an inspector will come and write a large number on the side with a white marker. This number allows the tractor operators to see the coil number from the cab of their tractor.

When the coil is processed at the GSC Processing Line, both of these numbers get removed because they will unwind the coil. In order to keep positive identification, a label prints automatically when the machine tells the system that it is done. This is placed on the new band of the coil, after which an associate will rewrite the large white numbers on the side.

This is done using a tool called Transform, which is a form creator. XML is generated when the coil runs through the line and is passed to Transform, which tells the printer what to do. A label that is similar in size to an address label prints automatically and enables the coil to be positively identified at all times.

![Coil ID tag](image)

**Figure 23: Coil ID tag**
5.10 Damaged Coil Tractor

5.10.1 Damaged Coil Tractor Application

The Damaged Coil Tractor application is what the main coil yard tractor operators use to determine which coils need to be reweighed. Coils need to be reweighed for various reasons, including when they return from the Processing Line. GSC modified this application to include the coils returning from the GSC Processing Line.

Figure 24: Damage Coil Tractor
5.10.2 Damaged Coil Tractor Report

If you notice on the screen above, there is a button to print what data is on the screen. This button calls a report that is supposed to print the same data, with a few additional columns. However, they are completely separate and can become out of sync. This is due to the way that the legacy systems were created. In order to print what is seen on the application, GSC had to modify the report to match the application.

![Damage Coil Tractor Report](figure25.png)

Figure 25: Damage Coil Tractor Report
5.11 Help Documentation

Help documentation was created for each new application to serve the users when they forget how to do something or what a particular screen is for. Gallatin Steel is currently investigating the best way to standardize help documentation across the organization. Because there was no standard at the time of this project, the help documentation was created in Microsoft Word as an interim solution.

The help documentation includes a table of contents that includes links to the various sections of the document. Below is a screenshot of the help document for the Scheduling application. The second screenshot shows that when “How to Schedule” was clicked, it jumps to the section of the document that explains how to schedule.

Figure 26: Help Document – Table of Contents
**HOW TO SCHEDULE**—In order to get a coil onto the schedule, you must click and hold on the coil that you want to schedule and drag it to the “Scheduled” screen.

**Note that you can also drag/drop the from scheduled to awaiting scheduling to take a coil off of the schedule.**

**Figure 27: Help Document - Example**
6. Testing

6.1 Functional Requirements

1. Quality must be able to enter the processing code in the disposition application along the special instructions for the work order.
   a) They must be able to enter processor, transfer mode, and special instructions
   b) Lab Technician’s must be able to call for a sample as they did previously
   c) Quality must be able to enter multiple processes
   d) Quality must be able to select multiple coils to be processed
   e) Default values will be “GSC IL” as the processor and “Rail” as the transfer mode

2. Commercial must be able to select a product type for the leveling process during order entry.

3. Associates must be able to create a schedule and see what is/is not scheduled
   a) It will only show coils for GSC Processing Line
   b) The coil will not be allowed to be scheduled unless it has a Processing Line coil yard location
   c) Coils will be dragged/dropped to the schedule and the status will change to “scheduled”
   d) Coils will be ready to start when they are in a “TUR” location
   e) Coils must be able to be reprocessed if necessary
   f) Data will be automatically saved when dragged/dropped

4. Coil tractor must be able to have same functionality as GSC coil yard at the Processing Line coil yard.
   a) Must be very similar to current screen such that little user training is required.
b) An “Inbound” screen will show all coils that have left GSC but have not been received at the Processing Line

c) Inbound screen will allow user to insert the coil into a location.

d) An “outbound” screen will show coils that are ready to go back to GSC.

e) Outbound screen will allow user to load it to the rail car.

f) Coil tractors should be able to easily load coils to the turret of the Processing Line.

