FAST

A bike rack with frame locking

LUNDS UNIVERSITET

Degree Project for Bachelor of Fine Arts in Design
Main field of study: Industrial Design

2024

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From Lund University School of Industrial Design,
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ABSTRACT

This bachelor projects investigates current bike racks and the problems people might have with them. The goal is a newly designed bike rack with frame-locking that will solve the problems that today's bike racks on the market have.

Keywords: Bicycle, bike rack, modularity, public, outdoors

ACKNOWLEDGEMENTS

I want to thank my classmates, my supervisor Jasjit Singh, Conny and Jens for helping and guiding me throughout my project. I learned a lot and I am looking forward to finally start my life on my design journey.

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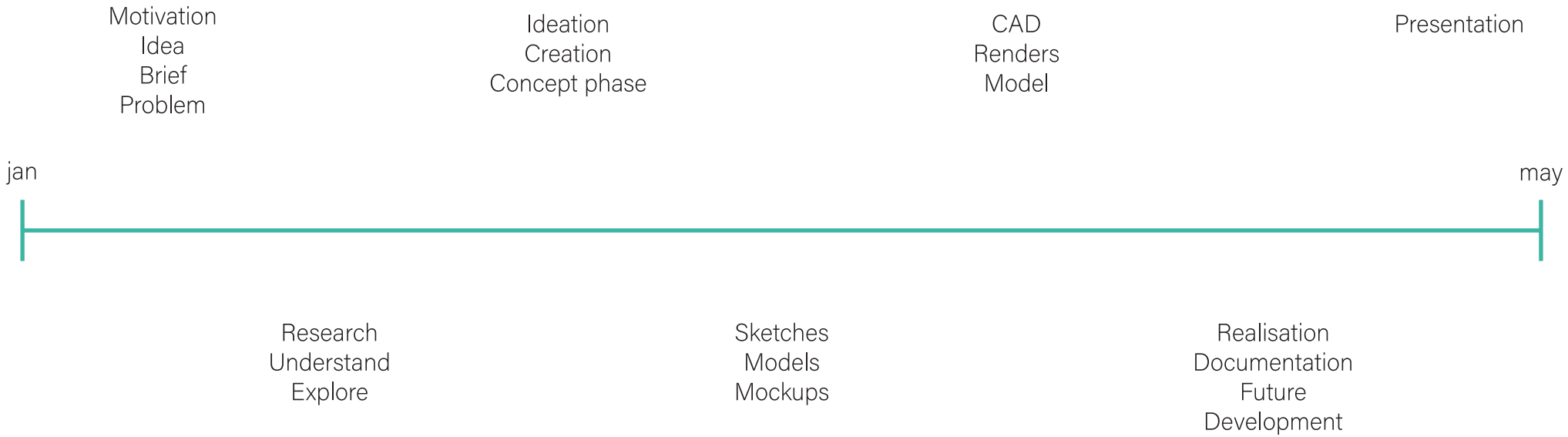
Motivation
Idea
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may
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MOTIVATION

During my 3 years spent in Lund cycling, I have pondered over all sorts of different bike racks found around the city. Very often, there has been irritation not only from my own experience but also from others when it comes to space, accessibility, and user-friendliness.

Being invested in cycling has motivated me to dedicate my thesis to designing a new bike rack that will hopefully fill the needs and criteria.

BACKGROUND

When discussing a sustainable society, transportation is often mentioned, ranging from cars to bicycles to walking. The bicycle is a great alternative as a sustainable transportation that benefits the environment, the individual, and is less affected by traffic congestion. (Samhällsbyggnadsförvaltningen, 2023-12-19). There are numerous advantages to choosing a bicycle as a means of transportation. Despite the fact that many people cycle today, especially in Sweden's bicycle-friendly cities, bicycles are parked most of the time.

In this bachelor project, I investigate current bicycle racks and how people choose to park their bicycles. What are the current issues with today's bicycle racks, and how can I potentially find solutions? My goal is not only to address practical needs but also to consider User-friendliness and sustainability. By combining my insights into cycling habits with identified problems in bicycle parking, I strive to offer a solution that is more lock-efficient, better spacing and intuitive.*

*Written with the help of Chat GPT

HISTORY
Why choose the bike?

Biking has many perks, not only for the environment but also to the health. By choosing the bike as a means of transportation you are choosing a healthy lifestyle. The bike contributes less to the environment in comparison to the car. "By choosing the bicycle for the 2 kilometer trip to work, you save the planet 86 kilos of carbon dioxide per year." (Välja cykeln istället för bilen, Håbo kommun).

An active lifestile reduces the risks of many diaseases such as metabolic diseases, cardiovascular diseases and mental illness.

BRIEF

Develop an innovative bike rack that maximizes space utilization, provides efficient locking and easy accessibility.

RESEARCH

Market Analysis

In today's market there are many different kinds of bike racks. From wheel-holding racks to a bike racks with two levels (that are hard to understand and use). The bike racks that offers frame locking is very often lockable on the front of the bike which makes it harder to reach the lock. Other frame locking bike racks only provides locking for the centre of the bike. Very few racks are eye catching for their design or coloured. I want to change that.

There is a gap in the market where a frame locking rack gives the biker the opportunity to lock their bike wherever they want, if that is in the front, the middle or the back part of the bike.

Through my bike rack, I want to communicate in an intuitive way with form how the bike rack should be used without any question marks arising as to how to lock your bike in the bike rack. My final design allows cyclists to choose to lock their bikes in the front, back and centre with the option of frame locking despite the different frame designs of bikes.

RESEARCH
Materials

The materials and surface treatment needs to have quality's that can be weather resistant: sun, rain, wind while still retaining the material's properties.

I came to the conclusion to use iron pipes because the pipes suited my design concepts and had the mechanical properties I strived for a material to have.

METAL

Iron or Aluminium

SURFACE TREATMENT

Electro-galvanizing
Creates corrosion protection by releasing zinc ions with an electric current

Powder coating is an effective barrier against corrosion. Brantviks Målarverkstad AB has a wide range of colours.

Hot-dip galvanizing also provides corrosion protection by dipping the material in hot liquid zinc.

FOUNDATION

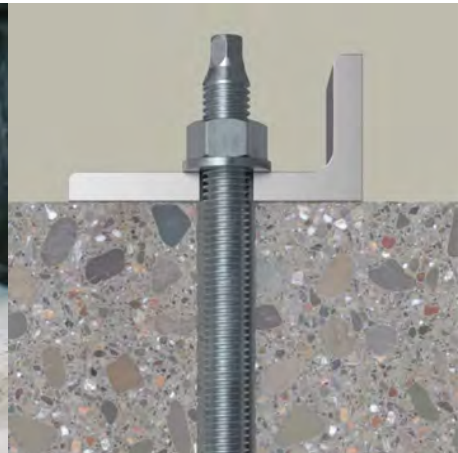
Concrete

ASSEMBLY

Anchor mass

ASSEMBLY

Anchor rod M12



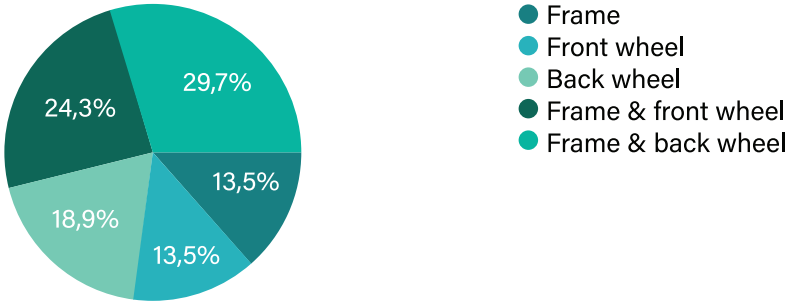
PROBLEM

The problem with today's bike racks are the narrow space between each parking spot. If you have a bag or similar it is hard to reach the lock because of the narrow space.

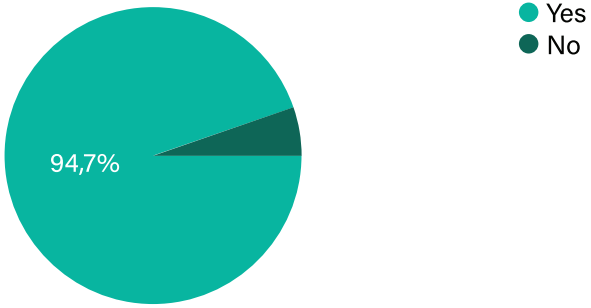
My goal is to design an universal bike rack that suits many different kinds of bikes and bikers.

RESEARCH
Questionnaire

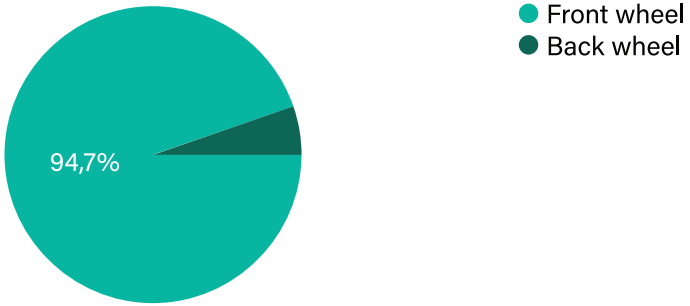
How do you lock your bike?



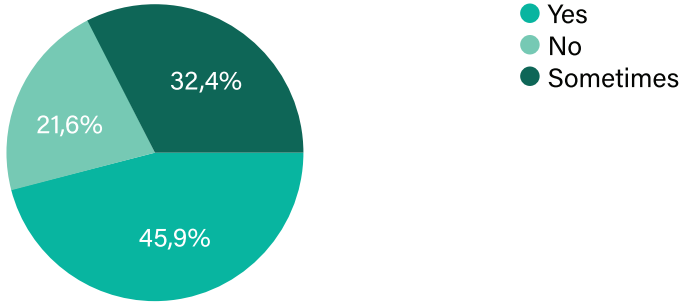
Do you find it cramped to park in a relatively full bike rack?



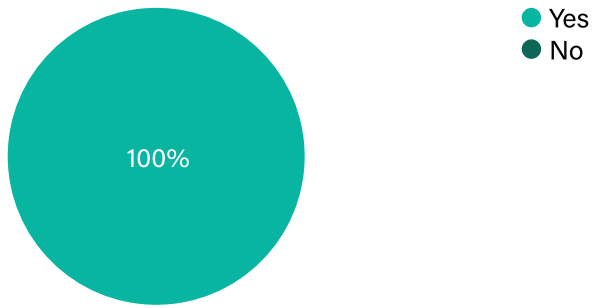
Do you park with the front or back wheel?



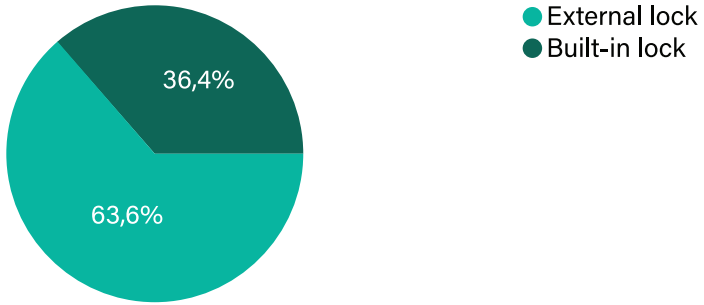
Do you find it hard to lock your bike when it's dark outside?



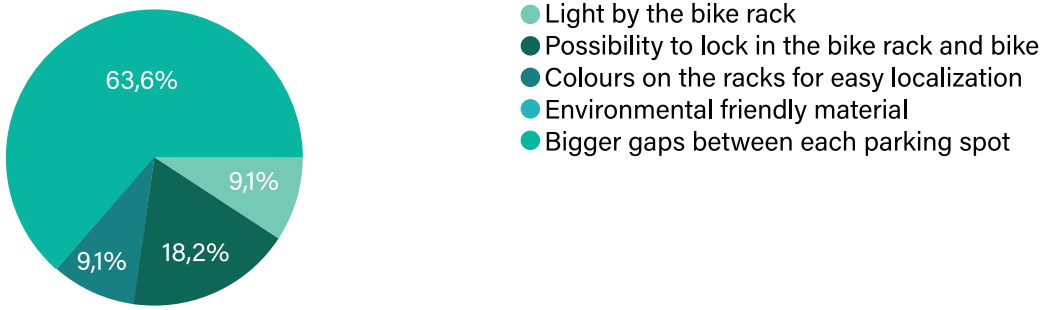
If possible, would you lock your bike in the bike rack and the frame?



Do you have an external lock or built-in?

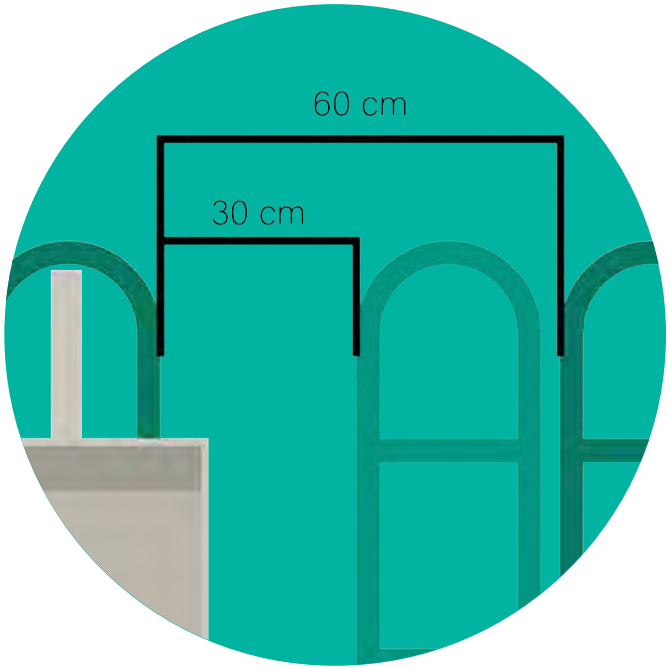


What is most important?



