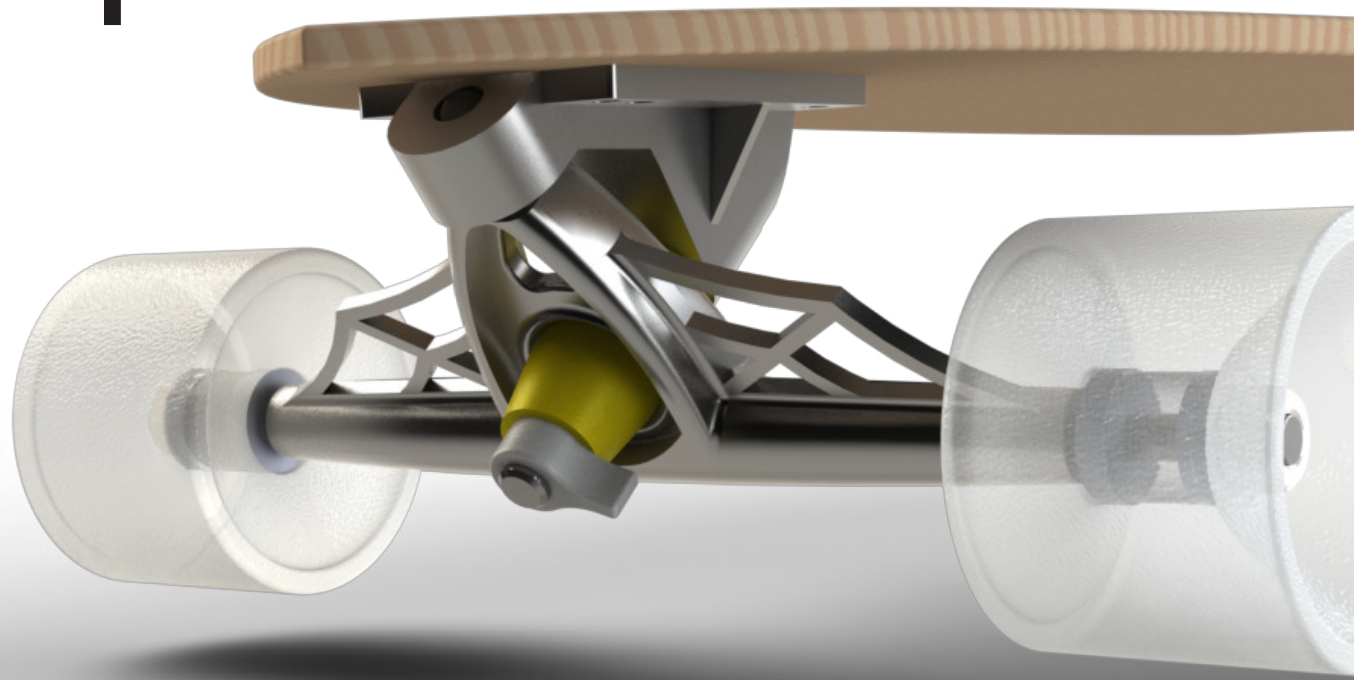


Spider Trucks



Process report

Ana Goga MSC4 -ID 2012

Title sheet

Abstract

This report is presenting the process of developing a product design. A new type of trucks is designed and presented in an overall concept of longboarding and the culture within. The relation with the users is reflected in the basis of the concept that follows their demands and wishes. A detailed presentation of Spider Trucks can be found in the enclosed product report.

Project title: Spider Longboard Trucks

Group number: MSC04 -ID

Duration: 01/02/2012- 08/08/2012

Year: 2012

Name: Ana Goga

Confidentiality status: Accessible to the public

Supervisor: Kaare Eriksen

Pages:102

Editions: 4

Volumes: 2

Preface

This process report is part of the Master thesis and it is made by Ana Goga, Industrial Design of the 10th semester, Architecture & Design at Aalborg University. The project is developed in the period of 1st of February 2012 to 8th of August 2012. The project's overall theme is called "Longboard Design".

The aim of this report is to provide an insight of the design process starting with the idea and concept suggestions and explain in a clear way on which basis decisions were taken. The final product is presented in the enclosed product report.

I would like to thank to Kaare Eriksen for the guidance, instruction and his time and help offered during this semester.

Table of contents

Introduction

The assingment	7
Expectations	8
Methods	9

Analysis

Short description	10
Common maneuvers	11
Setup guide	14
What is on the market	16
Market analysis	26
Competitors	27
Reflection	28
History and Culture	29
Short history	30
About the longboard and the culture within	31
The user	33
User	34
Interviews & Questionnaires	35
User needs identification	38
Vision & Mission	41
Specifications	42
Trucks details	43
Trucks assembling parts	44
Trucks	45

Concept

Inspiration	47
Inspiring organism	56
Spider web structure	57
Honewcomb structure	58
Leaf structure	60

Detailing

Elements	65
Hanger and axles	66
Final structure Hanger	67
King pin nut	70
Concept screening	71
The idea	72
Element specifications	73
Baseplate	74
Bushing	74
Pivot cup	75
Hanger and axles	75
King pin lock nut	76
Wheels	77
Deck	78
Assembling method	78
Material & manufacturing	79
Cost Calculations	80
Life cycle	81

Presentation

Trucks	83
Complete Longboard	84
Usage	85

Evaluation

Conclusion	86
Reflection	87

List of references

List of figures	91
Appendix	93

The assignment

The thesis subject is a consequence of the previous semester practice work that was held in a longboard manufacturing company. The thesis is focusing on the research and analysis of longboarding and the culture within. The aim is to create a new product by integrating technical, aesthetically and functional assessments. Through this project it is wanted to design a product that may be implemented by big brands or for small manufacturing companies that may attract investors with it. This could increase their profit and develop globally as an original brand. The user group consists of youngsters, mainly, but overall are people between ages of sixteen to forty years.

The assignment is to design a new smart solution for the longboard that can compete with the existing products on the market based on design aspects and functionality.

Expectations

During this period it is expected to fulfill the goals posted in the Study Guide. This includes that at the end of the semester the following aspects have to be covered by the student:

Knowledge

- identify design relevant problems within the chosen subject
- account for the appropriate research-based knowledge in the design process
- high degree of awareness regarding the main critical issues in the design proposal and the appropriate course of action to amend these

Skills

- create design proposals of a high standard, integrating selective aspects
- use professional tools and methods
- generate a design proposal based on clearly defined values, user needs and/or business plan
- select and use the appropriate method, techniques and tools for analysing problems, users, technologies, constructions, competitors, markets, products, strategies, companies and own design proposals
- demonstrate the ability to select and use the appropriate method, technique and tools for carrying out experiments and synthesising design proposals
- navigate a design process, by continuously drive the design process forward by focusing on the most relevant part of the project and delimit the scope accordingly
- communicate design and design proposals in a professional manner
- design and construct a design proposal that meets predefined criteria, target values and cost range

Competencies

- achieve a high degree of integration of appropriate aspects of the subject of choice, in a coherent proposal for a solution within the broad field of design
- plan, conduct, communicate and reflect on processes connected with the design of a subject of their own choice using a wide range of theories, methods and tools
- evaluate and perspective the final proposal in relation to its feasibility, market potential and further development"

[Study Guide 2012]

Methods

Below is explained the different methods used through the project in different phases.

Brainstorming

This is a technique used to boost creativity and is made by one or more persons. All ideas regarding the topic that pop-out are noted. There are not allowed critics regarding the ideas, everything can be used even the crazy idea. The aim is to make new ideas combining all the possible previous ideas. This method is often used in projects mainly in the beginning and during the concept phase to end up with a number of concepts that can be analyzed and evaluate before choosing the final concept. [Mindtools 2011]

Observations

This method is used to register and analyze people's interaction among them and with products and services. The observation is conducted without interfering in the action, the observer has to take notes and be like a shadow. The presence of the observer may disturb the natural flow of users' actions making them more aware of their actions. During the analysis phase the focus of the observation is on the users' lifestyle, and how they interact with the product-daily usage.

CES Edu pack

This is a software that enables the student to find one or more materials that would be useful for the chosen design. The software works putting limitations (tensile strength, density, cost ,young modulus,etc.) to narrow down all the material possibilities until finding the correct one. During this process is important to have references on the type of material that is wanted to be used.

Interviews

This method is used to get insights of the users life ,social concept and product usage and to expand the understanding as a designer. From interviews may come out great ideas, exceptions to the rule also by choosing extreme cases. For the project are organised situated interviews but also random interviews in the streets to get a diversity of ideas and answers so that the area of research will be much wider.