5. Users must be allowed to enter/remove reasons for samples and rewinds

   a) Unauthorized users cannot access screens

6. Managers must be allowed to add/remove columns in the Processing Line coil yard

7. Unauthorized users cannot access screens

8. The system should automatically record the processing steps in the Inventory Maintenance application.

9. The system should not allow a coil to show “Ready to Ship” before it has been returned to Gallatin Steel.

10. All coils should be traceable to a specific location at all times.

11. The process must work for other Outside Processors as well.
### 6.2 Testing Data

<table>
<thead>
<tr>
<th>Req No</th>
<th>Item #</th>
<th>Test Case</th>
<th>Input</th>
<th>Expected output</th>
<th>Actual Output</th>
<th>Pass/Fail</th>
<th>Reason for P/F</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1a</td>
<td>1</td>
<td>Inspection</td>
<td>Adds 3 to RD, adds inspection to plan</td>
<td>Added 3 to RD, added inspection to plan</td>
<td>Pass</td>
<td>Poor process from drop downs to invalid processor can be entered</td>
<td>2/1/13</td>
</tr>
<tr>
<td>1</td>
<td>1b</td>
<td>2</td>
<td>PPS, PP monot = 1 lap</td>
<td>Add 3 to RD, sample to plan</td>
<td>RD was not updated, plan was not updated</td>
<td>Fail</td>
<td>Unknown</td>
<td>2/1/13</td>
</tr>
<tr>
<td>1</td>
<td>1c</td>
<td>3</td>
<td>Inspection &amp; sample inspection</td>
<td>Add 3 to RD, inspection and sample to plan</td>
<td>Added 3 to RD, inspection and sample to plan</td>
<td>Fail</td>
<td>Picked multiple processes from drop downs so invalid values are entered</td>
<td>2/1/13</td>
</tr>
<tr>
<td>1</td>
<td>1d</td>
<td>4</td>
<td>Highlight multiple coils and add inspection</td>
<td>Add 3 to RD field for all coils, inspection to plan of all coils</td>
<td>Added 3 to RD field for all coils, inspection to plan of all coils</td>
<td>Fail</td>
<td>Multi select worked properly</td>
<td>2/1/13</td>
</tr>
<tr>
<td>1</td>
<td>1e</td>
<td>5</td>
<td>Screen will auto default to GSC IL</td>
<td>GSC IL will appear when button is clicked</td>
<td>GSC IL appeared when button was clicked</td>
<td>Pass</td>
<td>Default values were properly coded</td>
<td>2/1/13</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>6</td>
<td>In Order Info, user can select Level as a product type</td>
<td>Level will be added to plan of coil and new tab with info will appear</td>
<td>New tab appeared, level was added to plan of coil</td>
<td>Pass</td>
<td>Set up like all other product types</td>
<td>2/4/13</td>
</tr>
<tr>
<td>3</td>
<td>3a</td>
<td>7</td>
<td>Open map screens</td>
<td>Only GSC IL, coils will appear</td>
<td>No coils showed up that were not being processed at GSC IL</td>
<td>Pass</td>
<td>Processor id was properly included in filter</td>
<td>2/4/13</td>
</tr>
<tr>
<td>3</td>
<td>3b</td>
<td>8</td>
<td>Drag-drop between screens</td>
<td>Will not allow coil to be dragged dropped</td>
<td>Did not allow coil to be dragged dropped</td>
<td>Fail</td>
<td>Rens were read only that did not have a location</td>
<td>2/4/13</td>
</tr>
<tr>
<td>3</td>
<td>3c</td>
<td>9</td>
<td>Drag-drop between screens</td>
<td>Status will change to &quot;Scheduled&quot;</td>
<td>Status changed to schedule</td>
<td>Pass</td>
<td>Moved from awaiting schedule to schedule screen</td>
<td>2/4/13</td>
</tr>
<tr>
<td>3</td>
<td>3d</td>
<td>10</td>
<td>Move coil to TUR location</td>
<td>Buttons will appear</td>
<td>Buttons did not appear</td>
<td>Fail</td>
<td>Button has not been coded yet</td>
<td>2/4/13</td>
</tr>
<tr>
<td>3</td>
<td>3e</td>
<td>11</td>
<td>Record end time</td>
<td>Coil will move to bottom and &quot;Reprocess&quot; button will appear</td>
<td>No button appeared</td>
<td>Fail</td>
<td>Button has not been coded yet</td>
<td>2/4/13</td>
</tr>
<tr>
<td>3</td>
<td>3f</td>
<td>12</td>
<td>Drag-drop</td>
<td>I will be able to close and reopen and it will be the same</td>
<td>I closed/opened program and the schedule was the same</td>
<td>Pass</td>
<td>It auto saves when anything is done</td>
<td>2/4/13</td>
</tr>
<tr>
<td>4</td>
<td>4a</td>
<td>13</td>
<td>Open up application</td>
<td>Must look/feel similar to existing application</td>
<td>Main screen was very similar, could navigate exactly like existing application</td>
<td>Pass</td>
<td>We designed it based off of old app</td>
<td>2/5/13</td>
</tr>
<tr>
<td>4</td>
<td>4b</td>
<td>14</td>
<td>Open &quot;inbound&quot; screen</td>
<td>Will only show coils that have not been received yet</td>
<td>Only showed coils that have not been received yet</td>
<td>Pass</td>
<td>It filters out rest</td>