NEEDS

BF= basic function, N= necessary, D= desirable



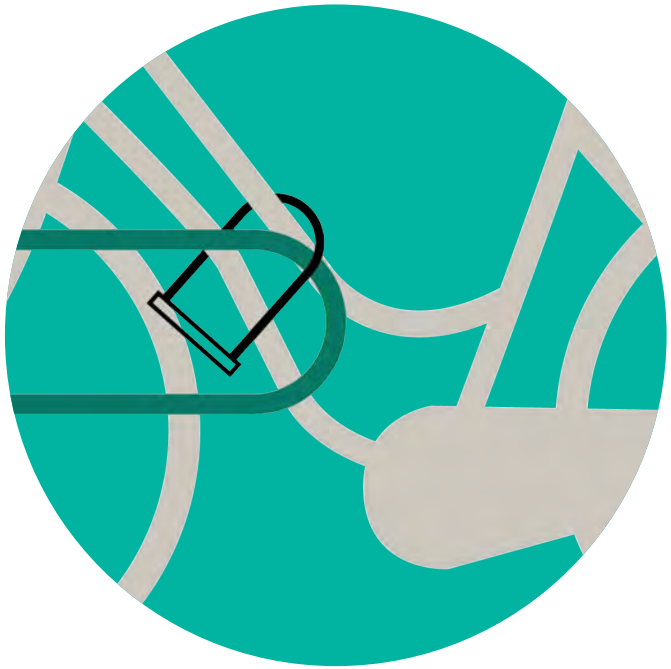
N

Bigger space between each parking spot

Colours on the racks for easy localization

D

Possibility to lock the bike with the bike rack



N

Graphics on the ground

D

AREAS

"The bicycle parking must be placed on the cyclists' natural route to the destination, i.e. adjacent to the bicycle network, and clearly visible so that the cyclists can immediately see where they can park." according to Trafikverkets handbook.

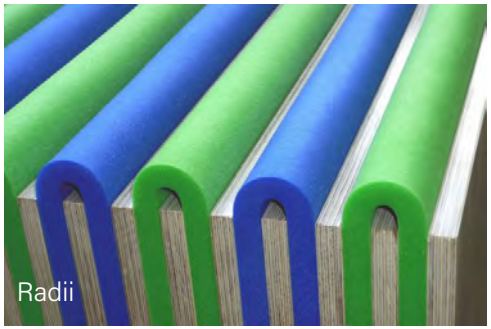
My bike rack will be suitable for the office, the school and residential areas. Each bike rack modul can be mounted on different kinds of terrains.

Residence: At least one bicycle space per resident and at least 0.2 visitor spaces per apartment. This means 2 places for an average apartment in Sweden.

Activity: Start from a travel habit survey that shows the proportion of cycling trips out of all trips and add at least 20 percent to gain height for increased cycling. With a bicycle share of 20 percent, there should be 0.22 spaces per employee, plus space for visitors.*

*Trafikverkets handbook


Peak and Valley


Radii

MOOD BOARD


Vibrant colours


Pipes


Race track

RESEARCH CONCLUSION

The main problem with current bike racks are the spacing between each parking spot. Most people from my research find it hard to park and unpark their bikes in a relatively full bike rack. The other problem I found was the accessibility to lock the bike with the bike frame and the bike rack that are minimal with the bike racks today. The racks that do provide frame locking accessibility only provides it in the front of the bike. It is more secure to lock the bike with the back wheel instead of the front wheel. After all my research I knew I wanted to do a bike rack that provided frame locking possibilities.

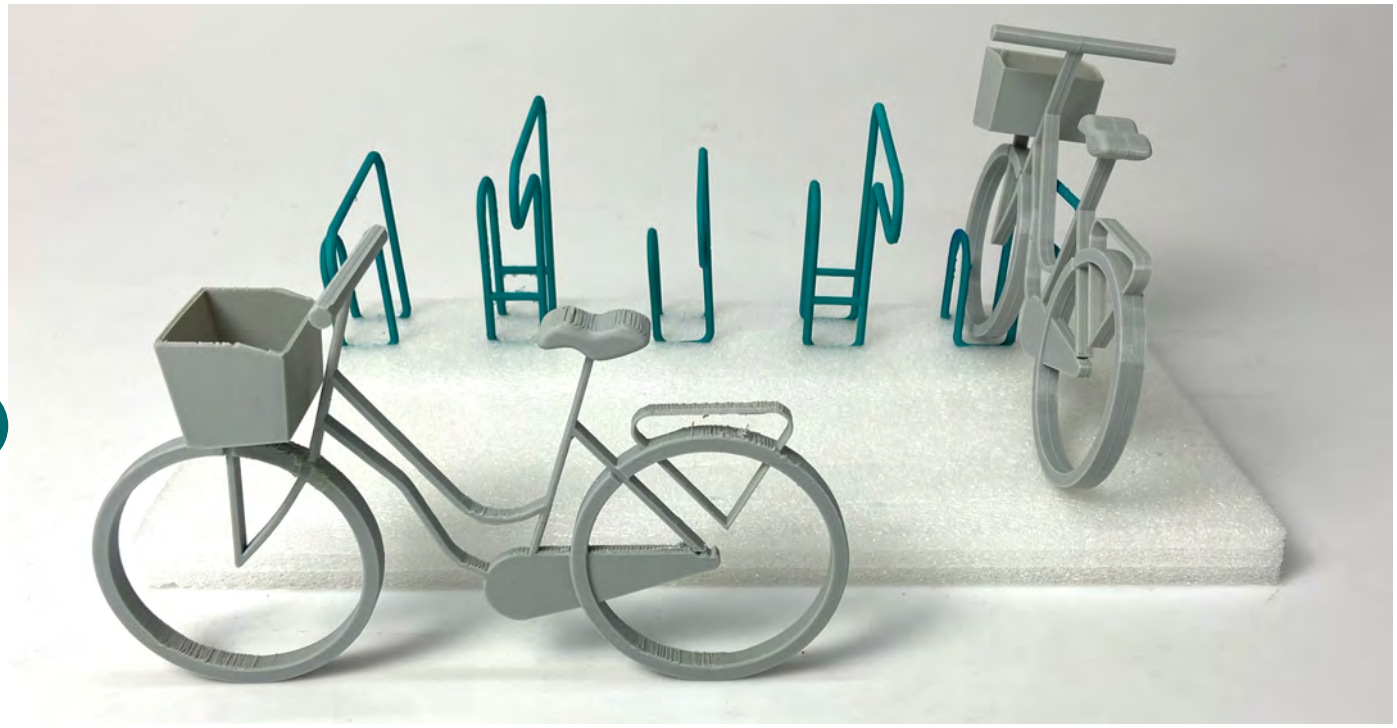
CONCEPT I

Concept 1 is a peak and valley solution for bicycle parking. Each bike rack offers frame locking at the front and in the middle. The distance between each parking space is also increased for greater accessibility.

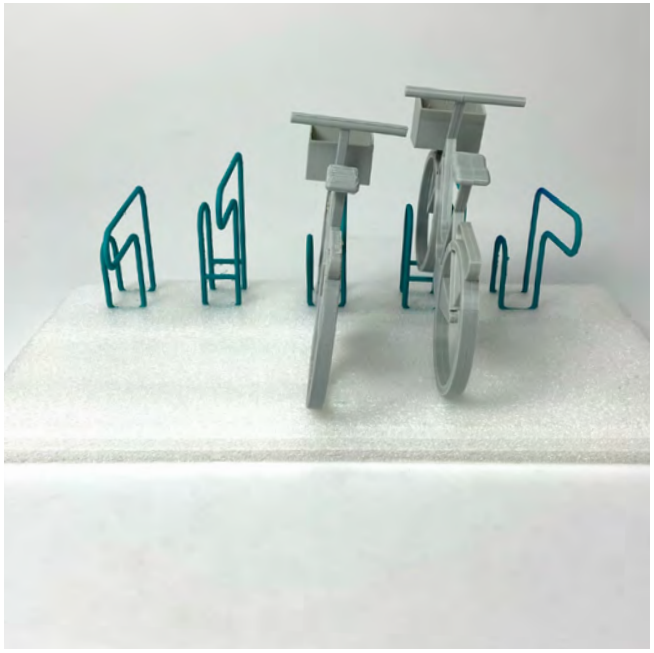
Models 1:10

CONCEPT II

Similar to concept 1 the second concept gives the opportunity to frame locking while also having the peak and valley solution. The design invites you to the left side of the bike rack while you are locking your bike.



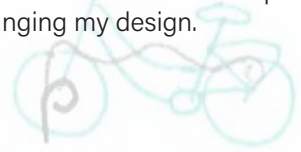
Models 1:10



RESTART 5


After presenting my two concepts at the kick-off presentations I had to rethink my project. How will my bike rack stand out and what is different from other bike racks?

The main idea with the bike rack is to increase the space between each parking spot AND having the possibility to lock the bike with the front wheel, back wheel and the frame. The bike rack will be suitable for a standard women's, men and child bike with a peak and valley solution. I also wanted to reduce the material by changing my design.

New sketches of concept III

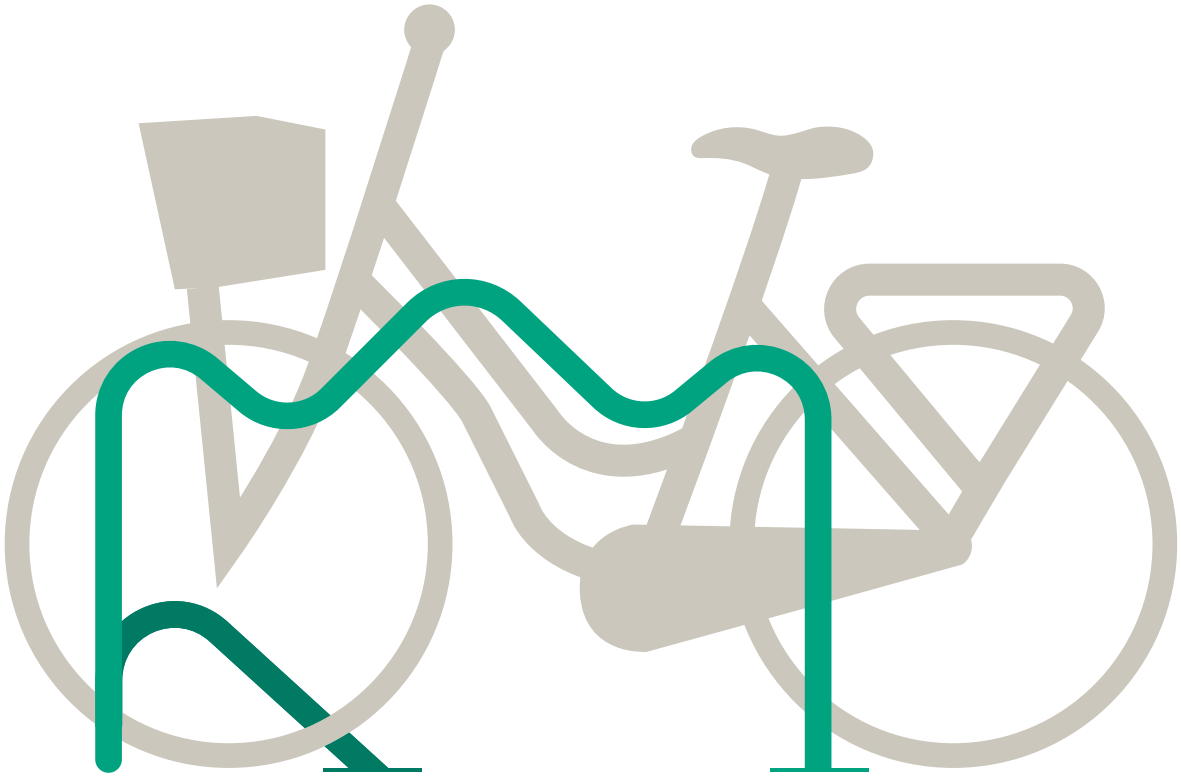




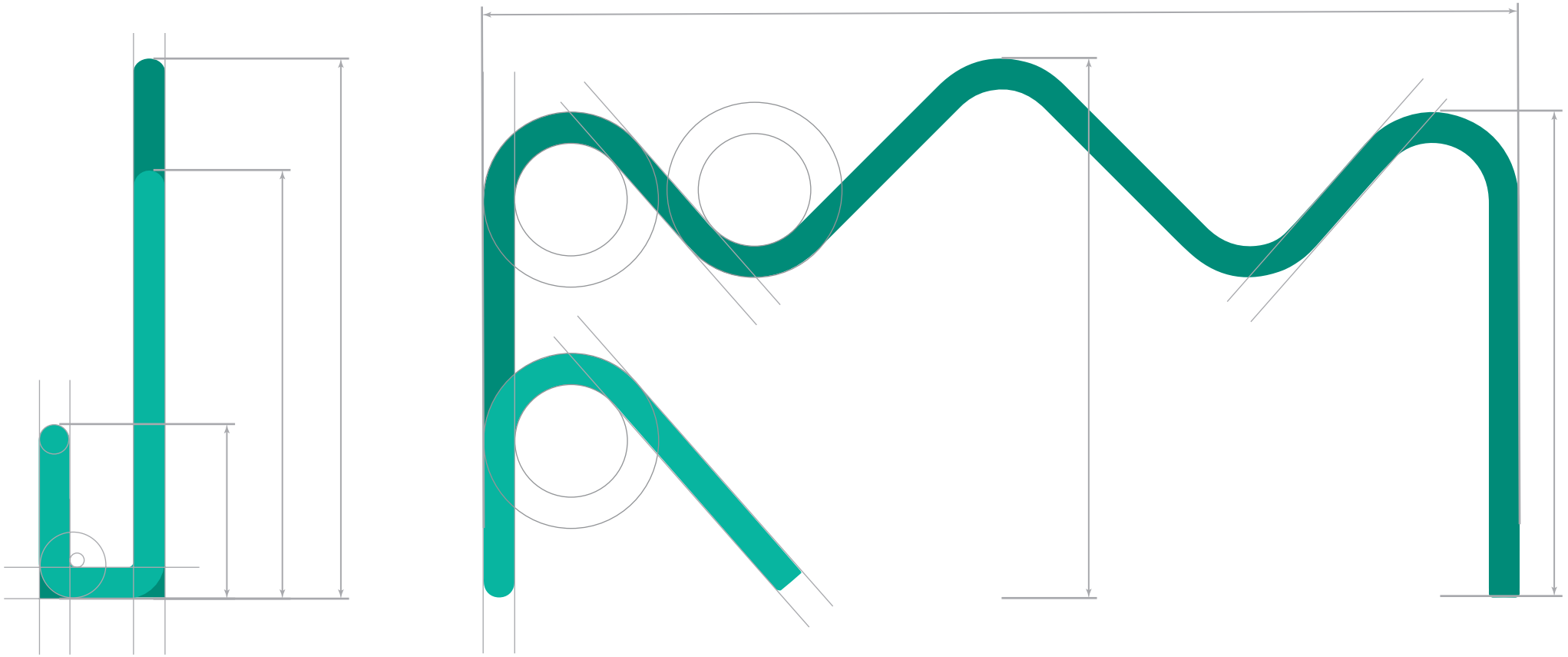


FINAL CONCEPT

The new design makes it easier to lock the bike both front, middle and back with the bike frame. The waves makes the bike rack lockable with a standard women's, men and child bike while maintaining a fun look. The highest peak of the wave is above the pedals to avoid them. The bike racks will be installed with a spacing of 600 mm between each parking spot that is recommended according to Trafikverkets handbook.

