Team Consulting Facilities Planning Project Brief

Consolidated Manufacturing Solutions (CMS) specializes in producing structural frame rails for commercial trucks. Their main facility is located in Southwest Virginia near Roanoke, however they have a global supply chain network and production facilities around the world. Their various manufacturing plants supply nearly 50% of the structural frame rails for major commercial truck manufacturers both in the region and across the country. As a leader in the production of commercial truck frame rails, they have perfected their manufacturing processes for steel. For the last century, steel has been the prevalent material used for commercial frame rails due to its structural properties, ease of manufacture, availability, and relative affordability.

New government emissions regulations mandate that all commercial vehicles produced after 2017 have reductions in both carbon emissions and fuel consumption. These new regulations are quite aggressive and range from nine to 23 percent reductions within the next two years. In order to achieve these lofty goals, the commercial truck industry has begun seeking any and all potential solutions for weight reductions for any part of the truck and efficiency improvements for all aspects of the drivetrain.

CMS has determined that changing the base material will provide the highest weight reduction potential of the frame rails. Based on tests of an assortment of materials, reductions in frame rail weight could range from 15-55%; with higher values being produced from new carbon fiber composite materials which have become prevalent in the high end automotive industry. While the new carbon composite materials would produce the highest weight reduction, CMS has decided to pursue a more conservative material selection of high strength aluminum. The particular grade of aluminum selected has material properties similar to steel with only a minor increase in thickness. CMS can leverage much of its existing processing knowledge in the development of a new facility or renovation of an existing facility with aluminum as the material for manufacturing commercial frame rails.

Your consulting firm has been tasked with creating a plan for either renovating the existing steel plant or creating a new manufacturing production facility to produce commercial truck structural frame rails out of high strength aluminum. They have requested that your firm construct a plan which includes decisions regarding the location, physical design/layout, and material handling considerations for the new facility. The remainder of this brief will provide you with relevant background information regarding their existing steel production process and required changes needed to allow aluminum production. Additionally, some specific concerns have been raised about aspects of the location, design, and material handling systems which CMS would like you to address in your comprehensive facilities plan.

Given that this plan will be distributed to the Board of Directors, they have requested that your comprehensive plan meet formatting and content guidelines found in the provided separate document.

1. Specifics for Facility Location Decisions:

Four different locations are being considered for the new aluminum structural frame rail facility. These locations include: (1) expanding or renovating the existing Roanoke facility to accommodate aluminum, (2) building the facility within five miles of the Roanoke plant, (3) placing the new facility in Dublin near one of the main manufacturers which CMS supplies, or (4) constructing the facility in Asia. Each potential location has some areas of consideration in which the Board is interested in your opinions, expertise, and analysis.

1.1. Expansion of the Roanoke Facility

Expansion of the current Roanoke facility would allow much of the existing infrastructure to be utilized in the new facility. This would likely save the bulk of costly capital investments as well as allow current supplier networks to be used. Depending on the material handling and process selection decisions, it may be possible to continue producing both steel and aluminum frame rails within the same facility.

A key drawback of expanding or renovating the existing facility is the disturbance of existing production of the steel frame rail line. Any construction on the facility would cause a significant decrease in production rate and renovations would lead to an extended closure of the facility. While the Board would entertain this as a proposed option, they are hesitant to stop production as this would strain the rest of the production facilities in the CMS network.

Additionally, concerns have been raised by the manufacturing design division about the difference in processes for aluminum versus steel production. Material handling systems throughout the facility would also be impacted by this change since magnetic systems are prevalent in the facility.

1.2. *Local (less than five miles) New Facility Location*

Another potential location has been identified within five miles of the current Roanoke CMS plant. This location is favorable due to the presence of three large former UPS warehouses which could be used as part of the new facility. With ample space, existing underground utilities infrastructure, and commercial truck grade paved roads, this location has many amenities which would reduce upfront costs.

One of the main motivating factors for UPS' departure from this facility was a recent environmental survey that found two rare species of frogs residing in the woods surrounding the facility. These species are dangerously close to extinction and currently on the endangered species list. While these frogs remain on the list any expansion requiring the

destruction of the surrounding foliage is prohibited. There is concern from the Board that this location could have serious financial and public relations costs if anything were to happen to this species during the retrofit and expansion of the facilities currently on the property.

1.3. Dublin, VA Facility Location

One of the larger commercial truck manufacturers is located in Dublin with a comprehensive assembly facility. A portion of the existing Roanoke steel frame rail production gets trucked directly to the Dublin facility less than fifty miles down the road. The location in Dublin is a large plot of land with potential for development into an aluminum frame rail processing facility. Overall, the site is ideal for a manufacturing facility due to being both flat and within a reasonable range of utility connections to support the power and water demands of the plant. There is interest among the Board for developing this site with its favorable proximity to an existing customer and large property with room for future development should demand continue to increase.