Finite element analysis

Finite element analysis is a method used to check if the product can manage a certain amount of applied loads. This simulation is made in Solid Works where the product is build from scratch with the right dimensions and appropriate materials applied to the product.

Analysis

In this chapter is presented a introduction to the longboard as a product as the core of a culture and lifestyle, so implicit the user is introduced. An analysis of trucks is conducted based on the features importance and details to get a better understanding of the product that is already on the market. Finally, is brought forward a setup guide with a incorporated presentation of the product interaction with the user. The chapter ends with a vision and mission and specifications stating the assignment.

Short description

.....

In the analysis phase the first was made a detailed analysis of a longboard: components, type of riding, common maneuvers, setup guide and some of the most common problems and how they can be solved. First it will be made a short description and presentation of some of the features of the longboard.

Longboard

Common names: Board/deck/trestle/planck/stick
Made from: thin layers of wood (veneers) glued together
Materials: maple/ash/bamboo/fiberglass

Board families

Mini	Carve-Stretch-kickflip	Super giant slalom
Street luge	Pool	Long distance push
Freestyle	Cruise	Technical downhill
Hybrid		

Usually it can excel in one or a few types of riding. But, of course, there are shapes that provide good performance at more than one type of riding

Note: Do not pick the longboard after looks or by what pro-riders say it is good, is better to understand the features and pick one that fits the best to the desired riding type.

Features and what they actually do

These names are set as official and may change but it helps everyone to use same terms and understand and talk the longboard language.

Concave

This shape strengthens the board length-ways. This makes it not to bend that much.



Image1

Short description

Rails

The effect of using different type of rails is the feeling of the board under the feet and what reactions has the deck when is hitting an object. There can be more various types in different spots.



Image 2

Kicks

This term means when the tail or nose has been bent up at a various angle.



Image 3

The trucks can be mounted on kicks and this will turn them into drops as shown below.



Image 4

Drops and drop-through

Drops and drop-through are methods to lower board's pan compared to its trucks is a matter of taste which of them is better for your feet

Chossing them is a matter of taste , it depends on which of them is better for the riders' feet.

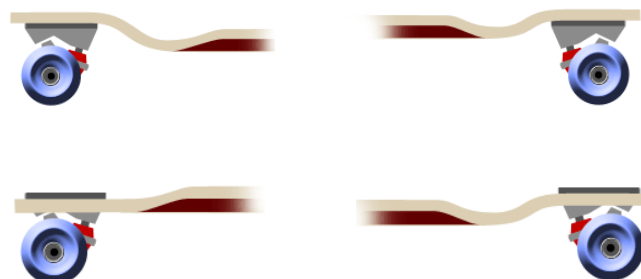


Image 5

Short description

Wheel-well and Cutouts

These two features refer to wheel-bites. The wheel-wells need to be in the right spot because different trucks will put the wheel at different positions. This means that also the size of the wheels also effects these wheel-wells.. Cutouts have removed the entire area that has any chance in contacting a wheel.



Image 6

Camber

Camber is generally applied to boards that need a high amount of flexibility. This dampens vibration, absorbs a certain amount of shock and as an effect the ride will be smoother.



Image 7

Rocker

Rocker is the opposite of the camber, is not that common.



Image 8

Note: Some deck manufacturers call this type of form a torture-bend because it forces the wood to bend in two directions at the same time.

Common Maneuvers

Longboarding is an active sport and is all about sliding on concrete and looking good while doing it. To make a holistic presentation is important to explain also what a rider actually does with the longboard. Below, are described the most common maneuvers among riders.

Braking

A longboard is like a vehicle when it comes to safety : is safe to ride it if you know how to stop it. There are various braking techniques used by riders and some are described below:

Run outs

When the speed is not very high and there are no people in the surrounding area, it is alright to jump off of the board and leave the momentum that is carried. This method of stopping is allowed if the longboard will not be a threat as it continues to go further. Running out is safe to be done if the ride is slow, or there is no other way to stop it.

Air brake

This method makes just a small brake. Air braking is using the wind resistance to slow down at high speeds. The riders stays upright and stretches his arms out to both sides.

Slide brake

Among riders is called also power slide and is used mainly by downhill longboarders because they need a complete stop very fast. Basically, the rider makes a fast, controlled turn on the side, usually placing a hand on the ground to prop himself (in this case are needed protection gloves).

Foot brake

If is needed to slow down just a little, it can be done by running the sole of the shoe along the road, it decreases the speed while dragging it. This foot braking asks for good balance and resistant shoes.

Sit brake

This is where a rider sits down on the deck, like standing on a sled, and uses the outstretched feet to slowdown untill the board stops. This maneuver doesn't have many fans among longboarders because it requires a lot of effort and balance to get in the sitting position, and also because is damaging the shoes.

The best option when stopping a longboard, is riding the momentum out. This means that sometimes is good to choose wisely the places for riding ,for example riding a hill with a long, flat area at the bottom, allowing the rider to slow down in some distance.

Common Maneuvers

While riding, to increase or to maintain the speed, the longboarders use their legs and hips to shift the momentum towards the nose (front of the board). The aim is to move the longboard forward without touching the feet to the ground.

Carving

Carving is when a longboarder makes controlled turns on the road by leaning back on his heels, also called 'heel side turns' or by leaning forward on his toes (toe side turns) or backward onto his heels (heel side turns). When these turns are connected it results in an S-shaped line that slows down the rider and gives the opportunity to achieve some style points.

Drifting

At high speed, when taking a turn, the wheels lose traction, sending the longboard sliding to the side as the rider rounds the bend. This can be controlled and done correctly it becomes a 'trick'. In downhill riding, if not achieved correctly, drifting can be dangerous and cause injuries, but when executed well, is a showtrick.

Board walking

Board walking means making technical stand changes on the board. Riders perform dancing moves, cross stepping up and down the length of the deck, and change feet by jumping or turning. This is seen as a form of style in longboard.

Setup guide

Below is presented a setup buying guide for a longboard from A to Z. Each step is explained and also there are introduced examples of products. This step of research is made in order to clarify the steps that are made in order to buy a longboard and which are the steps that have to be followed.

Cruising/ Carving Longboards

Intro: Top 3 Cruising Board Styles

Take your pick

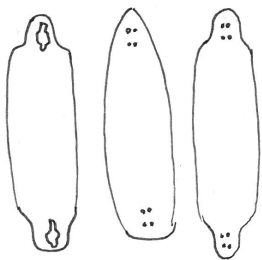
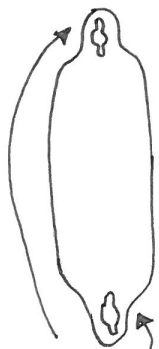


Image 9

Before buying a new longboard, usually the riders take their time and make a small research on the market comparing products based on functionality, quality and aesthetics. On the internet, on the specialized sites are a lot of helping-guides for the ones that don't know exactly what fits them the best. Also, they check all the new boards and the upcoming ones so they know exactly what they need and what is fitted for them. Further will be presented the top three best cruising boards that usually are chosen by buyers and continuing with describing the steps of choosing a longboard and the features within.



Stable + flexy

Image 10

Flexible Drop-Through

These kind of boards are more stable because they are longer and they have lower center of gravity. Also, it is easier to push and the flexibility is disabling the discomfort on longer rides because it's acting like a dampening system.



fun kicktail

Image 11

Traditional Cruiser Shape

These are medium-length longboards and are popular because of an addition of a kicktail that makes easier to navigate sidewalk.

Setup guide

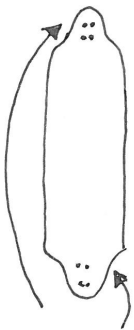


Image 12

stable + carry

Commuter Style

These top-mounted cruising boards have a lot of leverage over the trucks making them great for carving. By having the wheels placed at the very end of the deck, these boards have an increased sense of stability over the traditional cruisers.

Step 1 Cruising Boards

These type of boards are made especially for people who are planning to use a longboard to get somewhere in the city, this means that it's going to be weaving in and out of some foot traffic. In this case is needed a smaller longboard since it will help navigating easier through the crowds and sidewalks. Mostly, cruising is made on flat surface but if there is the will of riding also some hills is better to take a longer board for increased stability.

Next, are introduced the features, in order of importance ,that have to be followed when choosing the deck.

- 1 Deck Length - the length from the deck's nose to its tail
- 2 Flexy or Stiff - the flexibility of the deck
- 3 Kicktail or No Kicktail - a raised tail that can be used for tricks and riding transitions

1 Deck Length

Right Deck Length

Boards vary in length from 711.2 -1 168.4 millimeters. It can go also smaller but for the beggining is better to be safer until the riding is getting comfortable. Below, are described different sizes for different types of cruising riding.