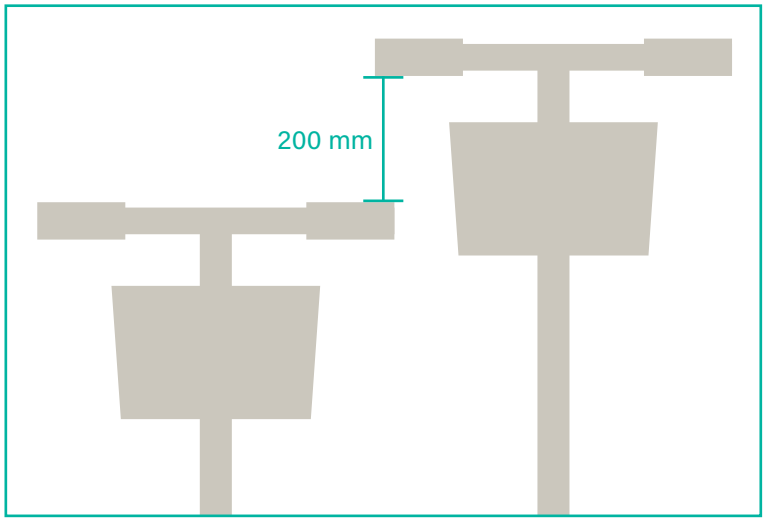


The bike rack is crafted using a pipe bending machine, allowing for seamless shaping in a single process. The organic shape has taken it's inspiration from the waves of Öresund all the way to the meandering bike roads of Lund.



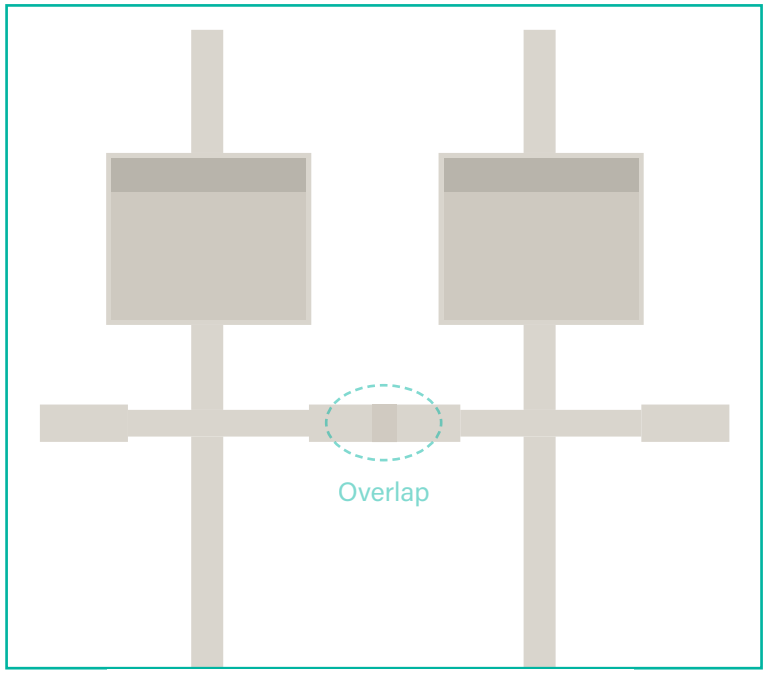
FINAL CONCEPT

Peak and Valley



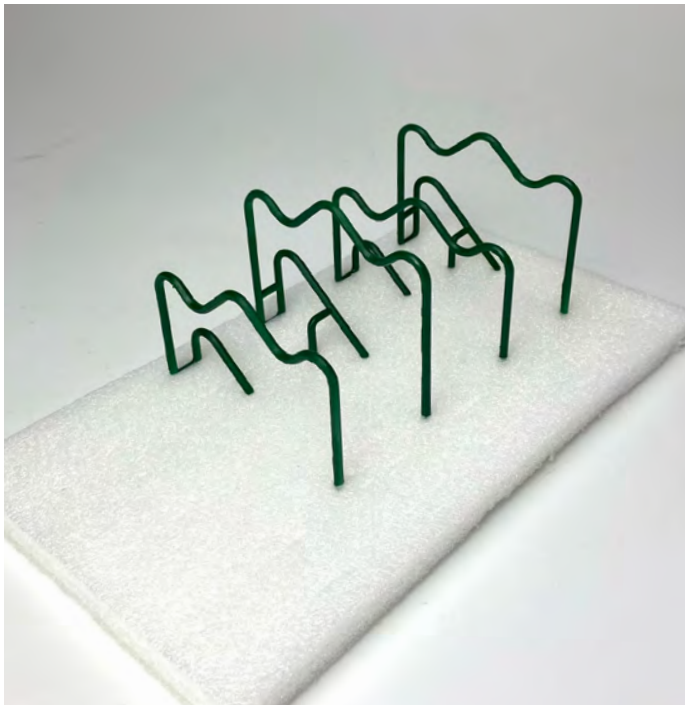
Front view

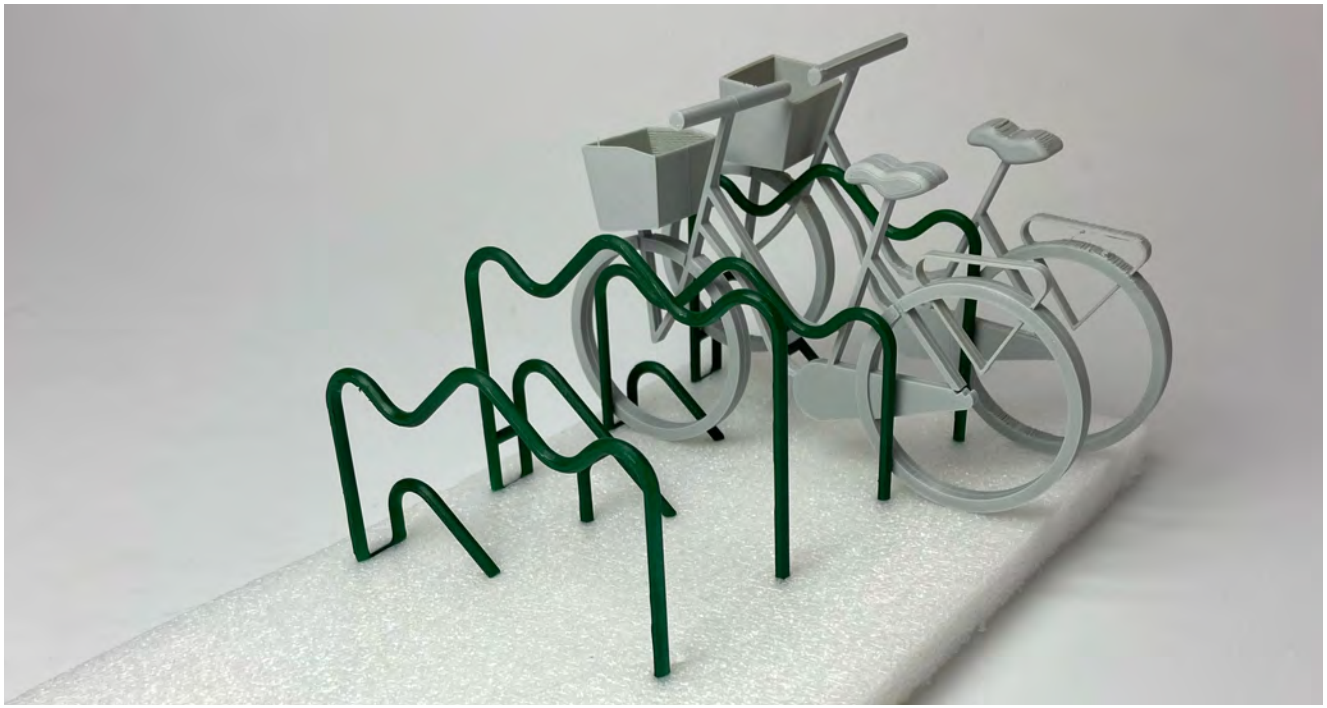
More bikes fits within a given space if the bike racks are in a peak and valley solution. The steering part will overlap other bikes BUT on a different planes where it will not interfere with other bikes. By raising the peak bike rack by 200 mm the bikes won't touch other bikes that are parked on a valley bike rack.