While this location does seem to be a viable option, there is a problem with how close the parcel is to Dublin. One of the Dublin elementary schools is less than half a mile from the site and some citizens have shown concern for this new potential project. While it is clear that the city of Dublin has an interest in bringing in additional manufacturing facilities, there has been some anxiety related to both environmental impacts of the new plant on the surrounding community as well as potential noise pollution. Given this limitation, the Board would like for your firm to evaluate the issues associated with locating a manufacturing facility so close to a surrounding community and if there is any precedence with other companies.

1.4. Asia Facility Location

Manufacturing has become a booming source of industry for many companies in Asia. Recognizing the prevalence of manufacturing within Asia, the Board would consider outsourcing the facility. There are a number of positive and negative aspects to establishing the plant in Asia. The Board is interested in better understanding these factors and would like to be briefed on not only the financial implications, but also how this facility location would be perceived from a public relations perspective. With the financial implications, the Board is specifically curious about the increased logistical costs of locating a facility in Asia. Their concerns on this matter include the development of a new supply chain network within the region, shipping of goods to the customer, and increasing the time to delivery for customers.

CMS has requested that in your facility plan proposal you address and critically evaluate each of the four potential location options. Due to the audience, a numerical analysis of the facility locations is not necessary. However, your consulting team is encouraged to judiciously assess both the advantages and areas of concern for each potential facility site. In addition to the cost and logistical implications of each facility, the Board is keenly interested

in the ethical and societal implications of each location. As part of your facility plan proposal, select the leading site location based on your analysis.

2. Specifics on Facility Processes/Design Decisions:

A process chart for the current steel frame rail production process can be found in Appendix A. The projected changes to this process flow with aluminum production have been described in the process chart found in Appendix B. Individual department space requirements for the existing steel production processes can be found in Appendix C. The current layout of the steel frame rail production process for the Roanoke plant is found in Appendix D and includes the dimensions of the building in feet. Should more detailed information regarding the current processing capabilities, sequencing, flow, or layout be needed, the Board has agreed to provide these resources as necessary.

Within the facility, there are a few challenges which should be considered by your team. First, the existing receiving area and roll former are not set up for handling aluminum which is a softer material and more prone to scratching. The manufacturing team has deemed that a much larger area will be needed to handle a roll former geared towards aluminum production.

Heat treatment needs to be addressed as the existing structures are geared towards steel production and not sufficient for aluminum. The temperatures would cause significant deformation in the aluminum material. Accordingly, two separate heating and cooling operations are needed to properly treat aluminum. A similar issue is also present with both the existing plasma and laser cut stations as the current equipment would cause issues with the structural properties of aluminum. In order to compensate for these issues, the manufacturing team has identified new processing operations which would be sufficient and are listed in the department listing found in Appendix C.

From a layout and design perspective, the Board is interested in how you would renovate the existing facility or create a new layout for the creation of aluminum structural frame rail components for commercial trucks. The Board would like you to either critically evaluate the issues related to switching to aluminum production in the existing location or design a new facility at one of the alternative sites. Additionally, they would like an analytical solution to the facility layout problem posed by the new material. Use one of the different facility layout algorithms to create a plan for the new or renovated facility and justify why this algorithm is sufficient for this problem.