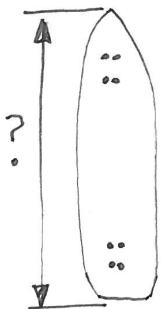


Image 13

Setup guide

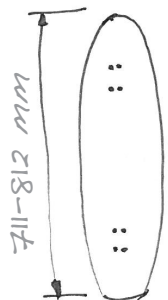


Image 14

Shorter cruising deck

These longboards are not quite 'long', dimensions vary in the range of 711.2-812.8 millimeters. Are a great for young riders. If taller riders are confident in their ability to ride, they can also use these ones.

Smaller riders



Image 15

Mid-sized cruising deck

If the rider is not sure what to pick, longboards in the range of 812,8 -1 066.8 millimeters are the perfect choice for cruising. With a medium length, these boards are intended to fit all riding types. Most of these longboards seen on the street will be in this range.

'Just right'

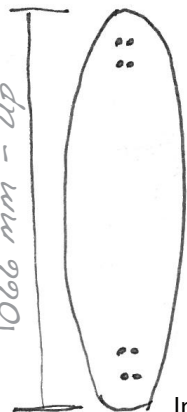


Image 16

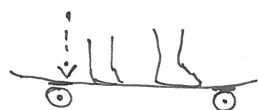
Longer cruising deck

These boards are ideal for longer, calm rides on the sidewalk or practicing boardwalking skills on flat surface. It is quite heavy, so maybe will be uncomfortable sometimes to carry it. The larger boards can get pretty heavy.

long + relaxed

Setup guide

2 Choosing Between a Flexy or Stiff Deck



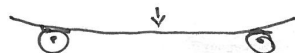
Flexy

Image 17

Flex is certainly very important when talking about cruising deck. On long rides is very helpful to have a flexible board. On a rough terrain, the flexibility absorbs the shock effects and also the riding is a bit lower to the ground than non-flexible correspondent parts. This type of shock absorption will help to disable some of the stress on the rider's body, mainly ankles and knees. Riding lower to the ground adapts rider's center of gravity making it easier to balance and push.

Some users love a flexible board, some like a stiffer deck so it gives them more stability. In any case, riders say that riding with a flexi deck is much more fun.

Flex 1: for those OVER 150 lbs
Flex 2: for those UNDER 150 lbs

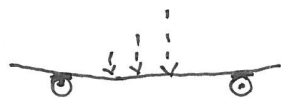


Small flex

Image 18

A deck with a small amount of flexibility

Many longboards get a sort of feeling that are more flexible than after are used for some time, but some have special features. The longboarding suppliers offer decks with a small amount of flexibility some giving extra leverage through turns and shock dampening effects for riding on rough terrain.

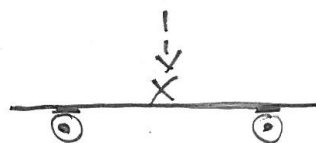


Flex options

Image 19

A deck with different flex levels

The right flexiness has to match with rider's body weight. Many companies offer different choices so it is simple to choose a proper flexibility on certain decks, even for beginners. Comparing to the other non-flexy boards this choice, depending on body's weight, gives a lower ride, closer to the ground, as well as a little bit of dampening system.



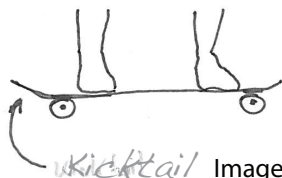
No flex

Image 20

A stiff longboard deck

Many riders consider a stiff longboard, a real longboard, they prefer to have a direct response from their turnings rather than a softer feel that the flexy deck gives. This type of board is easy to manufacture and it can be seen a lot in the downhill riding.

3 Choosing a Kicktail or No Kicktail



Kicktail

Image 21

There are two longboards that are perfect for this criterion: Loaded Dervish Longboard Skateboard Deck and Honey AMP 6 Longboard Skateboard Deck. The boards are easy to ride and they make the board more appealing. There are also people that like not to use a kicktail.

Setup guide



Image 22

A deck with a kicktail

A kicktail it is very useful when the rider makes quick turns, does tricks and down curbs. Everyone can ride boards with kicktails or without because it is just a matter of preference.

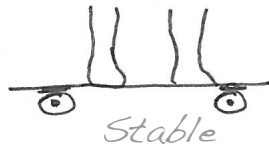


Image 23

A deck with no kicktail

If the rider doesn't want a aggressive ride, with kicktail assisted maneuvers, there are still plenty of options to fit other preferences. If is wanted a more stable deck ,is better to take without kicktail because are able to maximize the effective wheelbase.

Step 2 Cruising Trucks

Longboard trucks were designed with a important purpose: Control. Control over speed and control over direction, the control that users needs for longboarding progression. Below, are introduced the steps to be followed when choosing the right trucks for the longboard.

After the user is selecting the appropriate longboard deck, it's time to select his trucks. The selection is important since the trucks allow the rider to turn as well as keep wheels properly anchored to the board. There are many considerations for the trucks for cruising/ carving longboard. Luckily for someone who is a begginer the choices can be made very simply. The best and easiest way to select trucks is to choose one that are closest to the board's width. This will allow a proper selection of wheel choices and a consistent ride wherever is the rider heading.

Further, will be presented how to choose trucks depending on different aspects. These are showed in order of importance.

- 1 Truck Width - 150mm / 180mm truck widths
- 2 Standard or Reverse Kingpin

1 The Truck Width

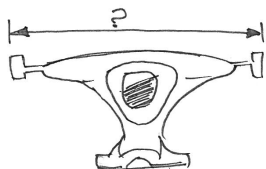
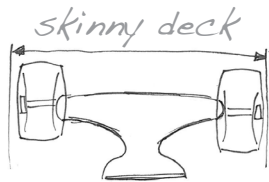


Image 24

The rules are simple. There are basically two widths to choose from: 150mm and 180mm. So, the trucks width has to be as close as possible to the board width.

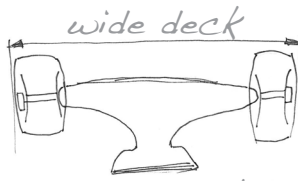
Setup guide



skinny deck
small trucks
Image 25

Trucks for Skinny Boards

Usually, the cruising boards have widths less than 215,9 mm. For these types fit the 150mm trucks.

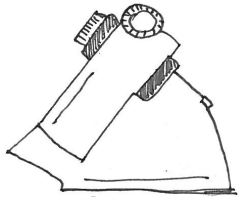


wide deck
wide trucks
Image 26

Trucks for Wider Boards

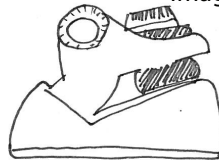
The carving decks usually have widths run 215,9 mm- 266,7 mm and up. For these fit 180mm trucks.

2 Choosing a Standard or Reverse-Kingpin Truck



Reverse
Image 27

The manual style of cruising longboard trucks are 'reverse-kingpin'. These type of trucks are designed for higher range of maneuverability. The use of standard style ones is more rare, but they do get enough turn. With a little bit of adjustment and upgrades (bushings), these trucks will allow a simple smooth turn whether they're standard or reverse-kingpin. Usually, riders choose the last mentioned.



Standard

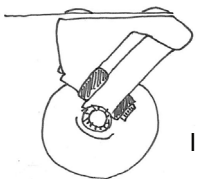


Image 28

Reverse-Kingpin Trucks designed for carving

In general, these types of trucks can be seen on longboards on the sidewalk or on the downhill race track. The main purpose of design is to allow more carving and more ability to turn.

Designed for carving



Image 29

Standard-Kingpin Trucks designed for street/slalom

The 'standard-kingpin' trucks are most often seen on street or in a half pipe at a skatepark. Professionals recommend the standard ones for cruising board with kick-tails since it allows for nice sharp response from the use of the tail.

Designed for street/slalom

Setup guide

Step 3 Cruising Wheels

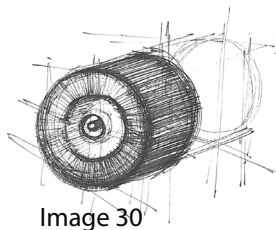


Image 30

The colors are not the most important factor when the riders get to choose the correct wheels. In determining how well the board will ride it has to be taken into consideration the following: the wheel's hardness (durometer), the size of the wheel (diameter). The color is used sometimes to differentiate the durometers. There are a lot of companies out there that sell a lot of types (brands and styles) of wheels so there is plenty to choose from.

Next are introduced, in order of importance, the features of cruising wheels.