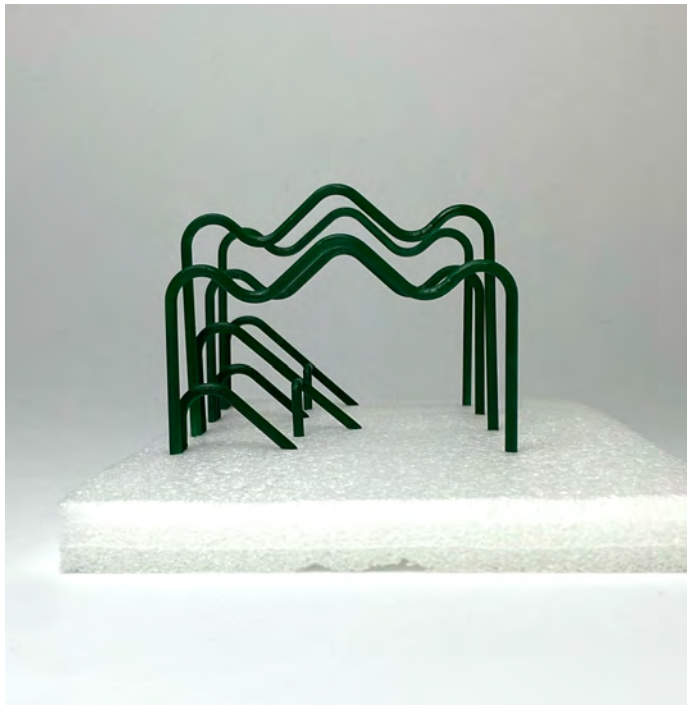


Top view

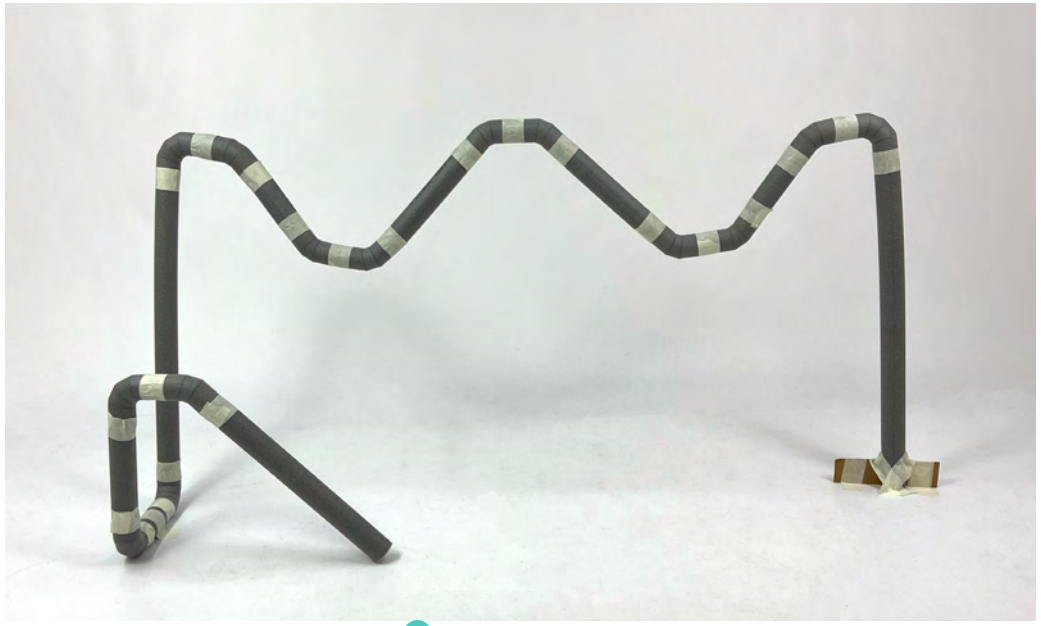
FINAL CONCEPT





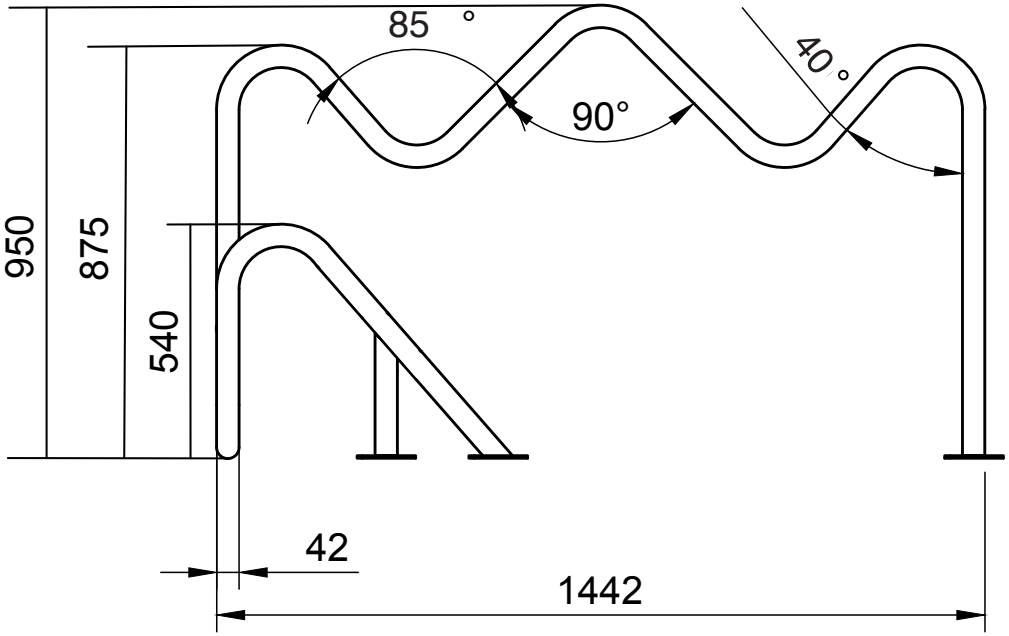


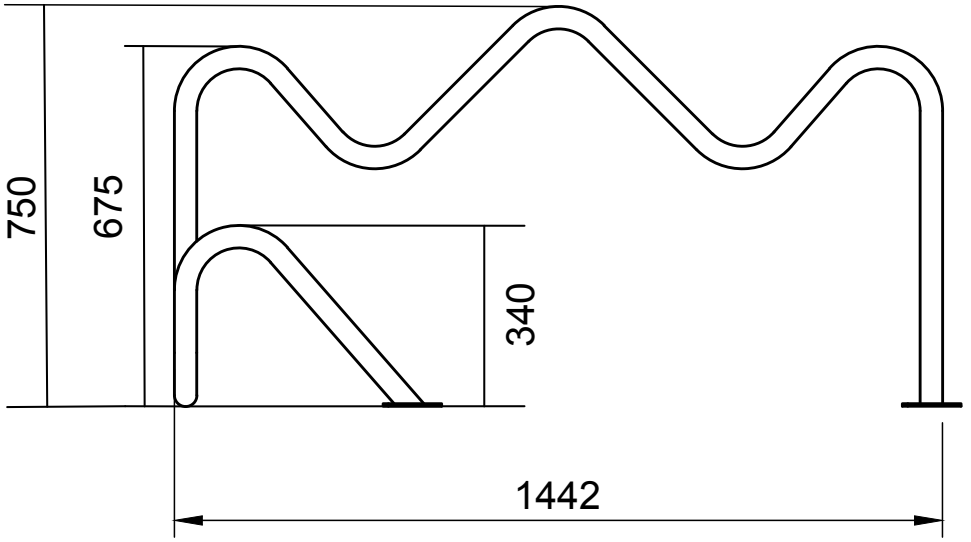
MODEL 1:1

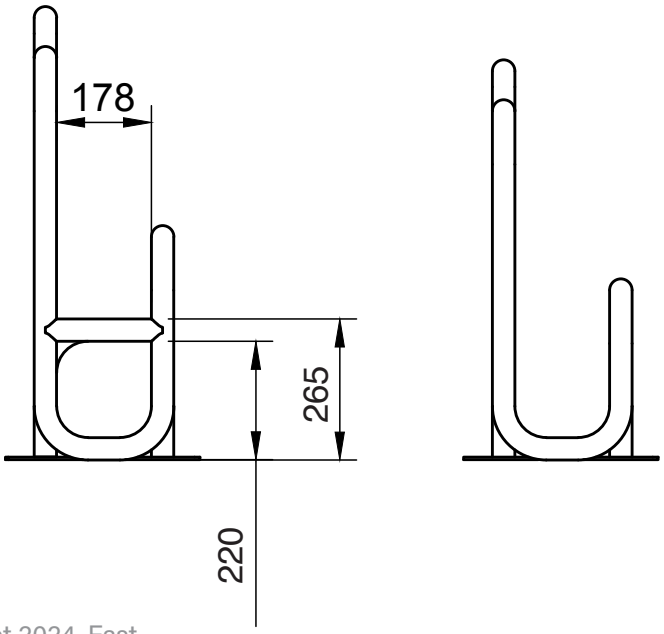


Polyethylene foam

By making a quick mock-up in 1:1 scale it helped me come up with the right dimensions. I had my own bike as a reference when building the mock-up.







DIMENSIONS

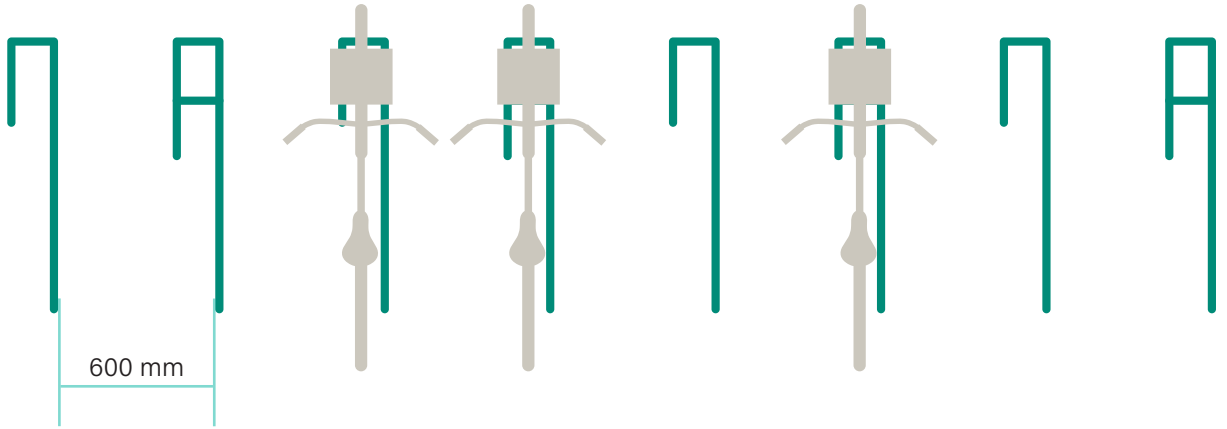
VARIATIONS

Top view

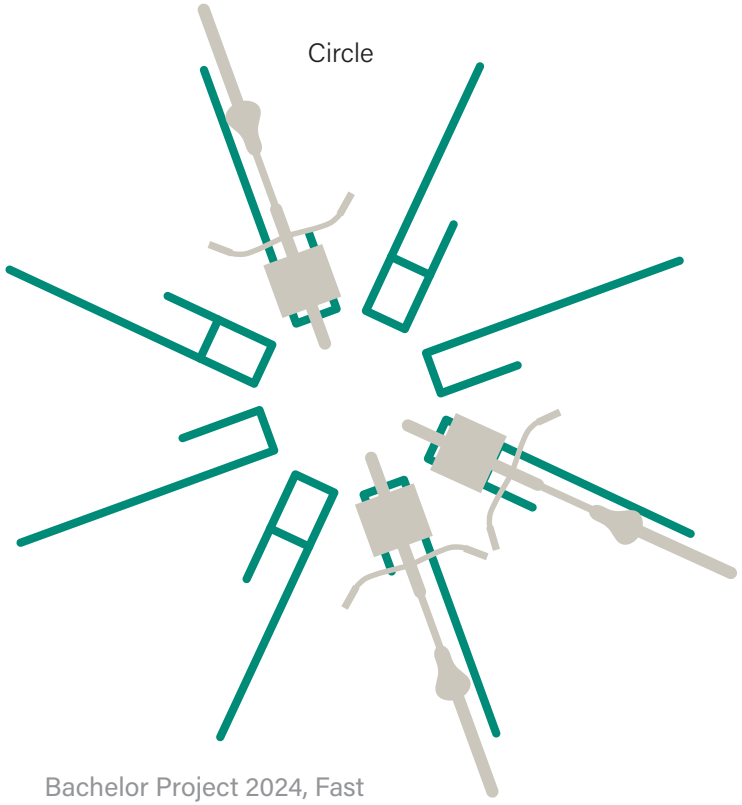
Valley Peak

Depending on the area the bike rack can be placed in different variations.

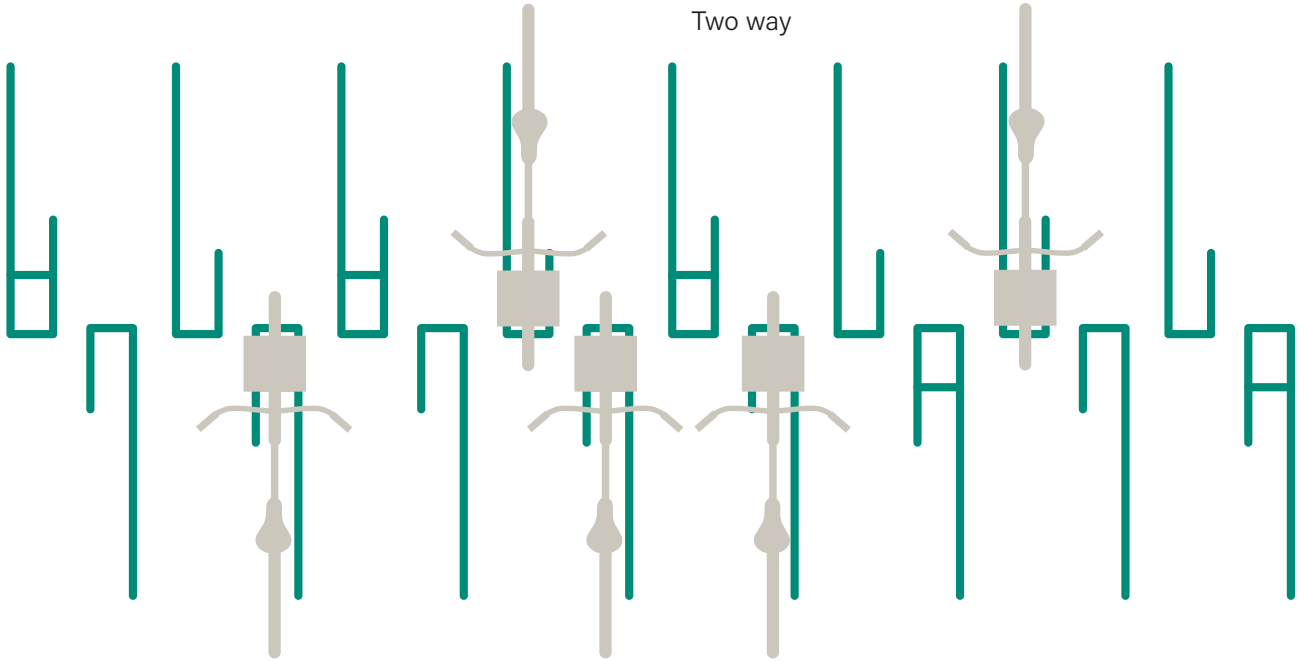
One way



Circle



Two way



MANUFACTURING

Pipe bending is a process where pipes and tubes are manipulated into the desired shape by a pipe bending machine. The technique gives you the option to create complex curves and angles depending on the material's dimensions and properties. Some metals require hot bending to maintain the mechanical properties and for best result while other materials can be cold bent.

Iron is a common material for pipe bending because of it's properties: strength and durability.

The risks of pipe bending

When bending pipes, the pipe is exposed to many forces that can affect the pipe to material deformation or failure.

1. Flattening of the tube cross-section- can be seen as an oval of the tube.

2. Lump on outside of the tube

3. Lump on inside of the tube

4. Wrinkles on tube

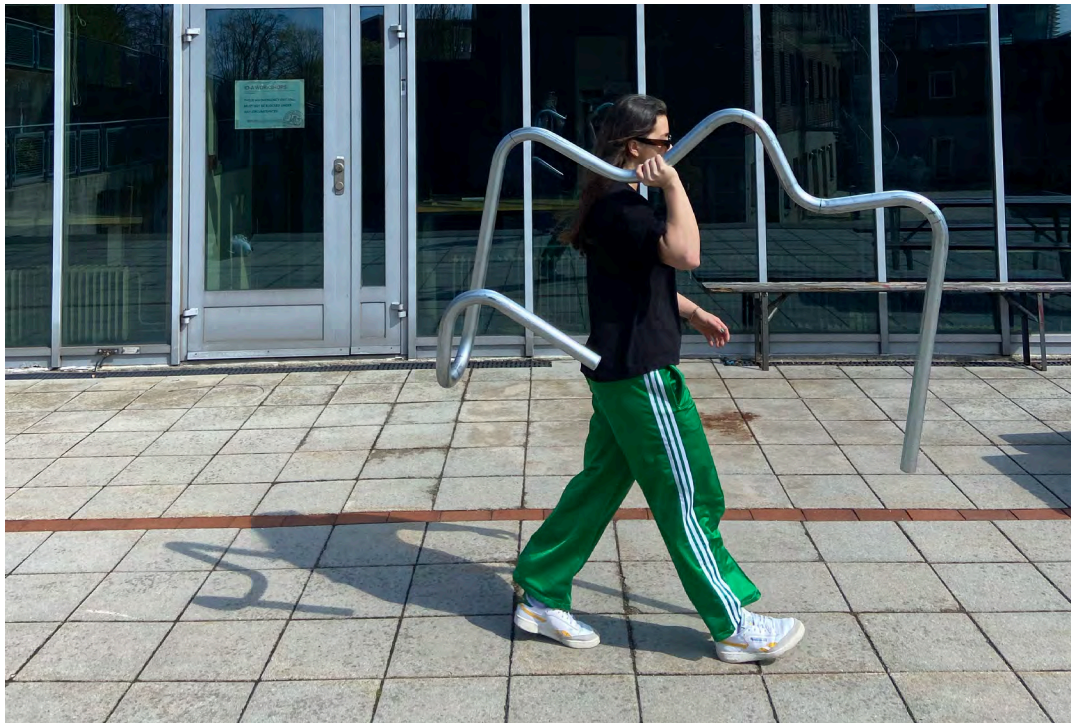
5. Splitting/cracking

6. Outer wall thinning

7. Spring back-returns partially to its original shape after being bent or deformed.

PROCESS
Hydroscand

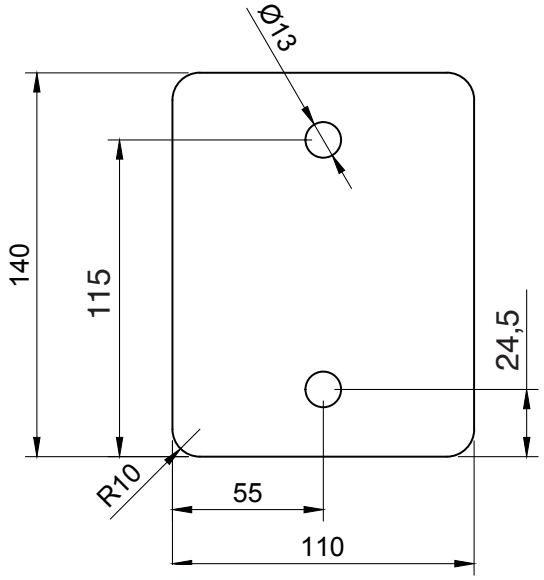
Hydroscand is a company that helps both private customers and companies bend pipes. The pipe dimensions vary between 6mm to 60mm and offer different types of pipes. I contacted Hydroscand and they helped me manufacture my design.