<td>2/5/13</td>
</tr>
<tr>
<td>4</td>
<td>4c</td>
<td>15</td>
<td>Click on coil and hit &quot;load&quot; button</td>
<td>Coil move screen will appear and let me choose location</td>
<td>Coil move screen appeared and let me choose location</td>
<td>Pass</td>
<td>Filtered for coils that have transferred to GSC as next process</td>
<td>2/5/13</td>
</tr>
<tr>
<td>4</td>
<td>4d</td>
<td>16</td>
<td>Open &quot;outbound&quot; screen</td>
<td>Will show coils that are ready to return to GSC</td>
<td>Shown coils that need to be returned to GSC</td>
<td>Pass</td>
<td>Filtered for coils that have transferred to GSC as next process</td>
<td>2/5/13</td>
</tr>
<tr>
<td>4</td>
<td>4e</td>
<td>17</td>
<td>Click unboxed button</td>
<td>It will move the coil to RB-1 and will not show up after screen is refreshed</td>
<td>Moved coil to GR-1 and was no longer on screen</td>
<td>Pass</td>
<td>Filtered for coils that have transferred to GSC as next process</td>
<td>2/5/13</td>
</tr>
<tr>
<td>4</td>
<td>4f</td>
<td>18</td>
<td>Click move coil button, have four TUR location buttons</td>
<td>Pressure of the buttons and it will move it to that location</td>
<td>Pressed TUR-1 and it moved it to that location</td>
<td>Pass</td>
<td>Filtered for coils that have transferred to GSC as next process</td>
<td>2/6/13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inserted data</td>
<td>Data gets saved and screen refreshes</td>
<td>Error message</td>
<td>Fail</td>
<td>Someone changed column data type</td>
<td>2/9/13</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>----------------</td>
<td>--------------------------------------</td>
<td>--------------</td>
<td>-----</td>
<td>----------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>5</td>
<td>5a</td>
<td>20</td>
<td>Openaps console as user who does not have access</td>
<td>There will be no &quot;ghent-PL&quot; screen</td>
<td>There was no ghent-PL screen to choose</td>
<td>Pass</td>
<td>User was not given access</td>
<td>2/6/13</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>21</td>
<td>Managers must be allowed to add/edit/remove columns in the inspection line call yard</td>
<td>If data is entered to create/edit/remove location, the call yard application will reflect changes</td>
<td>The call yard screen showed the changes that were made</td>
<td>Pass</td>
<td>Changes were added to the Location maintenance application. The call yard application reflected these changes</td>
<td>2/11/13</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>22</td>
<td>Unauthorized users cannot access screens</td>
<td>If user does not have R/W access, the screen will not appear. If user has read access, they cannot modify data</td>
<td>Read only users could not edit data. Other users could not see screen</td>
<td>Pass</td>
<td>Security settings are working properly</td>
<td>2/11/13</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>23</td>
<td>The system should automatically record the processing steps in the inventory maintenance application</td>
<td>Users should at no point have to record processes manually</td>
<td>Each step of the plan was recorded automatically as expected</td>
<td>Pass</td>
<td>System was designed and coded properly</td>
<td>2/11/13</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>24</td>
<td>The system should not allow a call to show &quot;Ready to Ship&quot; before it has been returned to Galatin</td>
<td>The call should at no point become ready to ship while it is at the processing line</td>
<td>Coils never became ready to ship while they were at the processing line. Had to move it back to GSC to ship it</td>
<td>Pass</td>
<td>There is always a shipping hold on coils that are not at GSC's main call yard</td>
<td>2/11/13</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>25</td>
<td>All coils should be traceable to a specific location at all times</td>
<td>Coils should never become &quot;lost&quot; and if they do, they should show up on the &quot;lost&quot; screen</td>
<td>Coils were traceable at all times. At no point was a coil lost without showing up on the last screen</td>
<td>Pass</td>
<td>Coils never lose the system when they are lost</td>
<td>2/11/13</td>
</tr>
<tr>
<td>11</td>
<td>11</td>
<td>26</td>
<td>Coils should flow through the system similarly when they are being sent to</td>
<td>The system should not stop quality from sending a coil to other OP's</td>
<td>Coils was not able to be sent to Steel Tech</td>
<td>Fail</td>
<td>Problem with the work order not being generated</td>
<td>2/11/13</td>
</tr>
</tbody>
</table>