- 1 Diameter - the wheel's size
- 2 Durometer - measured on the standard 'A' scale for hardness
- 3 Shape - Rounded edges, Squared edges...

1 Wheel Diameter

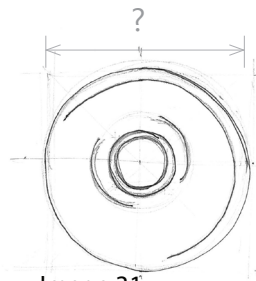


Image 31

Usually, longer decks go well with bigger wheels and smaller decks with smaller wheels. The small ones go well also with longer decks but in general a bigger wheel will provide a better overall ride. Larger wheels don't work with smaller decks because while carving, the wheels will rub the bottom of the deck (this effect is called 'wheel-bite') and this will stop briskly.

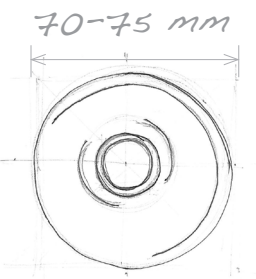


Image 32

For Large Decks 1016 millimeters and Up

A good choice for boards over 1016 millimeters and more will be a wheel in the range of 70-75mm. In general it goes like this a larger board should have larger wheels, meaning that the selection of the wheels is made in proportion with the board size. As an advanced tip: it should be selected a smaller wheel in this range for easier acceleration (pushing). Larger wheels go better for slightly higher speeds but generally speaking, is just a slight change.

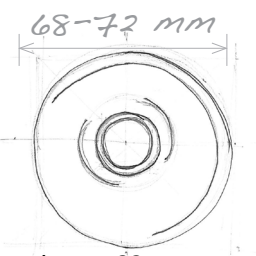
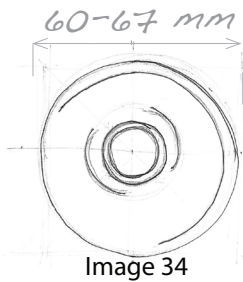


Image 33

For Medium Decks 863.6 -1016 mm

For boards between 863.6-1016 mm select a wheel in the range of 68-72mm. The right thing to do is to select a wheel in a medium size range for a medium size deck. Tip: for pushing select a smaller wheel in this range. For higher speeds select a larger wheel.

Setup guide



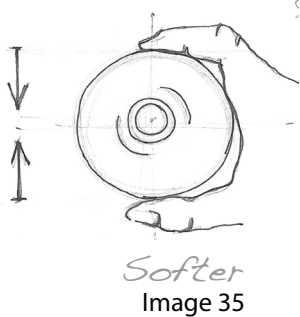
For Short Decks 863.6 mm and below

For boards 863.6 mm and below a good selection would be a wheel in the range of 60-67mm. Is better to choose a small wheel because small boards have small wheelbase so the board will not be top heavy. Tip: For pushing select a smaller wheel in this range and for higher speed a larger wheel.

2 Choosing Your Wheel Durometer

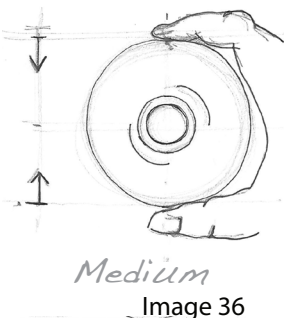
The hardness for a wheel is based on two aspects: personal preference
rider's weight

For the cruising setup, the best is the rider to imply that his preference is to have a comfortable wheel that will roll without any problems over bumps on the sidewalk. The heavier the rider is, the harder the wheels should be. If is too heavy for the wheel, it will slow down quicker and feel every crack on the sidewalk. On the other hand, if the rider is too light for the wheels, he may not produce the correct amount of pressure to keep the wheels gripping to the ground.



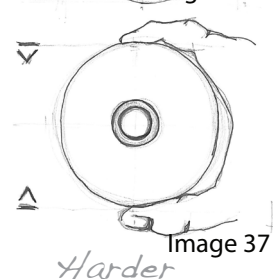
Riders weighing 61 kilograms and below

Cruising wheels in the 78a-80a range.



Riders between 61 and 79 kilograms

Cruising wheels in the 80a-83a range.



Riders over 79 kilograms

Cruising wheel in the 83a-86a range.

Setup guide

3 The Wheel Shape

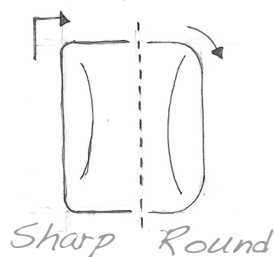


Image 38

The wheel's shape is another important factor in establishing the best cruising wheel for the longboard. In general, any shape will work for a standard cruising setup. But getting more specific, after narrowing down the wheel's features from the many options in size and hardness, the next step will be to look for a wheel with more of a square edge. This has an influence in maintaining traction while riding.

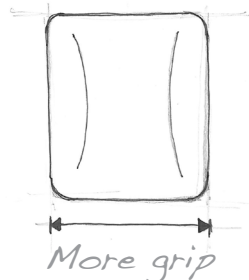


Image 39

'Sharp-lip' Shape

When hard force is applied while doing hard turnings, a round-lip wheel offers less grip than a sharp lip on a wheel. For general cruising and carving this style of wheel fits the best.

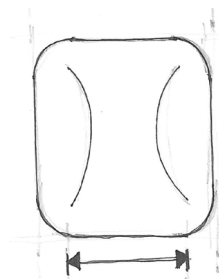


Image 40

'Round-lip' Shape

The round-lip profile gives a predictable slide from start and finish. If the user is looking to make slides and carves surf-inspired, then he needs wheels with round lips or this type of wheels can be perfect for someone who wants to learn how to powerslide.

Step 4 Cruising Bearings

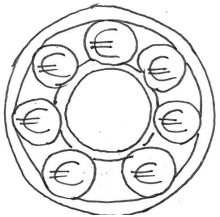
Bearings have a long history, they exist since the beginning when clay wheels were the best. Standardized bearings enable the wheels to spin freely without being affected too much by unnecessary friction. As long as water doesn't reach the bearings or dirt, there is no need to worry about replacing them. Most longboard fans have always spare bearings in case they need to make a fast replacement.

Setup guide

Next, are introduced the main aspects regarding the bearings. They will be presented in order of importance.

- 1 Cost
- 2 Durability - Abec bearings are not always better than non-abec bearings

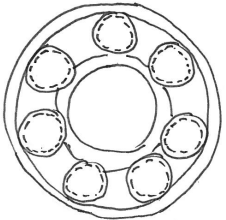
1 Bearings for Budget



More savings
Image 41

It is very simple. When limited by budget (or not) Bones Reds are the best choice for cruising. As long as are protected from water (also known as puddles) and sand, Bones Reds will last for a long time. They are easy to clean and to replace. There are also other bearings on the market at a similar cost, but these bearings have been around since 1983 for a reason.

2 Bearings for Durability



More strength
Image 42

If not constrained by money it is necessary to look in the market for a more durable bearing.

What is on the market

In the skateboarding industry the fastest growing sector is the longboard market. Riders and manufacturers continue to develop this active sport through constant innovations.

Covered in this section: Complete Longboards
Trucks
Reflection

Market analysis

The longboards are manufactured for different types of riding :downhill, freestyle, dancing, cruising ,the latter being the one that didn't evolve so much lately in terms of design and many people use the longboard just for this, going to the mall, having a ride in the park or just cruising through town. It is their own transportation method , is very handy and almost all riders have one ,even as an extra. Being that important it makes sense to be in the sector of design evolution like any other boards that are now in development. That is why the next pages will concentrate only on the cruising longboards sector.