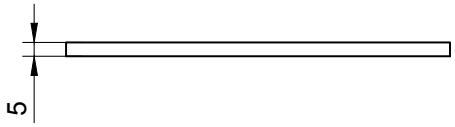


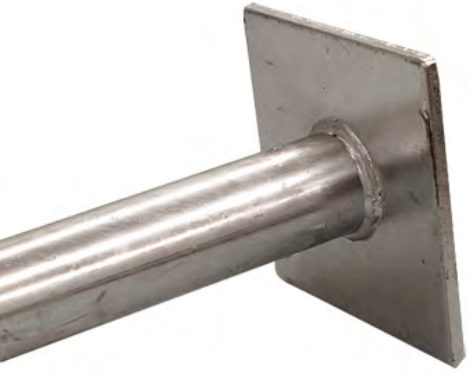
Thanks to Hydroscand, Conny and Jens, I managed to get a hold on 42 mm pipes and a workshop that the school could not offer. They answered all my questions regarding if my design was doable, the restrictions of the pipe bending and so on. Jens bent the racks for me in Hydroscands workshop in Malmö.

FEET

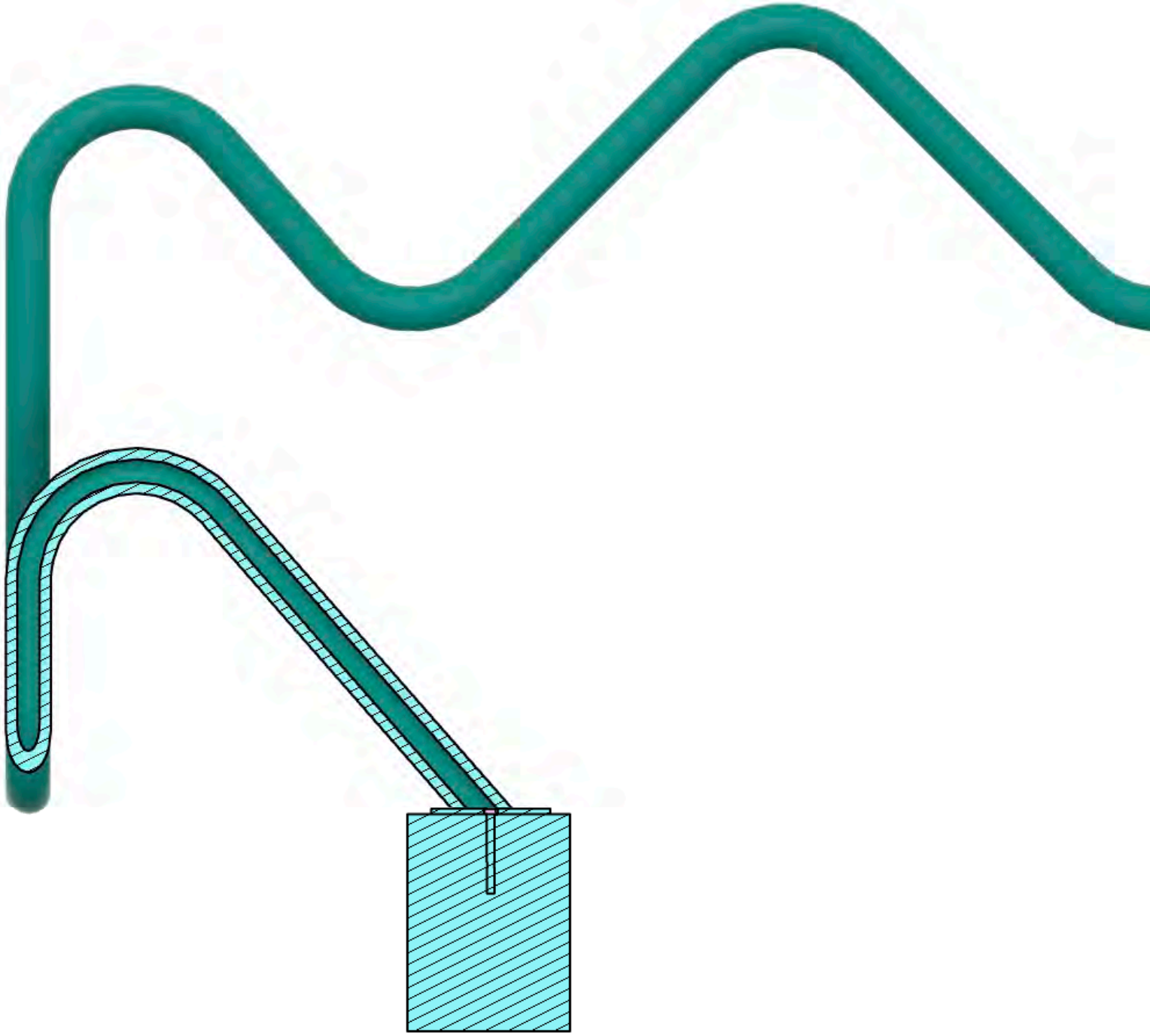
The feet of the bike rack is an important part of the assembly process. The feet are watercut from 5 mm sheet of iron with 2 holes for the M 12 bolts. The feet will be welded onto the bike rack after it is bent.





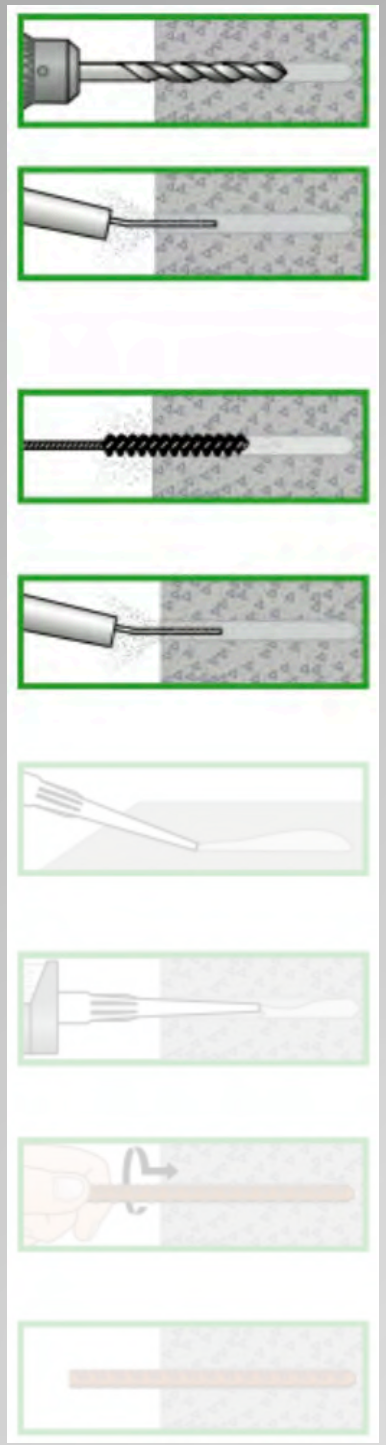


ASSEMBLY



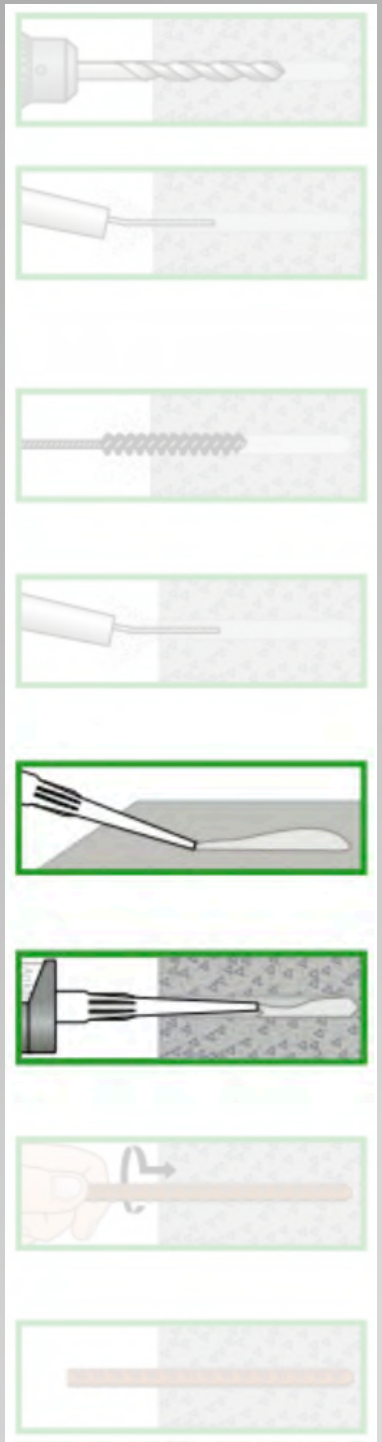
STEP 1

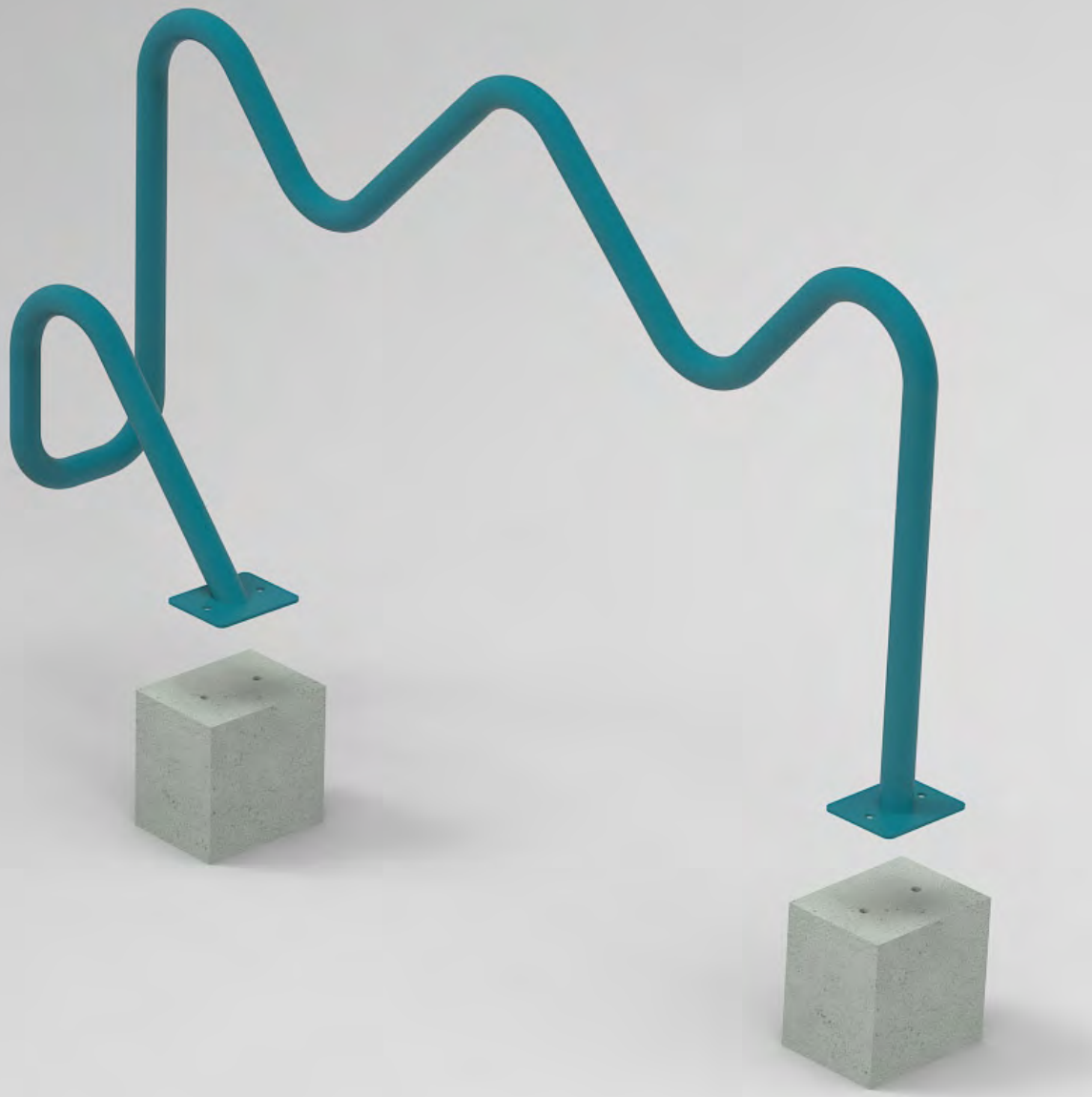
The first step is to place the concrete foundations where the bike rack is going to stand. After the foundations are in place the next step is to drill a whole for the bolts. After the hole is drilled, all dust must be blown away, then cleaned with a 2 mm wider brush than the hole before the dust is blown away once again.