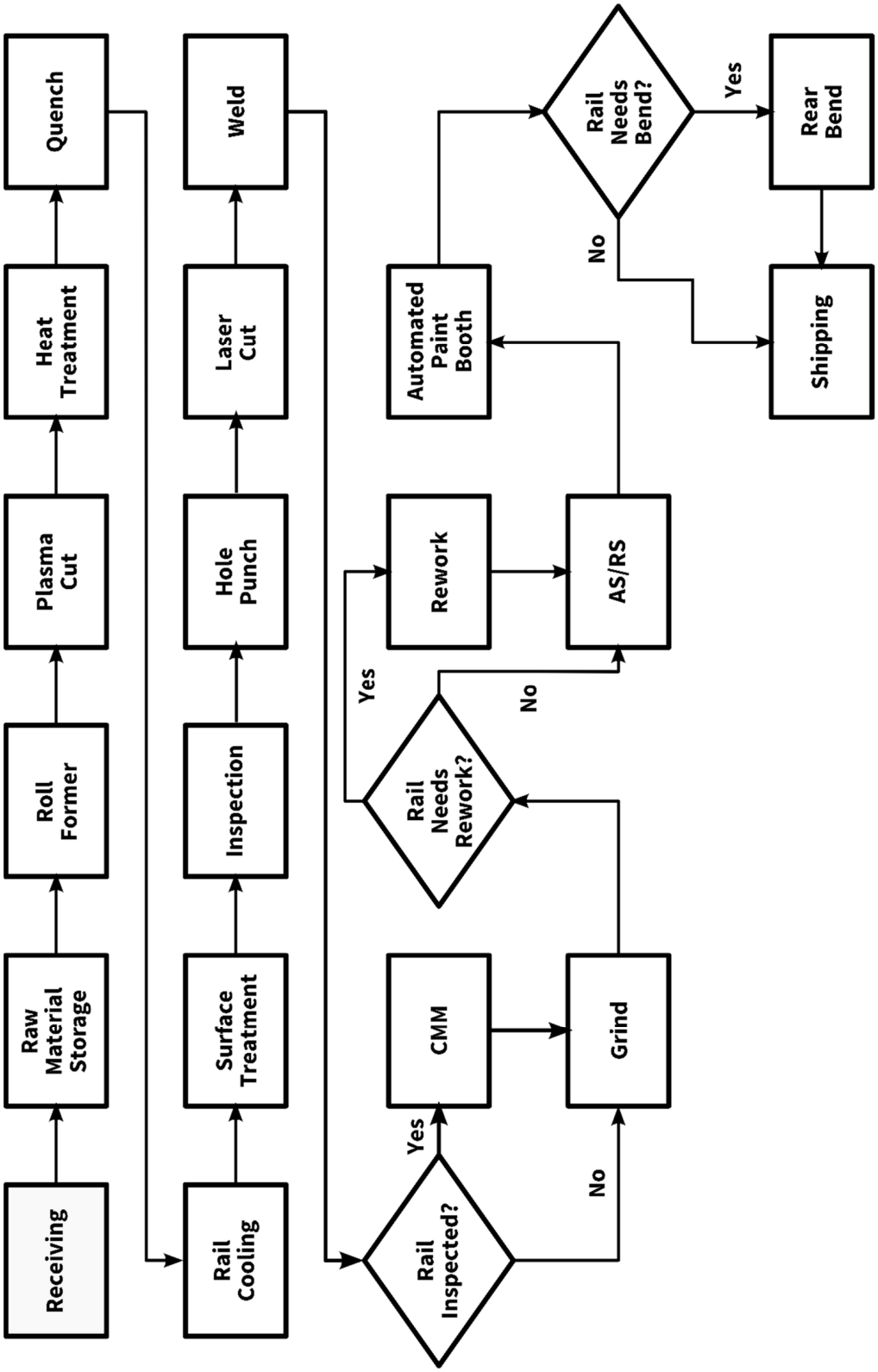
3. Specifics on Facility Material Handling Systems Decisions:

Materials within the steel production facility have been moved using a combination of motorized conveyors and magnetic material handling systems. Transitioning to aluminum