Complete Longboards

Company	Principal	Price	Technical Specifications	Product
	Traditional Cruiser more agile for moving around large crowds	€ 60.5	Length: 838.2 mm Width: 241.3 mm wheelbase 508 mm concave DEEP pop HUGE	Earthwing MiniGlider 
	Commuter Style	€96.84	Length: 914.4 mm Width: 241.3 mm Wheelbase 774.7 mm Griptape: Pre-Gripped Clear Spray-On Grip	Honey 2012 AMP 6 
	Flexible Drop-through No.1 Longboard	€148.96	Width: 216 mm Length: 1034 mm Wheelbase: 838.2 mm Deck material: Epoxy and Tri-axle fiberglass sandwich a vert-lam Bamboo core	Dervish 

Competitors

Trucks

Company	Principal	Price	Technical Specifications	Product
	trucks for Skinnier Decks maintain stability at higher speeds, through turns and while pushing base plates and hangers interchangeable adjusting caster angle by flipping the hanger	€20.15	Actual (Axle) Width: 216 mm Virgin grade aluminum. Grade 8 'cast in' axles 50mm Grade 8 axles Grade 8 king pin Red 92a Conical Bushing	Randal RII - Raw 
	trucks for Wider Decks extra lean and no turning restrictions	€48.44	Baseplate Angle: 52° Actual Axle Width: 247.6 mm Width: 181mm Truck Angle: 45° titanium axles and kingpin	Grizzly 852/840 
	Reverse-Kingpin Trucks Secondary heat treatment process adding strength and durability	€19.33	Width: 150mm Actual Axle Width: 216 mm Baseplate Angle: 50° virgin aluminum gravity molded baseplate and hanger steel axles and kingpin	Paris -Silver 
	great turning ability a low, light, and stable precision truck for downhill, cruising or beginners	€ 249.95	Width: 204 mm Angle: 45° Axles: 8 mm Bushings: Divine 90a Weight: 428 gram/truck	Kahalani Precision Truck 

Reflection

Reflection

This sport is growing fast and after a market evaluation it is clearly that longboards selling is rapidly increasing. There are many board manufacturers , plenty to choose from, but less for trucks. A possible explanation would be that truck manufacturing requires more technology , more money to be invest in. Or the actual design is the simplest and the most efficient and needs more tests to be made, prototypes and engineering knowledge to progress therefore not many designers and producers don't launch out in this area.

What is next?

For so long, many new companies have come into the industry with a promising product, and in the end to realize that they offer the same exact boards that other companies are already making. Every company offers the same thing, but whatever company pops up on a Google search first, gets to sell to the new young, uneducated customer. Is time to change and many riders are waiting for it with enthusiasm and ready to try them on.

Just few companies are trully making products by the rider for the rider. The ability to make universal products that fit any style of riding separates the true companies from the one-dimensional ones. This is maybe the future of longboarding. Changing and colaboratin components is the key to evolution and expansion which has to start right away untill the market is filled up with longboard clones.

Small hints

competitive longboarding will be established as a mainstream sport

will appear lighter but stronger materials

materials and manufacturing techniques previously used will be related to cheap longboards - luxury lines may appear

more people will buy longboards online- ecommerce growth rates are enormous

because of internet distribution, consumer will be closer to the longboard warehouse

big brands will acquire stable big longboard brand (for example Billabong bought Sector 9). This means that big brands will win the pricing manufacturing benefit that comes with complete longboard selling, leading to lower prices on the market but in the same time it can also have a downside: it may not appear further original and creative new designs.

if big brands take over, the small companies can make their own way and find a niche in the local markets and consumers that are less brand-oriented

History and Culture

This short chapter is intending to introduce the culture of longboarding : where all started, who made the first longboard and who was the first to ride it or how was the lifestyle back then. These aspects are important in this research because this culture is powerful and it is aware of the roots and people that really had influence on the evolution of this active sport. When designing a new product for the riders is important to listen to their desires and requirements but also to know their culture, the ~~research~~ ~~research~~ is mainly made by reading articles, specialized books and interviewing a small group of riders, so the chapter is a mixture of information ,objective and subjective opinions but when everything is arranged together it matches. It is an incredible culture to know about and analyze.

Short History

For the first time skateboarding appeared in Oahu, Hawaii. Surfers used this skateboarding as a cross-trainer. When there were no waves, they would go skateboard. They would mock the moves of surfers by skimming their hand on the ground, carving fast, walking up and down the board and try to have as much flow as possible. At first, board technology and riding technique improved slowly, later spurred on with more fervor by the advent of the urethane wheel. To better simulate the surfing sensation, hardwood tailplates were attached, making tail-dragging bottom turns and cutbacks genuine weighting maneuvers rather than sort of a balancing act. Walking the nose and impressive bottom turn spinners were a direct carry-overs from a the all-but-extinct brand of 'longboard surfing'.

At the beginning it wasn't call skateboarding ,it was called Sidewalk Surfing. In 1959 skateboarding hit the market place and became popular with this name. The boards were sold everywhere. The first professional boards were made by a company called Makaha. And the first fiberglass boards were made by a company called Gordan and Smith, a.k.a. G&S. But, of course, the boards were dangerous at the time. The components were: a plank of wood, trucks that came from rollerskates and the metal wheels that were on them. It took them a while to find out that the clay wheels were better and safer. And after a lot of time they realised that wheels made of urethane were not only safer, but smoother and grippier as well. Cadillac was the first company to invent the urethane formula for skateboarding wheels. People started to call skateboarding an unsafe activity so it died for a few years. . In 1973 (known as the second wave) skateboarding became popular again. The birth of the urethane wheels brought the sport back to life. All the companies started to produce this type of wheels. The disciplines of the sport also started to rise. There was now freestyle, cruising, slalom, downhill and so on.

A lot of skateboarders became famous like Tony Alva, Jay Adams, and Bruce Logan helped shape the sport. Because of the high numbers in skateboarding, Florida decided to make the first skatepark. It definitely sparked the fire and skateparks were all over America. In the late 70's, Alan Gelfand invented the "ollie" or no-hands aerial and so skateboarding moved to another level. It started to become more rebellious for example skateboarders listen to music that was about 'anarchy' and committing crimes. Often the skateboards were inked with skulls as a graphic on the bottom. But safety once again became

an issue because the nsurance was expensive so that skatepark owners closed the parks. In 1980, skateboarding died another time. In 1983, skateboarding started up again and fell in 1991. In 1993, skateboarding made a comeback and to this day, skateboarding has been a very popular sport.

In this great skateboard community was introduced the potentail dynamism and style of longboard skating. Comparing with the skateboard, longboard riding has generally has not progressed at a pace with riding conventional-sized boards with some exceptions.

Short History

Most latter-day longboarders would agree that little has changed in the fundamental concept behind their style of riding: longer (surfing-type) lines, speed and flow.

When and if skate environments become more adjustable and longboard interest grows, attention will undoubtedly return to the basics--the longboard itself. Board weight could be further reduced, for instance, through the use of carbon fiber and honeycomb construction for a higher absorption of forces. A line of longboard trucks might also be developed, although there is little concordance as to what should constitute an improved system.. Or, it could be that new vehicle design will be the impulse for longboardable parks.

Ed Economy was speculating in 1970 :‘Someday someone will come up with such a hot, functional longboard that everybody will get into it. Even if they ride a little board, they’ll want a longboard on the side.’



Tonger Johnson, Bruce Logan
considered by many
to be two of the best
in the world, and
they know what kind
of board works best.

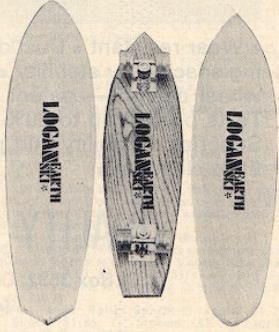
Birch wood (non-flexible)
3/4" thickness—7 1/4" wide
All-steel Chicago trucks
Regular size Roller Sports urethane wheels
(unless otherwise specified)

Designs & Sizes

☐ Pintail	29"
☐ Diamond Tail	25"—29"
☐ Square Tail	25"—29"
☐ Rounded Tail	25"—29"
☐ Rounded Diamond	29"
☐ Slalom Board	27"

☐ Wide Wheels \$1.00/pr.
☐ Large Wheels \$1.00/pr.
☐ Stokers \$4.00/wheel

Chassis only \$9.95, add \$1.00 per blank for shipping and handling.
Enclose \$23.95, plus \$2.00 for postage, handling and sales tax.
Mail to Logan Earth Ski, P.O. Box 279, Encinitas, CA 92024 Dealer inquiries invited.



photos Warren Bolster

Image 57

"I can relate longboarding to surfing. . .you have to torque your body as if you are riding a wave."
Brad Stradlund

Reading the previous pages, researching the riders' desires and new upcoming trends seems that this type of sport is starting to get 'back to the roots' in meaning of design, the functionality remaining the same. The functionality appears to lack though. Since 1970's the longboard didn't change much: in terms of components: . Until now the longboard contains a plywood board, trucks wheels and a griptape. The shape of the board changed a lot, mostly depending on the type of riding that the user wants. But still longboarders think that is place for more, for discovering new possibilities of riding, improving the old accessories or even giving new meaning to this lifestyle. Knowing the culture it can be easily seen that the aesthetics and functionality play an important role in the design of the board. Also the culture slowly it was introduced in fashion this making longboarding/skateboarding/ surfing well known as culture and slowly it spreads around the world becoming a trend in lifestyle.

About the longboard and the culture within.....