STEP 2

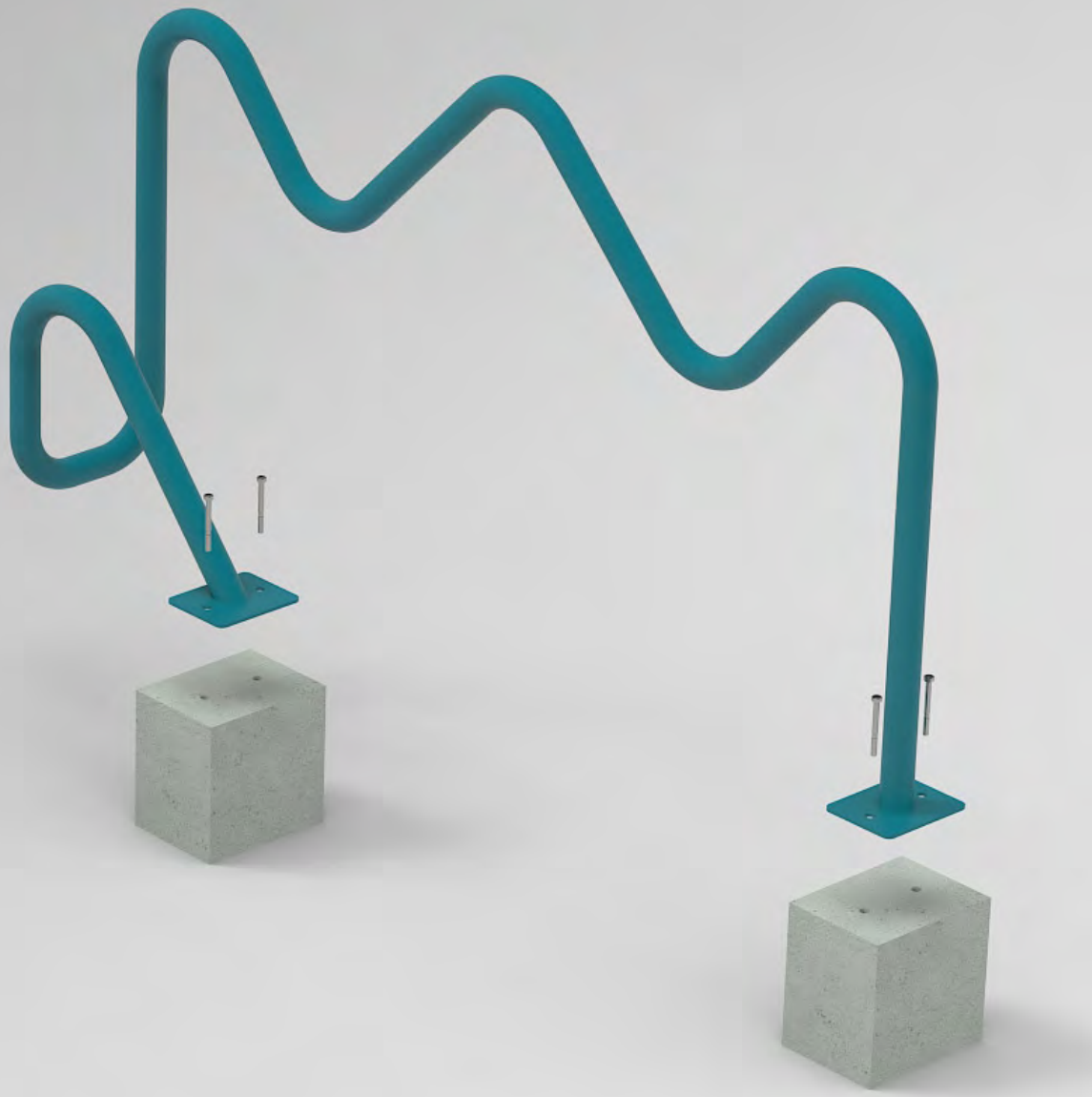
The second step is to mix the anchor compound by spraying out a strand until the compound turns light gray. Then 2/3 of the hole is filled with the compound.





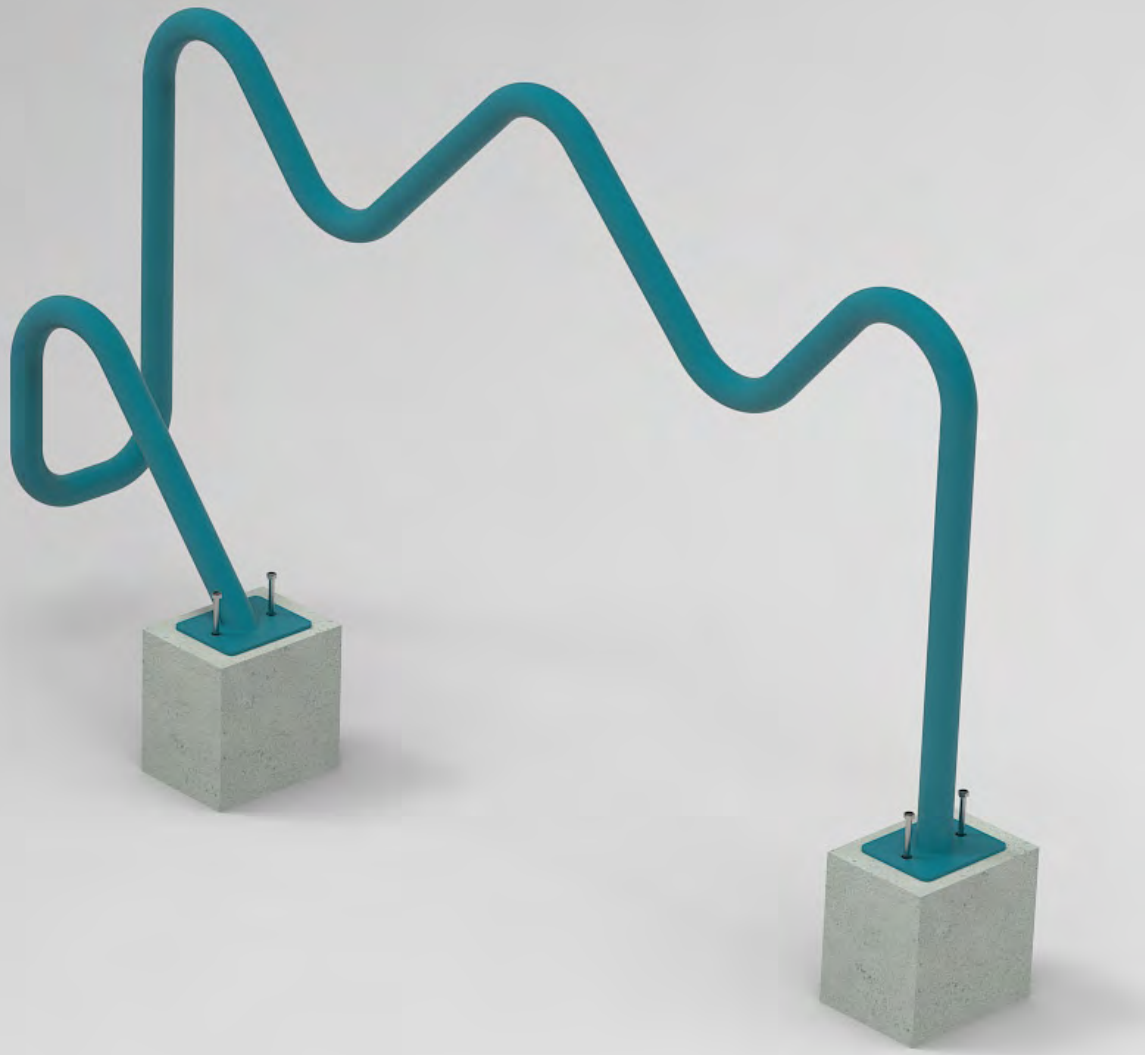
STEP 3

Step 3 is to place the bike rack where it supposed to stand and have the M 12 bolts ready for assembly.



STEP 4

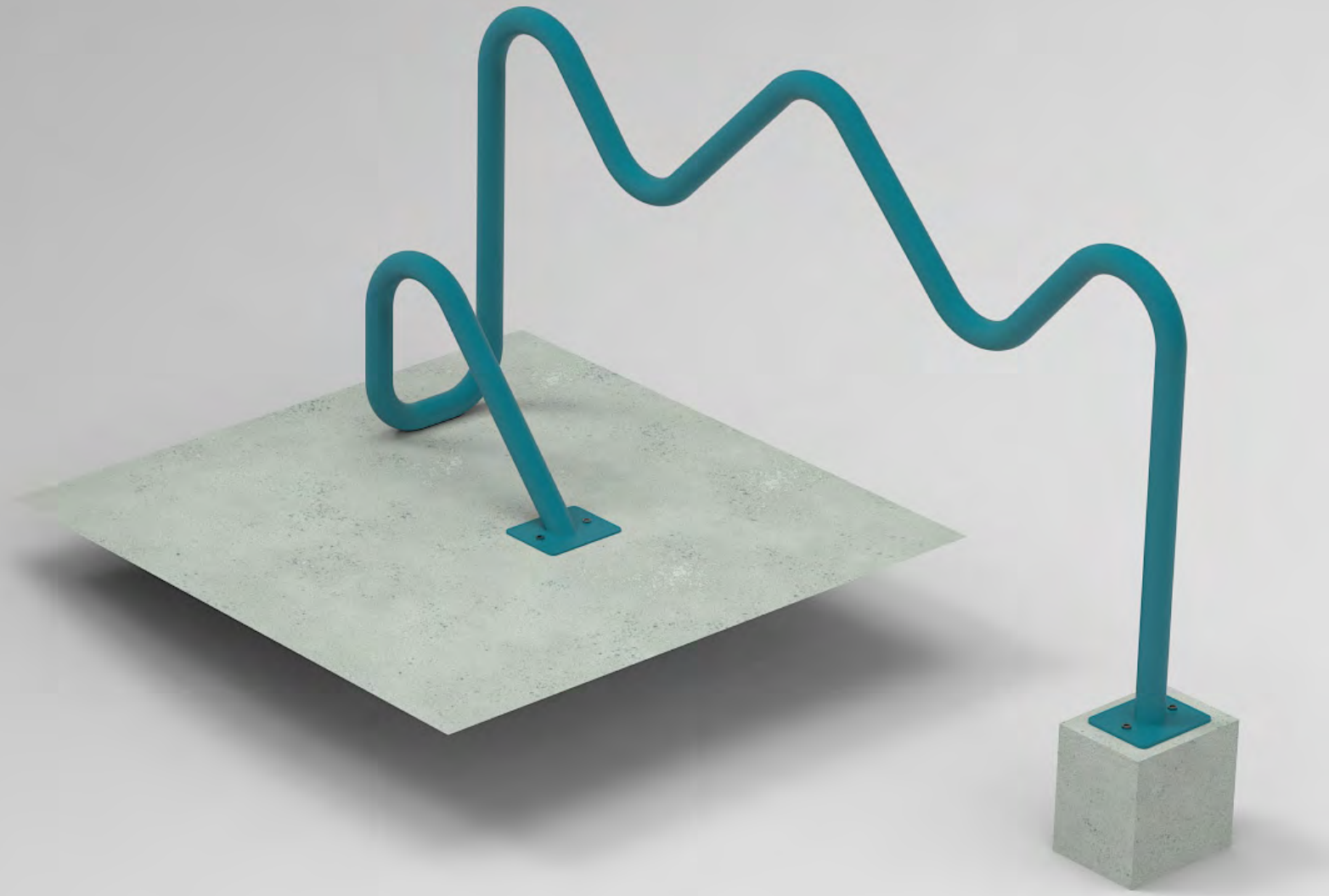
The bolts are placed in the holes of the foot. It is important to let the anchor mass harden and not to load with power.



STEP 5

Ready!

Different anchor mass suits different grounds. It is important to know the hardening span to different anchor mass.

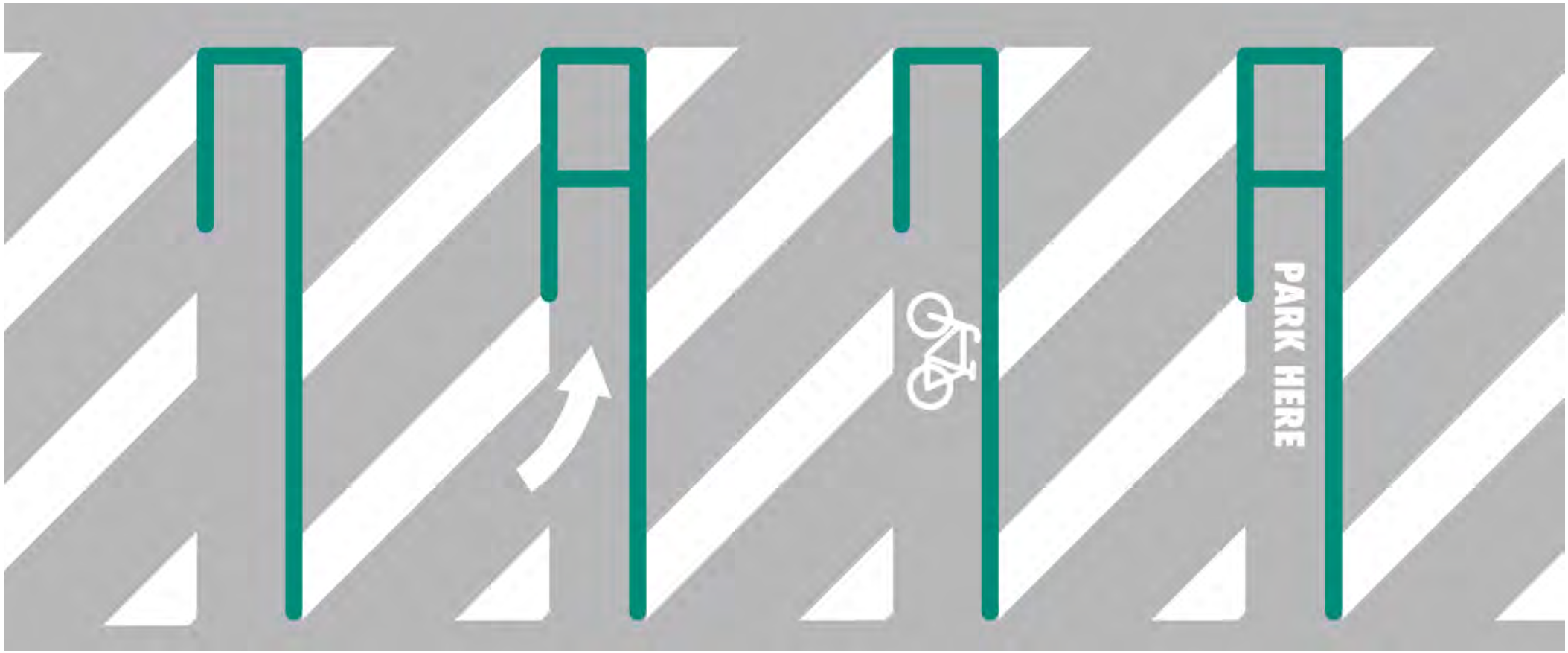


FINAL RESULT

Fast- a bike rack where the cyclist can choose where to lock their frame of the bike with the bike rack.

