Pool Lift Optimal Design Report

Pool Lift for Zak Mahoney

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Project for Mahoney Family

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1. Pool Lift Optimal Design

1.1 Introduction

The optimal design for this project will be one that mounts the pool lift directly to the pool deck. The deck mount would be set off to the side of the deck and be somewhat permanent, but the lift could be removed as needed, for times such as storage in the winter. The harness that will be used will provide as much support as possible for Dominic as he is being transferred in and out of the pool to ensure his safety.

This design was chosen over the other two for safety and price concerns. A mounting system on wheels could turn out to be quite dangerous for the client, as it could begin rolling as Dominic is using the device. On the other hand, creating a cement base in the ground for the pool lift would require hiring a contractor to come in and make the base for the team to ensure it was up to code with Connecticut laws. This would increase the cost exponentially and not be worth all the hassle.

1.2 Subunits

1.2.1 Base

The base being used for this design would be made of stainless steel to ensure it will support the load of the lift. It will feature a 12” by 12” plate, with 4 holes in it for 0.5” diameter nuts and bolts to secure it to the pool deck the Mahoney family will be building. Centered on this plate will be a stainless steel pipe with an outer diameter of 4” and a wall thickness of 0.5”. The cylinder will stand 8” tall. This will allow for the pool lift to both fit inside the base properly and be adequately supported. The base will be covered with a white epoxy powder coat finish to match the pool lift. The design of the base can be seen in Fig. 1.

![Figure 1: Base of pool lift design.](image)
1.2.2 Pool Lift
The pool lift will be a pre-purchased part for this project, and as of now, will be the EZ Pool Lift made by Aqua Creek with an item number of F-03EZPL. It will feature a hydraulic lift system that allows the lift to support up to 400 pounds. It is made up of stainless steel protected against the environment with a white epoxy powder coat finish. The lift will be manually rotated and operated by the client's family. It will have an operating range of 53”. Figure 2 shows the pool lift that will be used.

1.2.3 Harness
The major modifications being made to this design can be found in the harness system. The system already comes with a mesh sling which could be used to move Zak in and out of the pool, but this sling would require his parents to move him from his wheel chair into the sling. This will become increasingly difficult as he grows older. Therefore, a harness system will be implemented in place of the sling. Zak can put the harness on while he is still in his wheel chair, before the harness is attached to the pool lift itself. First, Zak will put his legs through the loop holes at the bottom of the harness. Next, the harness will be pulled underneath him before he passes his arms through the shoulder straps. The harness will then be secured by tightening the straps to secure him in the pool lift system. Two metal carabiners will be attached to the shoulder
straps. The existing chains and sling attachment device can be used to attach the harness to the pool lift. The system features a stainless steel bar which will feed chains down to be attached to the carabiners on the shoulder straps. The bar attaches to the chains by a quick release mechanism. The harness to pool lift fixation bar, its quick release clips, and the harness itself are shown below in Figures 3 through 5.

Figure 3: Lift to harness fixation bar.

Figure 4: Harness safety clip.
2. Realistic Constraints

2.1 Engineering Standards

Engineering constraints include the choice of material which will be used to construct the base of the pool lift and the materials used to construct the harness. The base must be strong and stable enough to support Zak’s weight and the weight of the pool lift. Furthermore, the deck must be strong enough to support the pool lift. Use of a strong wood of appropriate dimensions should provide a safe surface to which the pool lift can be bolted. The sling is effective for most assistive pool lift applications, but Zak will require extra support and stabilization for this project to be safe.

2.2 Economic

This project must remain within the budget. With the pool lift being purchased prefabricated, additional purchases should be kept to a minimum. Materials for the modifications to the harness can likely be harvested from the treadmill support system for Dominic. These materials would include extra nylon straps and rigid stabilization components.

2.3 Sustainability

This project will be used by the Mahoney family for years. In order to maximize the life of the pool lift, it should be easy to remove from the deck during the winter months. Since the deck...
mount consists of a few bolts to the deck, unfastening the bolts should be simple enough for the lift to be removed during winter months. The use of stainless steel components and the epoxy coat finish will provide corrosion resistance to the lift, further maximizing its life time.

### 2.4 Manufacturability

Since the pool lift is being purchased pre fabricated, there are not many manufacturing constraints to consider. Perhaps the most prominent is constraints of attaching the rigid components to stabilize Zak within the harness to the harness. If the mesh is not strong enough, these rigid parts could tear out of the sling. When the sling is obtained, the design team will have a better idea of how the rigid components can be attached, and then decide whether a modified sling or a new harness solution should be implemented.

### 2.5 Safety and Ethical

Safety considerations have constrained the design to a fixed support system as opposed to a mobile base which was considered as an alternative design. Safety considerations will determine whether the sling can be modified to adequately stabilize Zak or if another harness needs to be implemented. The design team will have a better idea of what modifications need to be made once the sling is obtained.

### 2.6 Social

There are no social constraints of this pool lift. The social impact is on the Mahoney family, as now they have an opportunity to enjoy their pool with Zak even as he continues to grow larger.

### 2.7 Environmental

The pool lift will be environmentally friendly once mounted to the deck. The epoxy powder coating during manufacturing has little environmental impact due to the low to zero carbon emissions during the process and its low toxicity.

### 3. Safety Issues

The structural integrity of the lift is assumed to be safe, as it is a pre-existing product currently on the market. The lift itself is made of stainless steel, which will be more than adequate to support Zak’s full weight, and this is reflected in its rating to 400 lbs. The rock climbing harness which is being used here will need to be able to support Zak’s full weight as well. The harness being purchased is a children’s harness, and we will ensure it is rated to support Zak’s weight. As Zak gets older, a larger harness may need to be purchased to fit him and support his full weight. The base of the lift yields major safety concerns. If it is not strong enough, the whole lift could fail while in use. Additionally, if it is not secured in an appropriate fashion to the pool deck, it could detach while being used, and cause injury. By purchasing the existing deck mount which comes with the pool lift, we know that the base is compatible with the pool lift, and it will be able to support the lift with a 400 lb load at the end of it. The base features a 0.5" thick plate and cylinder, as well as the 4 0.5” diameter bolts used to secure the base to the deck. As long as
the deck itself is constructed properly and is well maintained, the pool lift will be safe for Zak to use.

4. Impact of Engineering Solutions

The impact that this will have on the Mahoney family will be great. Zak has enjoyed the Mahoney’s above ground pool for the time they have had it. Swimming provides Zak with great happiness and a valuable means of exercise. This pool lift will allow Zak to enjoy this pool into the years to come as he continues grows larger. The Mahoney family will now get to enjoy the pool together, enjoying time together as a family while using the pool with Zak.

5. Life-Long Learning

This project will challenge the design team to utilize engineering principles to ensure the pool lift is adequately mounted and stabilized on the Mahoney’s pool deck. Furthermore, we will need to analyze the harness system extensively in order to maximize stability and comfort while Zak is using it.

6. References