Knowing the culture it can be easily seen that the aesthetics plays an important role in the design of the board and slowly it was introduced also in fashion. The reason is that also appearance is important for the riders as individuals. In general, they like original looks combined with functionality: one rider likes a pair of purple well known brand of skateshoes but it doesn't buy iFreddy Gonzalez

It's important to consider the grassroots culture where all of this began.'

This sentence is the epitome of the research part, always it is take note of it and also reflects an important part in the analysis process.

Comfort, self-expression and function

These were the three main ideas that propel and dictated the surf and skate style long time ago. Once tagged as lazy and outsiders, these rebels have now become this generation's style innovators due to the upsurped popularity of action sports.

Actually, as you interact with this people or research about this culture you discover that it's only about the boardsports. The true essence style goes further products, clothes and accessories. When looking at this community of skaters and surfers it is easy to understand that their true style comes from how they apprehend the world around them. For these people it's not only important the time they spend riding the boards, but also the moments leading to it. You concretize the style if you experience happiness in the small things as well, for example a walk through the park or to the beach, the meetings with friends, and the sun on your skin when is a perfect day of riding.

Freddy Gonzalez explains : 'The thing that makes the boardsports style unique is that it's a subculture, an identity'. He is the President of Freesurf, Inc., a company that distributes action sport brands through specialized stores.

It is amazing how this culture rapidly grows and also it's interesting to observe that it's spreading from the core practitioners to everybody else but is still maintaining the style and cult status. Nowadays, the functional world of these sports becomes stylish, looks mixing hardcore boardsports lifestyle with the art-driven fashion.



Image 58

The User

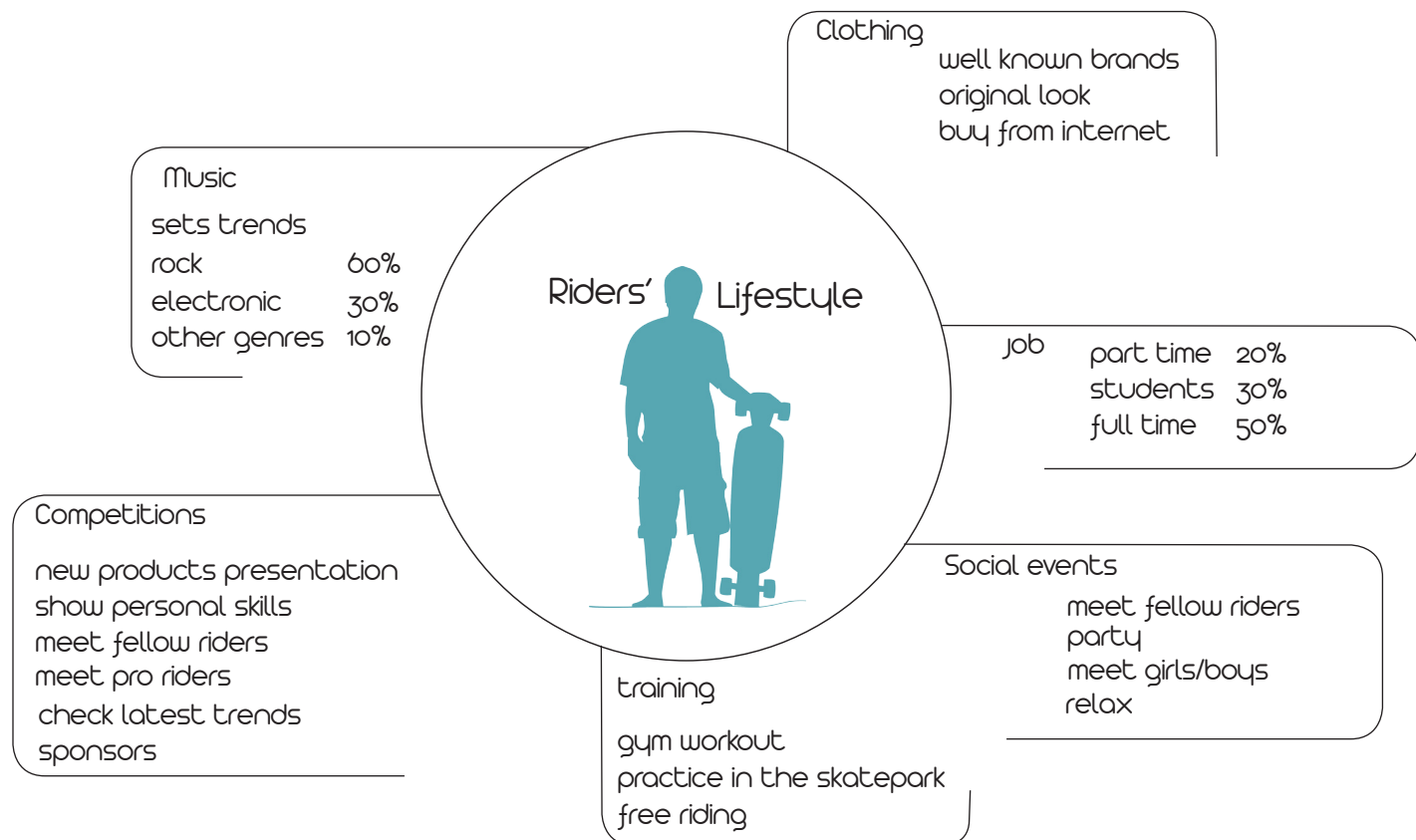


As longboarding is a trendy active sport now, many people are making it for fun, some for competitions and some just because it is cool to have it. Anyways, it is known that this active sport is getting spread around the globe pretty fast and many people of different ages are delighted to ride one of these items.

Making a high-end quality product means also to be aware of users' needs and demands therefore in this chapter it is introduced the interview method and also the shadowing. Last mentioned is used to observe a situation or a person, but without interfering or interacting. This part of the project will present longboarders' life by making an analysis and reflection on their lifestyle, their demands and the culture of this sport .

User

Meet the longboarder. An enthusiastic person who never finds himself needing a reason to get on the longboard and go. There can be million things on his mind, but as soon as he steps on his board, everything disappears. When he is riding along on his board, he feels safe. Not physically, but regards to the day to day aspects. Everything goes away and the ride begins: like a painter painting on a white canvas, the city becomes the canvas and the rider drawing the lines with the four urethane wheels of his longboard.



The diagram presents the sectors of longboarders' main interest. The purpose is to get closer to the user and get to know their daily habits, what they like and dislike, what they care about and finally get to know their preferences in this active sport.

User

Below are charts made towards with different aspects regarding rider's information, preferences in longboarding, small answers that can guide the project to a certain area of analysis and find a niche where this users need a new design implication.

Riding type



Occupation



Hours of riding / week



Occupation in domain



Trend oriented



Trend vs function



Cruising



Longboard for transportation



Longboard design



Note: All charts are a result of questioning thirtyfour riders between ages eighteen to twentyeight during interviews in the streets and situated interviews.

Target

The majority of riders have ages between seventeen and twentyeight, different from the ones that practice skateboard ,where the average age is around fifteen. Longboard is more adult oriented, is a level up in meanings of awareness , accessories investments and riding style. The safety gear is expensive and in most of the cases it is must so the users has to afford to pay for it. Changing wheels, trucks, getting riser pads or other accessories also requiers money, which in many cases the youngsters do not have so this can be also another possibility why adults are longborders. Another aspect that does not imply money is the riding style and location. Many longboarders ride long distances, or big hills with a high grade of danger, or that imply high speed ,tha latter is for many young people not appealing, yet. So, in the end the longboard design is dedicated most to the adults, to the ones that are more aware of safety and in the same time like extreme feelings.

Lifestyle

The riders have different occupations, different music preferences, or clothing style but one thins is getting them together and that is longboarding. Lots of riders meet in weekends riding the hills with high speeds, recording and making short movies with'perfect days for riding'. But untill they get there, the week-day is different. Many have jobs or are students which is an impediment when it comes to riding, but their opinion is that is better to progress slowly-in the weekends-, safe-afford safety gear-, than all day without money and no chance evolving in style. This sport requires an amount of money per month, depending on the usage of course, for changing wheels, bushings, bearings and they are not cheap that can be a niche to be analized: reducing the hardware costs or reducing the need of changing it.

Interviews & Questionnaires

As this active sport is dedicated to its users personal requirements on riding, an important fact, in knowing the user and its desires, would be to actually have a life meeting with them. The process of knowing the riders is interesting and full of information related to culture, design, technical aspects. Getting an insight on how they are thinking and what are their opinions about this sport had a lot of repercussions in the evolution of design process.