GRAPHICS

To ensure that cyclists park their bike in the right way the graphics will guide them to do so. The graphics on the ground also makes it easier to assembly the racks with 600 mm between each parking spot.



CMF

R:88 G:125 B:1
Brittany Blue

R:112 G:183 B:162
Holiday

Waves from Öresund

R:108 G:138 B:105
Stone Green

R:180 G:202 B:136
Sap Green

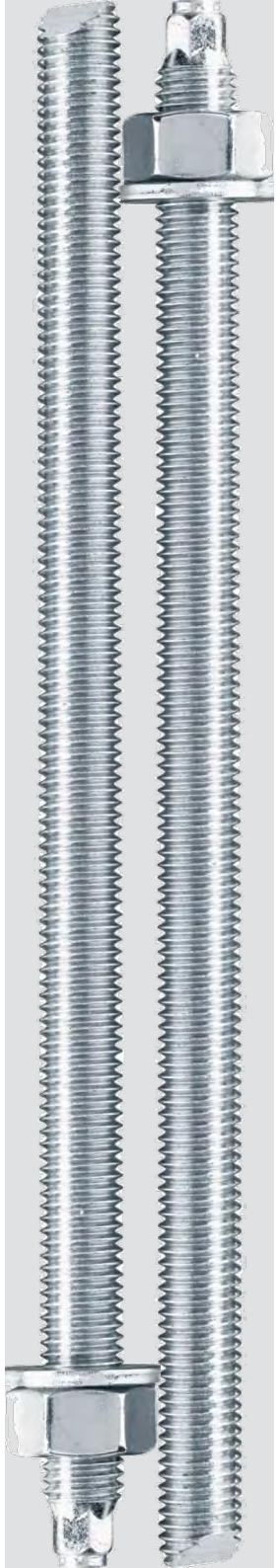
City parks in Lund and Malmö

R:183 G:69 B:70
Tandoori Spice

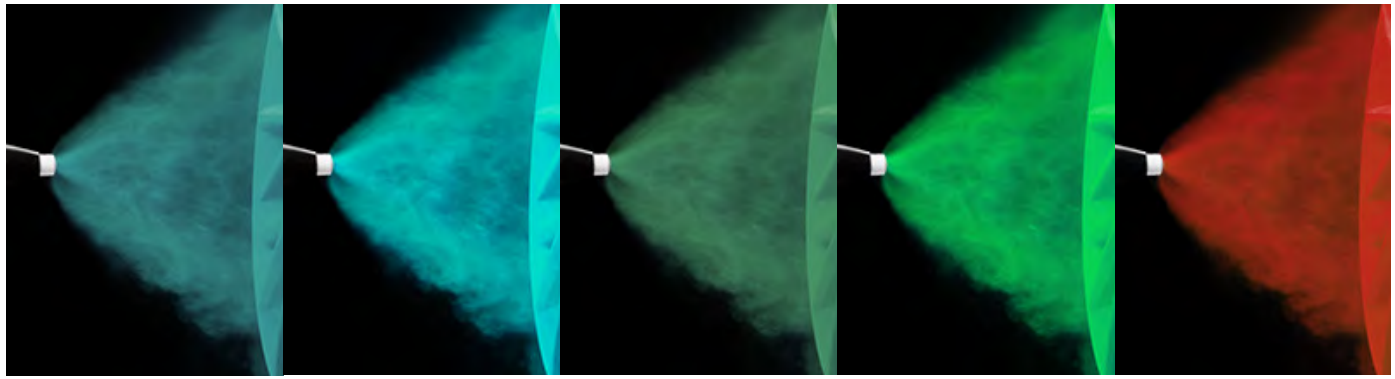
Lund and Malmös municipality

CMF

- Anchor mass
- Iron sheet, 5 mm
- Bolts,
  carbon steel, galvanized
- Iron pipes, 42 mm
- Concrete



