

Project Deliverable C: Design Criteria and Target Specifications
GNG 1103F – Engineering Design
Faculty of Engineering – University of Ottawa

Team 3 F01

Jeremy Leung - 300167809
Jada Goodman - 300176802
Piotr Holocinski - 300124524
Simone Santos - 300108855
Zhili Wang - 300140458

Introduction

The effects that salt has on our modern infrastructure as a means of snow and ice prevention are detrimental. Our goal is to develop a design that will replace salt in many situations as a way to preserve buildings and pathways as well as nature. As we learned in class, benchmarking successful products is an important part of product development. Comparing products which can fulfill our requirements gives us an idea of what could work well, and which of our ideas haven't been tried yet. This document focuses on benchmarking 5 products which provide sensible solutions to the problem statement, and rank the importance of our needs and design criteria.

Translating Needs to Design Criteria

Based on the client statements, a list of needs has been outlined. The design criteria which are relevant to each need have also been listed.

#	Need	Design Criteria
1	Design is wheelchair accessible	Height (cm) Width (cm) Texture
2	Design has the ability to be upscaled	Cost (\$) Size (cm ³)
3	Design is easy to remove	Size (cm ³) Weight (kg)
4	Design is easy to clean and maintain	Material Size (cm ³) Texture
5	Design uses heat to melt ice	Exterior temp. (°C)
6	Design is compact	Size (cm ³) Weight (kg)
7	Design is able to withstand salt to a certain extent	Material
8	Design is modular	Size (cm ³) Connectability
9	Design is slip-proof	Texture Material

10	Design is easy to assemble and repair	Cost (\$) Size (cm ³) Connectability
----	---------------------------------------	--

Design Criteria

In order to ensure that the most important design criteria are taken care of first, they are listed below in order of importance, with a short explanation on the side. These are rated on a 5-point scale, and one criteria isn't necessarily more important than another if it's placed above a criteria with the same rating.

Design Criteria	Rating	Explanation
Cost (\$)	5	Not only is our budget limited, but the competition for our product is salt/salt alternatives, which are very cheap. The cost of our product is crucial to its viability
Height (cm)	5	In order to effectively assimilate our product during the winter, the height of our product
Exterior temp. (°C)	5	The exterior temperature is very important as it determines if our product will be useful or not, and has to be within a small margin.
Width (cm)	3	Width is important to us as it ensures our product will be storable and meet the sidewalk standards required by bylaw. However, depending on how connectable our design is, we may be able to overcome making our product any specific size.
Size (cm ³)	2	Optimizing the size of our product is important, but this will naturally come with the width/height adjustments. Size will have the biggest impact on storage/transportation, but it would take extremely odd sizes to outweigh the benefits it may have for other design criteria.
Connectability	3	While not a requirement for our product, it's likely to be the most effective method of covering large/long spaces. This also is likely to make transportation/storage easier.
Texture	4	The texture our design has is very important as it determines the extent our design will be slip proof.
Material	3	The material we use will affect how cost effective, slip-proof, and waterproof our design is. Looking into an ideal material is something that will be essential for our conceptual designs.
Weight (kg)	3	Similar to size, this mainly affects transportation/storage. Unlike size, however, it's easier for the weight to be a limiting factor for our product.

Benchmarking

The properties that are most relevant to us have been listed in the table below. Listing all relevant properties in a single table allows us to easily rank the merit of each product.

Product	<u>Heattrak Walkway Mats</u>	<u>WarmlyYours In-Ground Heated Sidewalks</u>	<u>Snow Melting Heated Mats</u>	<u>WarmlyYours Temp TempZone Mesh Floor Heating Kit</u>	<u>Solar Roadways</u>
Cost	≈ \$60-200/unit	≈ \$14/sq.ft	≈ \$200- 700/unit	≈ \$250-630/unit	N/A
Grip/Texture	Thermoplastic	Dependant on install. Cables go under the pathway.	Heated Cubes or Snowflakes	N/A	Tempered glass
Area	3870-11612 cm ²	14585 cm ²	2696.77-13935.46 cm ²	12500-46000 cm ²	4078 cm ²
Height	1.27 cm	0.6 cm	N/A	0.32 cm	3.56 cm
Exterior Temperature/ Melt Rate	5 cm/hr	Automatic or manual controls	7-10°C	Adjustable	N/A
Weight	6-100lbs	2.7lbs	10-54lbs	N/A	70 lbs
Power Source	Electrical Outlet, connected cables between units	Permanent Electrical Power installation	Electrical Outlet	Permanent Electrical Power installation	Solar Power
Electrical Requirements	120-240 V	120V	120-240V	120V	N/A
Connectability	Modular, connected by cables.	Can be connected, but install is permanent.	Can be connected, but not very built-in	Single roll-up matt of varying size, but installed underneath flooring	Modular but when installed it is permanent
Warranty	2 years	10 years	2 years	N/A	N/A

Target Specifications

Based on our benchmarking, needs, design criteria, and limitations, the design specifications for our product have been listed below. Separating the table into 3 metrics provides a clear framework for our product.

#	Metric/Specification	Relation	Value	Units	Verification Methods
Functional requirements					
1	Able to heat melt ice (Exterior Temp)	=	Yes	N/A	Analysis and Test
2	Modular Design (Connectability)	=	Yes	N/A	Test
3	Slip-proof (Texture)	=	Yes	N/A	Analysis and Test
Constraints					
1	Cost	<	100	\$/unit	Compute
2	Height	<	1.5	cm	Measure
3	Width	<	3	ft	Measure
4	Weight	<	45	lbs	Measure
5	Exterior Temperature	=	0 - 5	°C	Test
6	Operating Environment: Snow	=	Yes	N/A	Test
7	Supporting Capacity	>	140	kg	Compute and Test
Non-functional requirement					
1.	Durability (Material)	=	Yes	N/A	Test
2	Safety	=	Yes	N/A	Test