Organised interviews and questionnaires were arranged in the beginning of the research phase. Many riders were happy to help and give information and expressing personal opinions about different subjects. They are full of enthusiasm and a flush of information is coming from their behalf. This was hard to remember so for the interviews it was prepared a stack of sticky-notes each one to put down their thoughts, wishes, demands. The comments in between the interviewees were actually the most interesting. In break-time, not knowing they were 'secretly watched and heard', the riders were just discussing free, imagining new possibilities or just arguing on different personal opinions. The entire interviews and the questionnaires can be seen in the Appendix.



Image 65

Interviews

The interviews were relaxed with free discussions, sometimes conducted depending on what was the interest at that moment, but in general it was just a meeting between riders with a 'spy' that listens and takes notes. The reflection is made in accordance with the answers' interpretation from the questionnaires. After the interview is finished, a questionnaire is launched on a forum of longboard riders in Austria and one in Romania.

Questionnaire

Since the live interview gave so much useful information also besides a questionnaire was organised a live one. Were invited six participants, three girls and three boys, that were riding in different styles between the age of twentyfour and twenty-nine.

The questionnaire has seven questions with given 'answers', represented by pictures and a blank space that can be filled in with own opinions, if wanted. They have to make combinations of images as they like. This type of doing a questionnaire seems to be much more attractive for the interviewees and also for the interviewer is a better way to analyze the answers.

Interviews & Questionnaires

The subjects of the questions are different and are trying to get as much as possible an insight of how the riders are and what do they want.. Below are the seven questions with a general interpretation. The answers differ but it is easy to see that mostly the riders are similar in terms of character and demands. As an example is presented the question number three and the pictures related to it.

Reflection

Playful but professional. This are two characteristics that came out each stage of interview or questionnaire.

The neon colors are the most wanted and this means they like to be flashy, to be noticed. The colors are intended to be not only on the longboard but also in accesories, clothes or shoes.

Also the attention goes on the high tech gadgets, starting with smartphones to professional film-ing cameras and watches with new features. The gadgets seem important for the riders, espa-cially the ones that are related to longboarding but also the daily one s seem to be a big interest.

The riders like extreme feelings and they want something more from the current sport, that they can compare with flying. Meaning they need a new sensation , to eliberate throug riding. They dream at 'spaceships', at a different function and form , more futuristic and with a lot of small helpful features.

The girls made extreme combinations, for example romantic bikes with mountain race bikes or another combination was a motorcycle mixed with a monocycle. In any case, it can be felt that they desire something new, an original type of riding , a crazy combination that can satisfy their unsettled soul..

When they were asked with what can longboarding make a 'couple', many answered travelling, creativity, superman, food and beach. Most of them represent the pleasures or the basic things in life.... and longboarding is staying right next to them. They see it as a basic, daily activity, it is important for them and they see it as a part of them.

Flying appears again on the desires list. The new longboard should be on that can be rided in a new way , with no effort, just use the movement of the hips or hands. Also Alladin's carpet was brought forward. It can have two menaing's one that is like a dog, man's best friend, always around, helping and playing with you. Or is the one that get's them out of troubles, it is always around ,you just have to jump on it and run away. So , for the new longboard would be the follow-ing demands: it has to be always around, easy to carry (maybe following the rider?), the effort of riding is decreased, similar to flying, an auto pilot could be great.

Interviews & Questionnaires

The accessories are very important when talking about longboarding, even if talking about clothes, protection or new wheels. The most wanted are: first aid kit, neons and lights. This means that safety is important! a flashy look could be great, they want to stand out and look different and the last one is that they need to see by night. By night, the traffic is diminished and is better to ride in that time but some streets or hills are not illuminated so a good accessory would be some running lights.

Flying appears again on the desires list. The new longboard should be one that can be ridden in a new way, with no effort, just use the movement of the hips or hands. Also Aladdin's carpet was brought forward. It can have two meanings one that is like a dog, man's best friend, always around, helping and playing with you. Or is the one that gets them out of troubles, it is always around, you just have to jump on it and run away. So, for the new longboard would be the following demands: it has to be always around, easy to carry (maybe following the rider?), the effort of riding is decreased, similar to flying, an auto pilot could be great.

Despite the fact that they like neon, flashy colors and also they like to be noticed from the rest of the people, many describe themselves in the same time as simple, modest and supporting the classic look and sometimes luxurious.

So, this can be seen as a good opportunity in design: a new elegant line of longboard that distinguishes its rider from the others and in the same time keeps the classical lines and rises one level up in functionality.

User needs identification

Wishes	Demands
easy assamble/dissasemble	assembling method easy loosening the kingpin & axle nut
easy handling	weight of hardware type of mounting
light weighted	material hardware size
easy to maintain	easy loosening the kingpin nut easy loosening the axle nut
last long	clean & lube bearings material strong kingpin manufacturing process
reasonable price	material manufacturing process hardware complexity
effortless adjustments	assembling mechanism easy loosening the kingpin nut easy loosening the axle nut truck bushings
safety of the hardware	geometry of trucks assembling mechanism trucks attachment
high-end quality	kingpin and baseplate design material assembling mechanism
environmently friendly /recyclable	material manufacturing process
'crazy' look	trucks design material board design
stability	lower angle baseplates easy tightning the kingpin
turn-ability	easy loosening the kingpin higher angle baseplates

Vision and Mission

Vision

... design a solution for the longboard with focus on the trucks that is both **functional** and **appealing** for the rider. The mounting solution also has to be **easy, fast** and **universal** -can be applied to any other trucks available on the market. The design should be unique , comfortable and functional fitting user' s needs in various ways.

Mission

... create a new design for longboard trucks that fits **current** mounting system and **upcoming trends** and that will make the **ride smoother** and the **assembling easier**, more efficient and pleasant while also having a great attention to aesthetics.

Specifications

Wishes

- assembling and dissassembling method should not require tools
- minimum use of material
- hardware mounting method should remain unchanged
- the truck shape should raise the riding speed
- the material used should be water resistant

Demands

- the king pin nut should have an ergonomic shape
- the manufacturing process should be cost effective
- the reinforcement pattern should strenghten the trucks structure
- use a much higher quality metal
- permanent bond between the axle and hanger

Trucks details

In this chapter are presented the most important features and components of trucks. To have a clear image and understanding of how longboards work it is necessary to get deeper into analysis and reflect upon options of mounting, the assembling parts and what influence have the trucks upon the riding.

Trucks' assembling parts

Axle	holds the bearings
Axle offset	axle's position compared to the pivot axis
Axle travel	This is the path the axle takes when it rotates on the pivot axis
Roll center	defined where a line, square with the board, crosses both the axle's center, and the pivot axis. A line between these points on both trucks defines the roll axis
Top bushing	made from polyurethane, it helps hold the hanger in place and control turning.
Roll-axis	this line is what the board rotates around when it leans
Roll center	defined where a line, square with the board, crosses both the axle's center, and the pivot axis. A line between these points on both trucks defines the roll axis
Cup washer	these help push the bushings into the hanger's bushing-seat. The cup shape also helps control the shape of the bushing's distortion when the hanger turns
Bushing seat	this part's shape helps the bushings to keep the hanger in the right place
Hanger	holds the axle and bushings and has a pivot. It's width controls the distance between the truck's wheels.
Pivot	part of the hanger, it helps hold the hanger in place, as well as constrain it's motion to the pivot axis.
Pivot-axis	this is what the hanger rotates around when it turns
Pivot-cup	made from hard polyurethane, it holds the pivot in the correct position
Baseplate	connection with board, when turning holds the pivot-cup and kingpin
Kingpin	is a bolt that holds the truck together as one unit. How tight it is affects how the board turns.
Bottom bushing	it helps hold the hanger in place and control turning. is made from polyurethane.the bottom bushing takes rider weight
Caster	Positive is the tendency for the truck to stay centered. Negative is the tendency of the truck to stay in a turn. This is determined by the axle offset being either above or below the axle.