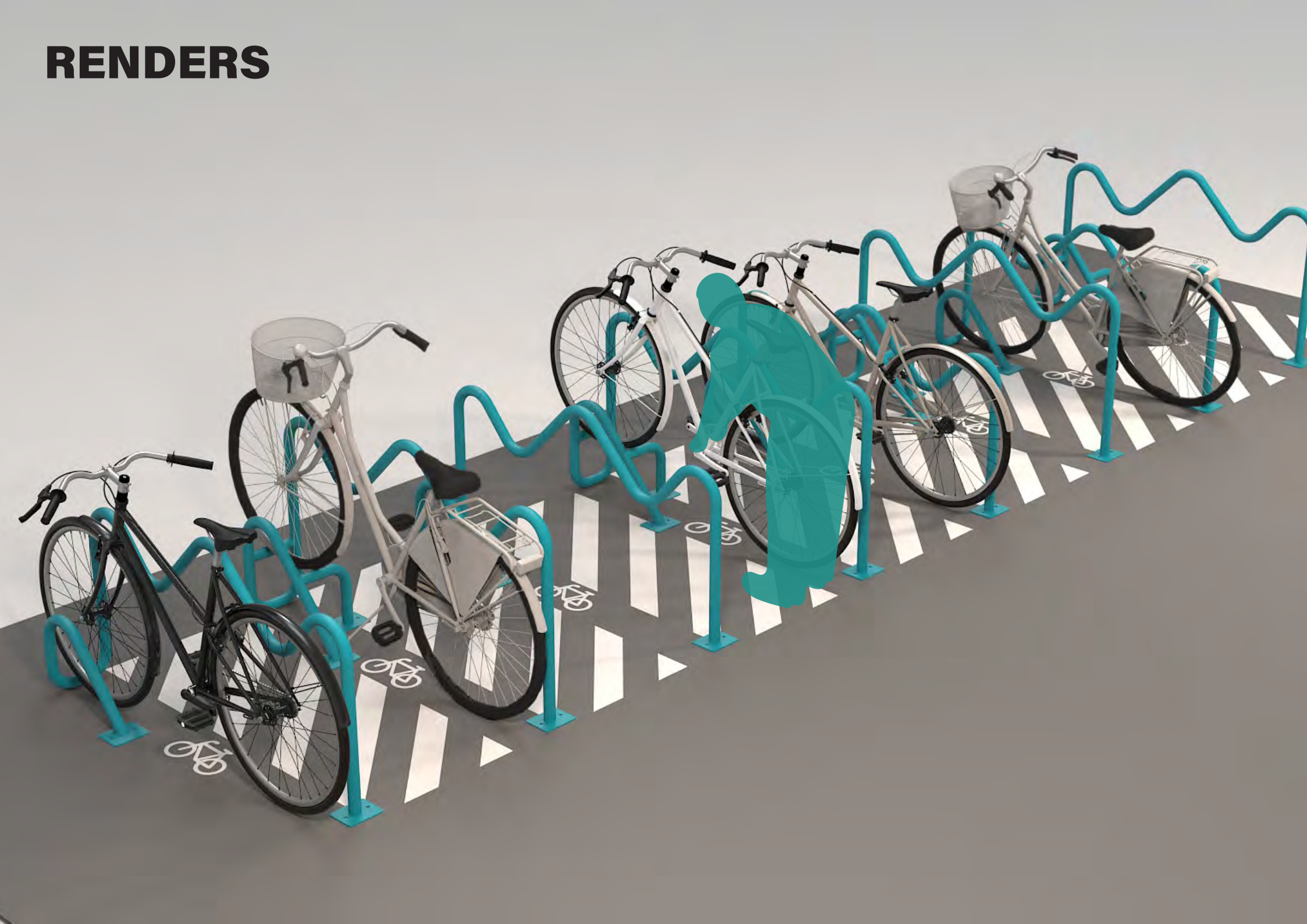
CMF

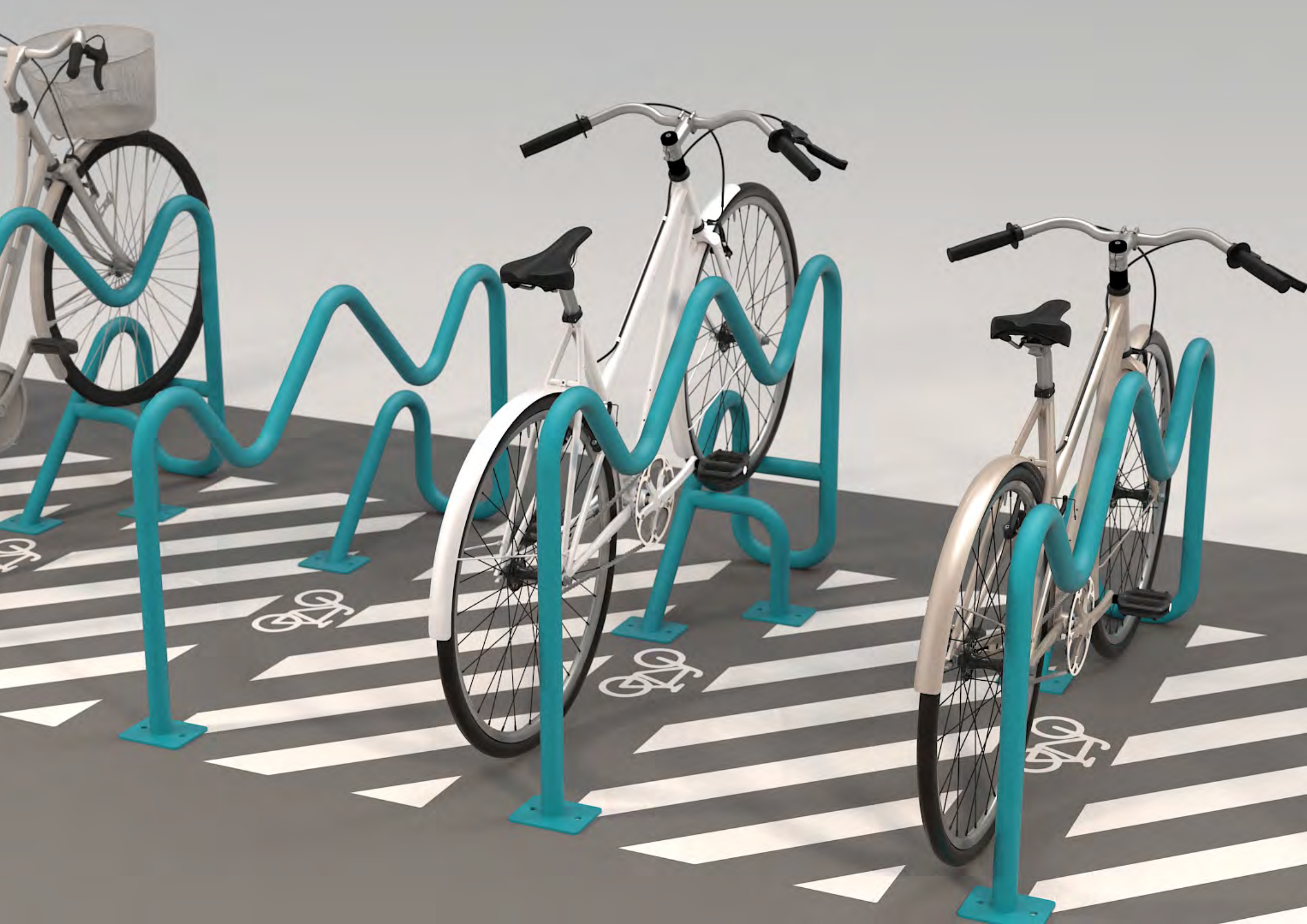


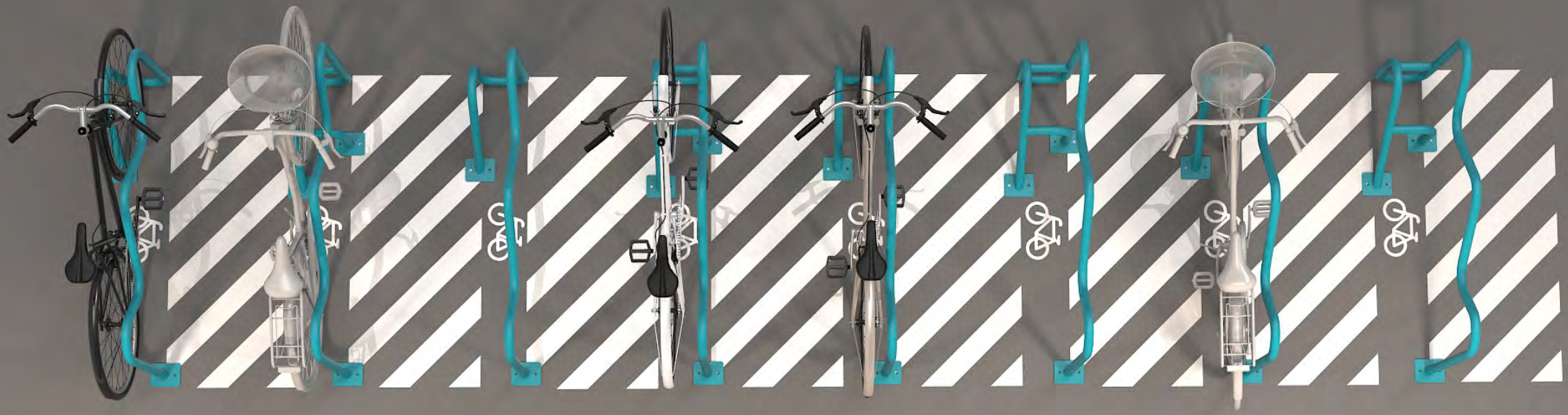
Powder coating

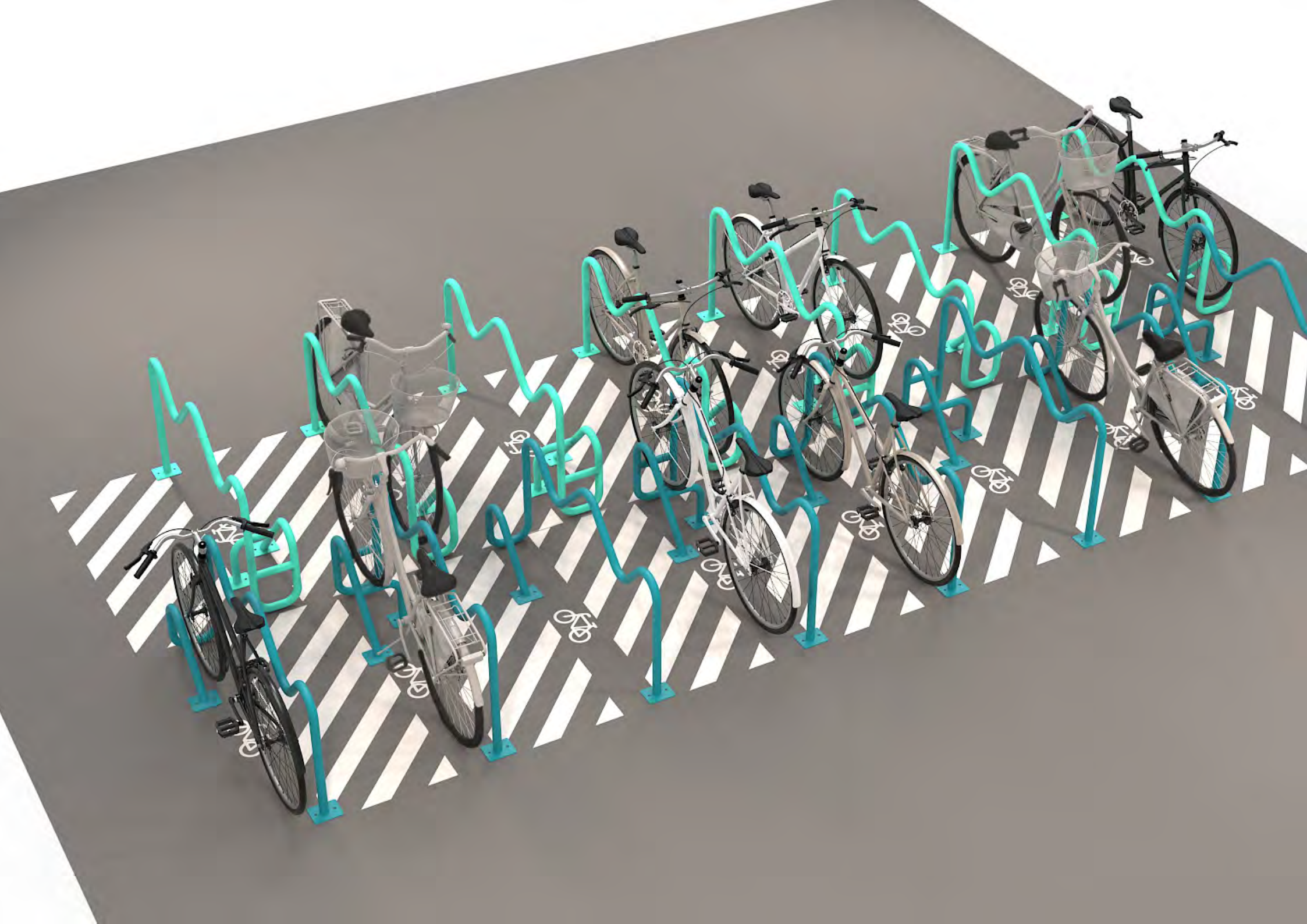

MONA

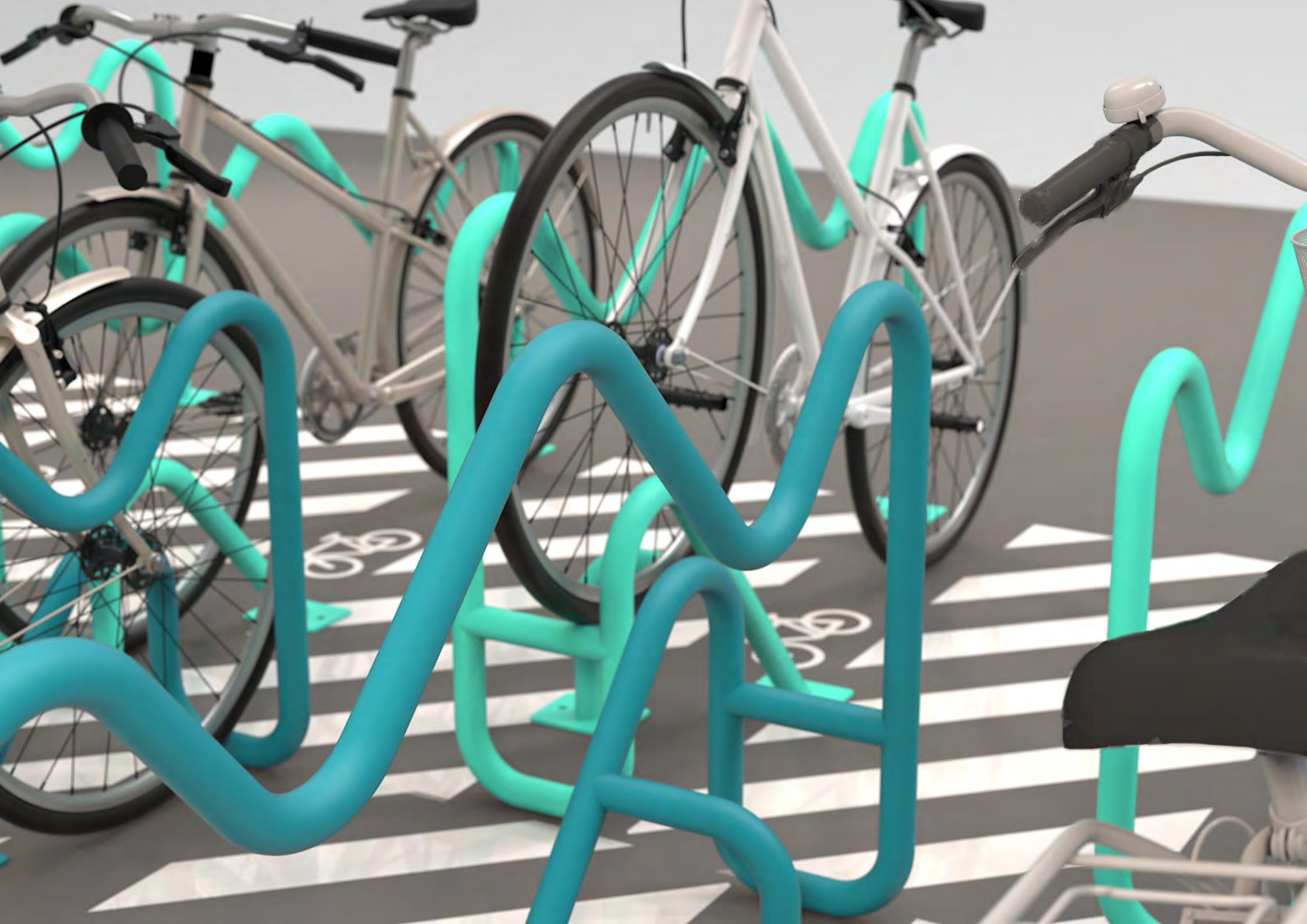
RENDERS

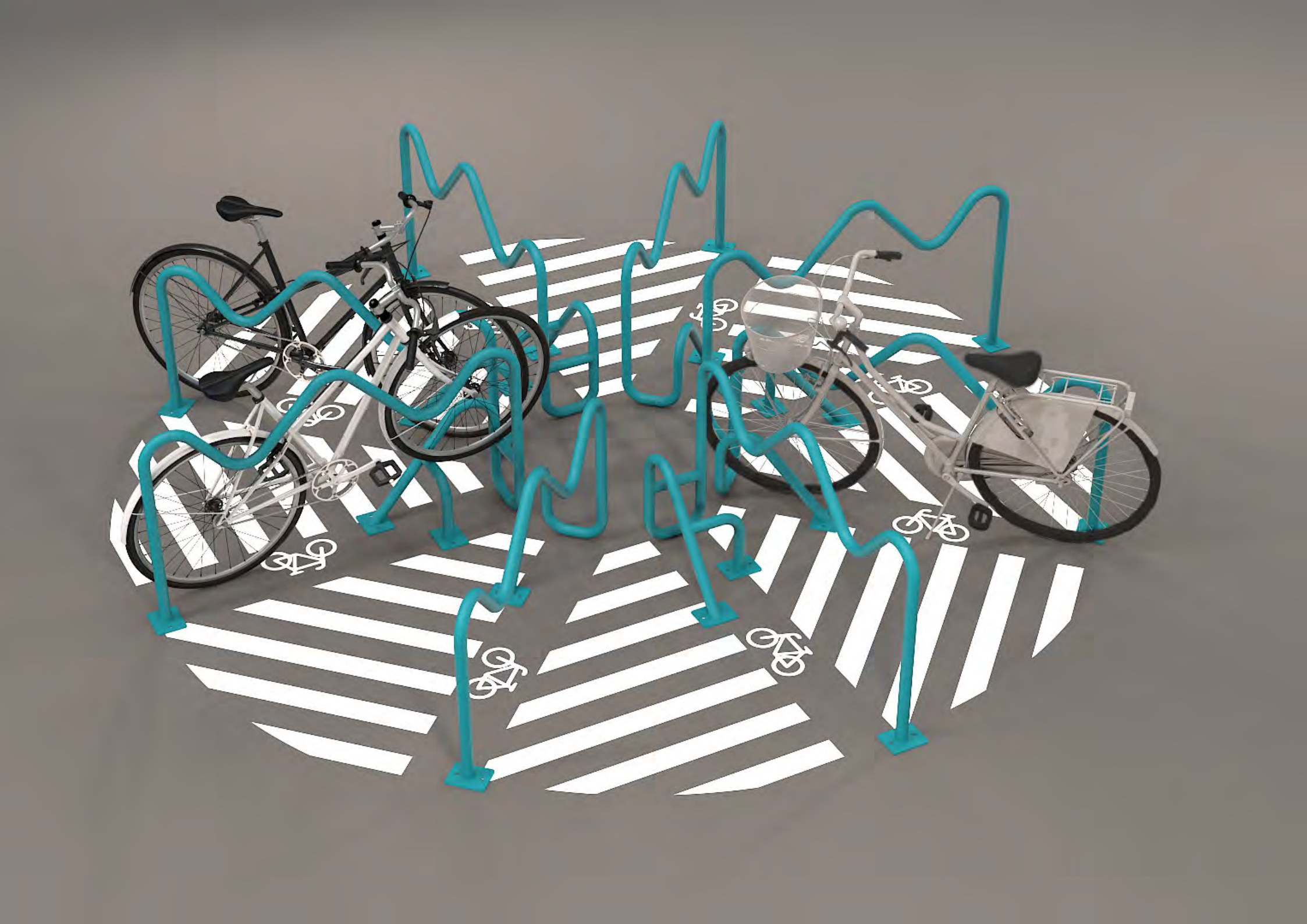












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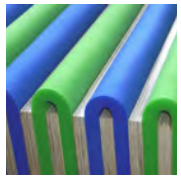

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Appendices

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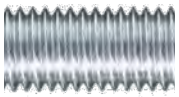

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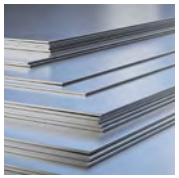

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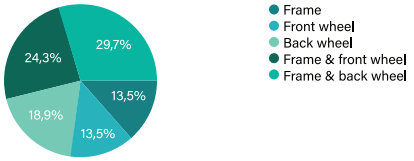
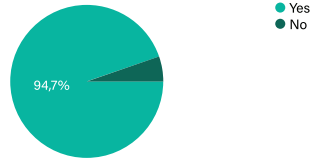
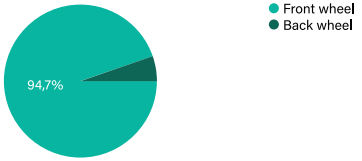
How do you lock your bike?



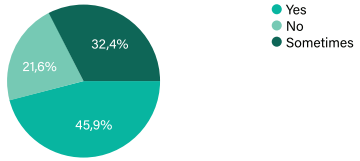
Do you find it cramped to park in a relatively full bike rack?



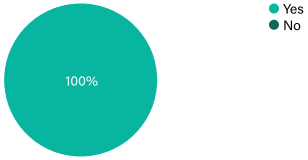
Do you park with the front or back wheel?



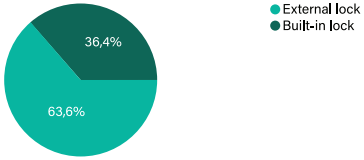
Do you find it hard to lock your bike when it's dark outside?



If possible, would you lock your bike in the bike rack and the frame?



Do you have an external lock or built-in?



What is most important?