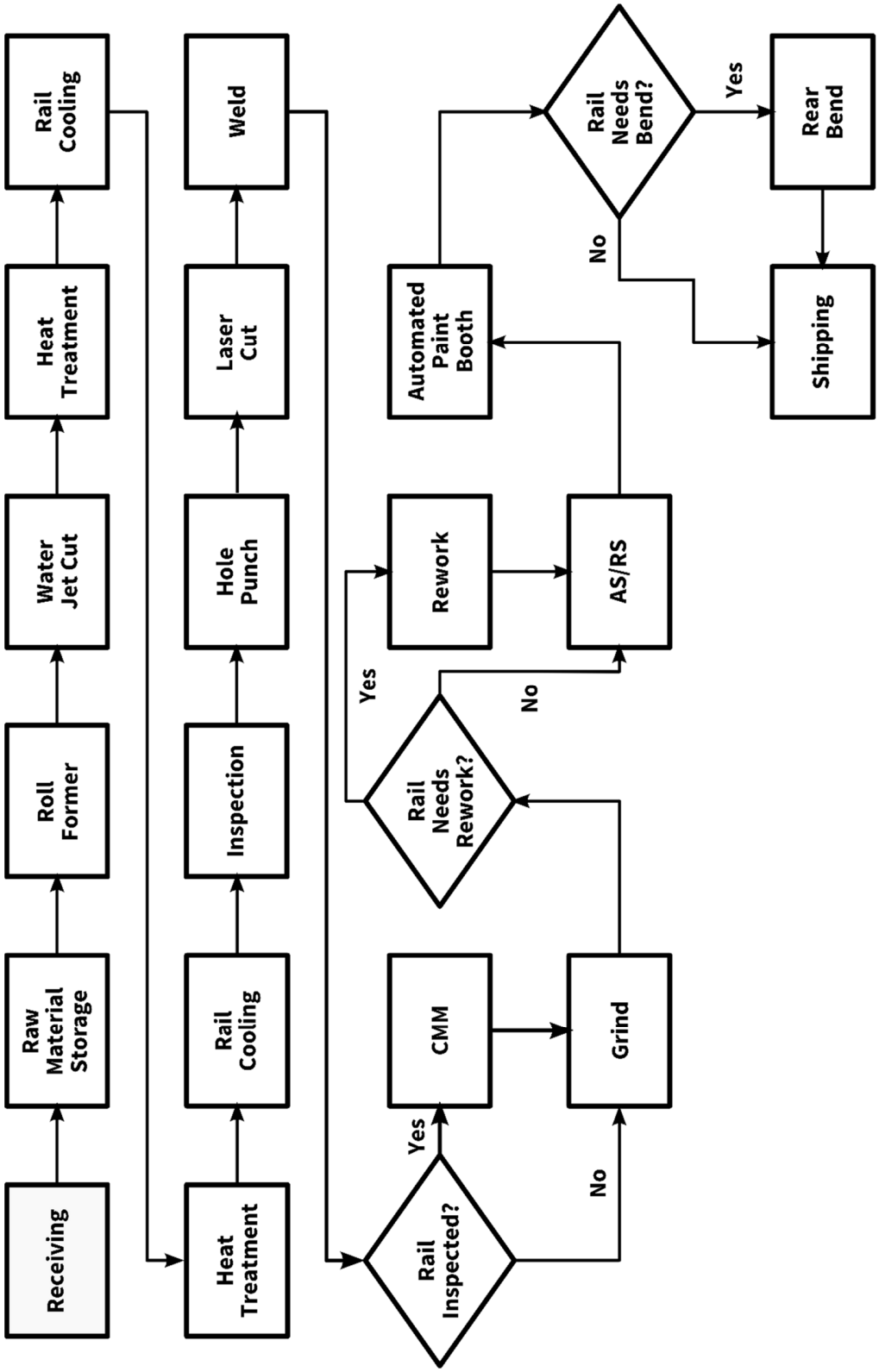
requires that the material handling strategy be changed due to the non-ferrous nature of aluminum. The facility layout shown in Appendix D depicts the general flow of materials through the facility. While the material handling systems have been omitted from the figure, the arrows show how material flows through the facility. Magnetic material handling has been used in the majority of scenarios when a frame rail needs to be lifted, flipped, or rotated during processing. Taking this into consideration, the Board is seeking innovative solutions to dealing with the new material handling needs of the facility. Specifically, the proposed material handling system must have the ability to lift, flip, rotate, and move aluminum from precise locations. Given that aluminum is a relatively soft material, the selected system should not scratch the surface as this could lead to degraded final performance of the material.

Another specific challenge with the existing facility is related to the grind rooms. Should both materials be processed in the same grind room, there is potential for the steel and aluminum particulates to mix with a spark and create a dangerous thermite reaction. If the decision is to use the existing facility, this problem should be addressed.

Appendix A: Process Flow of Steel Frame Rail Production



Appendix B: Proposed Process Flow for Aluminum Frame Rail Production



Appendix C: Departmental Space Requirements

Current Steel Production Departments

Department Name	*Length (feet)*	*Width (feet)*	*Total Area (ft^2)*
AS/RS	525	20	10500
Automated Paint Booth	140	160	22400
CMM Inspection	60	30	1800
Grind	45	50	2250
Heat Treatment	50	120	6000
Hole Punch	75	60	4500
Inspection	50	10	500
Laser Cut	27	30	810
Office Space	100	150	15000
Plasma Cut	100	45	4500
Quench	50	85	4250
Rail Cooling	45	75	3375
Raw Material Storage	100	55	5500
Rear Bend	120	55	6600
Receiving	50	35	1750
Rework	50	30	1500
Roll Former	180	30	5400
Shipping	50	225	11250
Surface Treatment	30	20	600
Weld	50	45	2250
		Department Totals	110735
		Facility Totals	247450

Aluminum Department Changes

Department Name	*Length (feet)*	*Width (feet)*	*Total Area (ft^2)*
Roll Former	250	50	12500
Heat Treatment	100	75	7500
Water Jet Cut	75	75	5625
Laser Cut	50	50	2500
		Department Totals	28125

Appendix D: Current Steel Frame Rail Production Facility Layout