|   |   |   | other outside processors | Should flow similarly as it did before except with more detail | RD was set to 3 and the sample was added to the plan | Pass | Bug was fixed | 2/15/13 |
| 1 | 1b| 27 | PP=5, PPconnect = 1 lap | Add 3 to RD, sample to plan | RD was set to 3 and the sample was added to the plan | Pass | Bug was fixed | 2/15/13 |
| 3 | 3d| 28 | Move coil to TUR location | Start button will appear | Start button appeared | Pass | Logic for button was implemented | 2/15/13 |
| 3 | 3e| 29 | Record end time | Call will move to bottom and "reprocess" button will appear | No button appeared | Fail | This function was moved to Phase 2 of the project due to unforeseen complexities | 2/15/13 |
| 5 | 5 | 30 | Inserted data | Data gets saved and screen refreshes | Data gets saved and screen refreshes | Pass | Program was modified to accommodate data type change | 2/15/13 |
| 11 | 11 | 31 | Coils should flow through the system similarly when they are being sent to | The system should not stop quality from sending a coil to other OP's | Coils was able to be sent to other outside processors | Pass | Work order issue was fixed | 2/15/13 |

Figure 28: Test Scripts
7. Conclusion

When Gallatin Steel Company was founded, it was not designed to accommodate any outside processing, including quality processing. As the business grew, business processes as well as system processes were patched together and were never really looked at from a holistic view. When the decision was made to build an internal Processing Line in an attempt to gain market share, GSC saw the opportunity to improve the process from the top down. By simplifying its business processes, GSC was able to modify its current system to greatly improve visibility and efficiency in respect to quality processing. I believe that in due time GSC will also see efficiency improvements in other areas as a result of this project because they will not be spending as much time on non-value added work that was previously being done. Gallatin Steel Company can now efficiently perform quality processing as an internal part of its ever growing organization.

This project taught me several valuable things about project management and software development that I will take with me throughout my career. One of the things that I learned from this project was that no change is a small change. Applications in an ERP software suite are so intertwined that when a change is made, there is a ripple effect throughout the whole system. Another thing that I learned was that it is very easy to let a project grow passed its initial scope. Several times throughout the project I had to remind users what the deliverables were for this project and if it did not impact those deliverables, it would not be included in this project. The biggest thing that I learned from this project was that introducing something new to users is a monumental task all by itself. Convincing users to change was one of the greatest non-technical challenges that I faced. I had to defend why it was necessary show how the change improved the job of each individual that was affected. I believe this will help me throughout the beginning of my career and into the foreseeable future.