SUSTAINABILITY PROPOSAL
Aluminum: Sustainable Solutions

Design Team # 4
HANK Corporation
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Submitted to:
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SECTION 1 EXECUTIVE SUMMARY

The goal of the project is to take advantage of aluminum’s intrinsic properties for the purpose of increasing the efficiency or sustainability of products and product systems throughout Penn State University Park campus. After taking everything into account, the design team decided to replace the concrete loading docks with aluminum grating.
SECTION 2  INTRODUCTION

2.1  LOCATION. The loading dock is located at Findlay Commons in University Park, PA.

2.2  CAMPUS SETTING. An outdoor environment where goods are easily transported to a specific location.

2.3  WHAT IS SUSTAINABILITY. “Sustainability is based on a simple principle: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations. Sustainability is important to making sure that we have and will continue to have, the water, materials, and resources to protect human health and our environment.”

2.4  BENEFITS OF ALUMINUM. Aluminum is a lightweight, strong, and versatile material that is highly recyclable. Aluminum can provide the needs of the efficiency of energy usage and creating sustainable solutions. Due to aluminum being highly recyclable, it allows new products to be created with a fraction of energy used without sacrificing performance.

2.5  SUSTAINABILITY OF ALUMINUM. Aluminum is the most abundant metal in the earth and is round up as aluminum silicate in clay, minerals, rocks, and gemstones. Aluminum is malleable and ductile. It is also highly resistance to weathering and corrosion. When exposed to air, aluminum quickly forms an oxide layer on its surface that protects the metal from further corrosion. The life cycle of aluminum has advantages when it comes to recycling the material with the primary benefit of recycling being the reduced energy consumption. Large exposure to aluminum can be toxic to human, but high exposures levels are typically limited to miners, aluminum production workers and dialysis patients. In general, aluminum is not significantly bio accumulated in plants and animals.

2.6  CURRENT PRACTICES. For loading docks, aluminum would be less susceptible to rust. Aluminum also has about one-third the weight of several metals like iron and steel so easier to build with aluminum. It also is effective at supporting heavy objects. Aluminum becomes stronger in winter time, but also will not warp in warm weather. Due to its high strength and low weight, aluminum can be used to make curtain walls or windows. Lastly, it also has a great amount of flexibility and can stretch under loads or bounce back from shock of impact.

2.7  GUIDING PRINCIPLES. We strive for cheaper material cost and higher efficiency of loading docks which can be accomplished by using aluminum.
2.8 STAKEHOLDER ENGAGEMENT. The stakeholder of the project will be Alcoa. The stakeholder may be affected by cost of building material but also may get accredited for the loading dock.
SECTION 3  BACKGROUN

3.1 SPONSOR BACKGROUND. Alcoa is the world’s leading producer of primary fabricated aluminum and the world’s largest miner of bauxite and refiner of alumina. Alcoa innovation has been behind major milestones in aerospace, automotive, packaging, building and construction, commercial transportation and consumer electronics markets. Alcoa employs approximately 61,000 people in 30 countries around the world and has been inventing the modern day aluminum industry for 125 years.

3.2 PROJECT OBJECTIVES. Identify opportunities across the campus to take advantage of aluminum’s intrinsic properties for the purpose of increasing the efficiency or sustainability of products and product systems.

3.3 PROJECT BACKGROUND. Aluminum is a lightweight, strong, and versatile material. Since the discovery of the process to economically produce aluminum in 1888, it has played an important role in many markets. From the Wright flyer to the Boeing 787 Dreamliner, from cookware to high performance automobiles, aluminum has been the material of choice. Today, increasing the efficiency of energy usage and seeking solutions that are increasingly sustainable are of extreme importance, and aluminum can provide solutions to meet these critical needs. Its strength and light weight allow aircraft and ground vehicles to save fuel while providing us with the performance we need. Aluminum is highly recyclable, allowing new products to be created with a fraction of the energy use without sacrificing performance. In fact, over 70% of the aluminum ever produced remains today.

3.4 SCOPE OF THE PROPOSAL. The Design Team is proposing the aluminum grating loading dock to replace the concrete loading dock in Findlay Commons. Replacing the concrete loading docks will not only be sustainable, but it will also be cost effective when it needs to be replaced. The proposal is sustainable because aluminum can be recycled, so when the loading dock is broken, the aluminum can be used for other products. Aluminum is also cost efficient because of how it is a lightweight, strong, versatile material.
SECTION 4  QUALIFICATIONS

4.1  CREDENTIALS. All design team members are first and second year students in the College of Engineering at Penn State University.

4.2  DESIGN TEAM MEMBERS. Our Design Team includes:
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SECTION 5  METHODOLOGY

5.1  GOALS. Reduce building cost as well as to increase sustainability.

5.2  METHODS. We brainstormed to come up with our idea of loading docks. The sustainability proposal originated from Alcoa. We gathered data from the power point slides as well as using Google Search. We analyzed the data by searching for data relevant to aluminum’s intrinsic properties and chose the properties which were tailored to our specific idea.

5.3  IMPROVEMENTS. Implementing the aluminum grating in the loading dock will reduce the cost in the long run and be more sustainable. It will reduce cost in the long run because overtime, concrete tends to deteriorate and will cost more to repair. Aluminum also does not rust due to oxidation. If the aluminum happens to break, it will not only cost less to replace but, will also be able to be recycled which will increase sustainability.

5.4  IMPACT. The aluminum grating will have an impact on safety around campus and the surrounding region. With the previous concrete loading docks, when the concrete will deteriorate, it will eventually fall off and/or create ditches in the platform. These falling pieces could end up causing people to trip or may possibly even hit them. The ditches in the platform can cause people to fall depending on the size. The aluminum grating will increase safety because it will be durable enough that it will be tough to break. Even though the grating has holes in it, the holes are small enough that it will make it difficult for someone to accidentally hurt themselves while stepping on the aluminum grating platform.

5.5  ESTIMATED COSTS. The estimated total costs for the project is $1,500. $672 for material, installation would cost around $828. Because of aluminum’s properties, the long term cost, as well as the maintenance cost would be little to nothing. Aluminum gratings costs are higher at first but over time it will less expenses then the current material used to make loading docks right now.
5.6 MODEL.

The photo on the left shows a forklift on the aluminum grating in the loading dock. The photo on the right is a close up of the grating. These renderings were created in SolidWorks.

5.7 IMPLEMENTATION. First the current loading dock at the Findlay Commons would have to be torn down and then a building crew would have to be hired to build the new loading dock.

5.8 SCHEDULE. This project would be started immediately with the demolishing of the current loading dock. After that the new loading dock would have to be built fast because the loading dock is a necessary part to the Findlay Commons.
SECTION 6  DISCUSSION

We replaced the loading dock with aluminum and noticed it is more durable. We also noticed that there was some damage to the aluminum dock though. I hypothesize that a truck or large car collided with the aluminum dock. Aluminum can be recycled to be used to build something else. Thus, our proposal can be applied in a broader context since aluminum can be easily recycled.
SECTION 7 SUMMARY

With aluminum, you can detect if there is a sign of flaw so it is safer. Strengths of our proposal would be cost efficiency and sustainability. Weakness of our proposal would be that the loading dock could still get damaged. An advantage is that aluminum can be recycled to build something else. Disadvantage would be that we would need to tear down the existing loading dock. Aluminum can be recycled so you can use it anywhere.