Trucks assembling parts

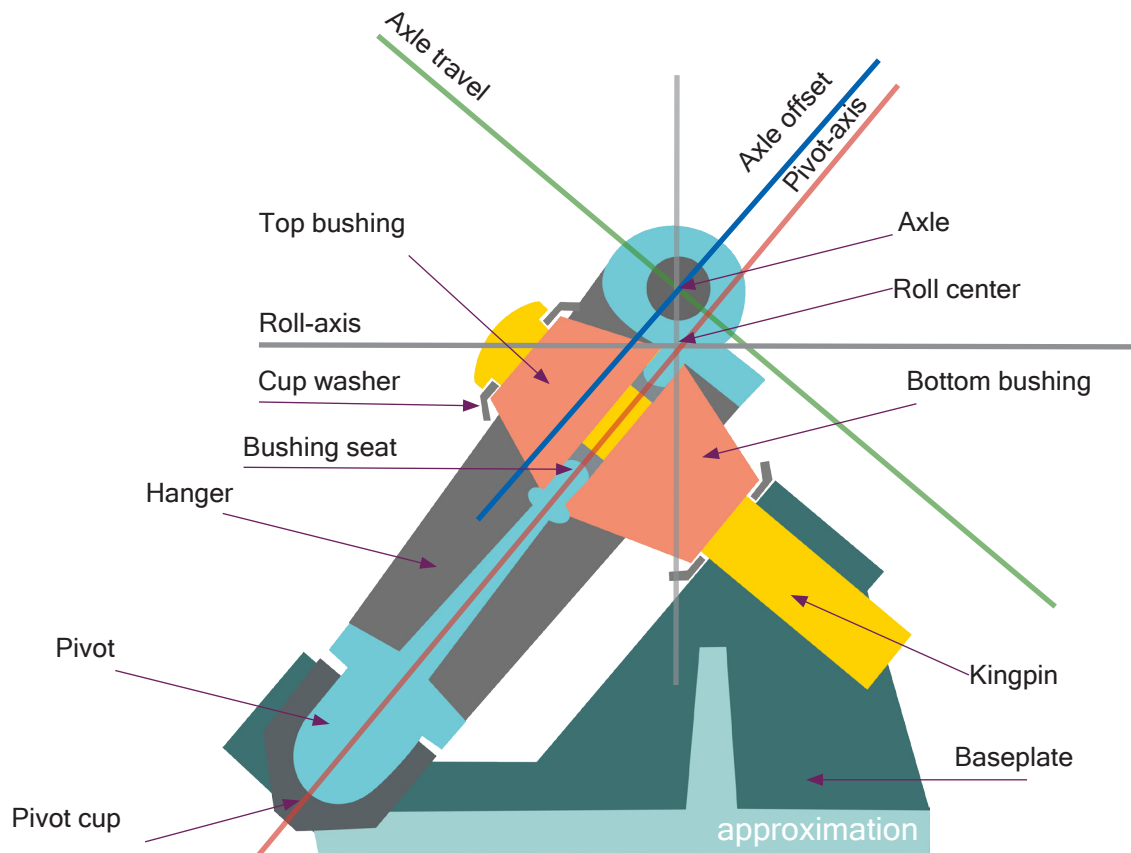


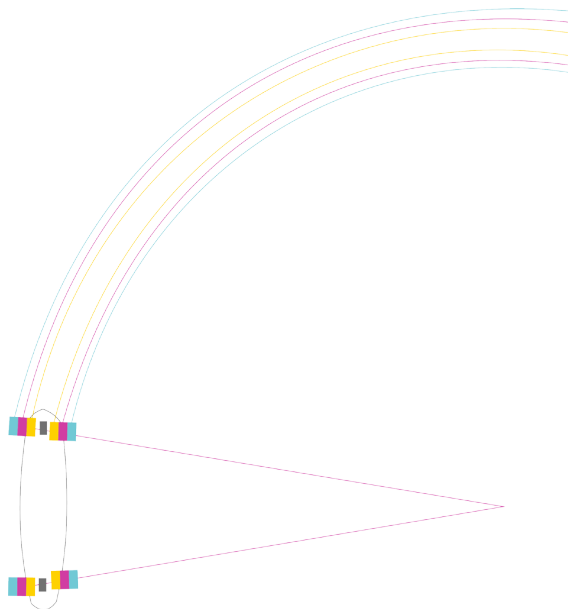
Image 66

Trucks' width

When choosing a truck it has to be taken into consideration the width of the board. The best would be to try to match the outside of the bearings with the edge of the board where the front foot stays. This will provide good leverage over the hanger.

Tip: The best would be to have a hanger that's a bit wider, than too thin- if not, the outer wheels may lift when turning. Having a wider hanger, the wheel will travel a longer distance to get to an angle and also more board-lean is lost to bushing compression. The thin hanger makes quicker turnings because the deck usually has more leverage over the hanger so the wheels travel a shorter distance to get to an angle. It is wide spread among riders to purposely choose thinner hanger to increase their board's leverage.

Trucks



wider hanger **Pros** more stable
less board-lean

Cons wheels travel longer distance to get to an angle

thinner hanger **Pros** quick turnings
wheels travel longer distance to get to an angle

Cons wheels may lift when turning

Angle

On the same wheelbase, a higher angle pivot-axis creates more steering per board-lean than a lower one. The high angles are more suited to turning and the low angles are suited to speed. However high angled still have to be stable for a good turn. And low angled ones have to keep board length down, without sacrificing stability.

How to measure the angle

Angles are defined by the a line running between the pivot cup and the point where the hanger face is intersecting the kingpin.

There is no "better" just different angles for different reasons. The average truck has around 45 degree pivot angle . That means the axles bend about the same amount as the board inclines.

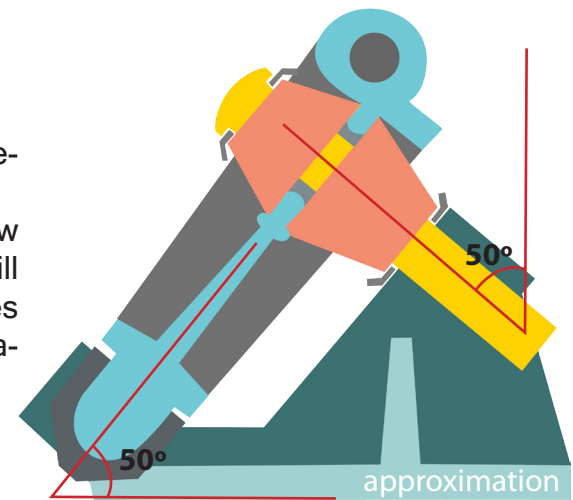


Image 67

> 45° - the axles turn more degrees than the board leans
< 45° - board leans more than the axles turn

Trucks

At a high-angle truck, the wheels move in-and-out more than low angle trucks. The low angle ones have a more up-and-down motion. The wheel-wells' position can be affected by this difference. Together with wheel-size and hanger width will affect surely the size and shape of cutouts.

The illustration below represents how low-angle trucks create less turn when compared to high-angle trucks. It has to be considered that this representation is made when the board lean angle is the same.

example

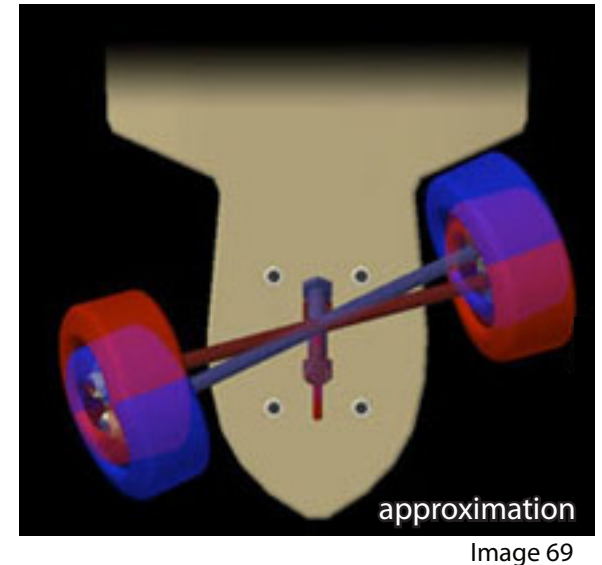
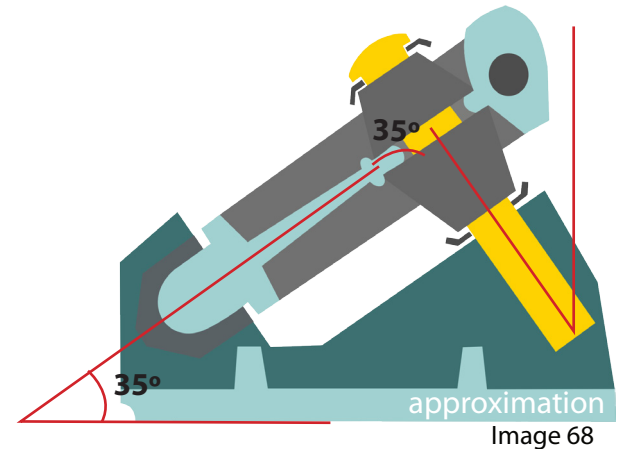
50° pivot axis - 32° angle turn

35° pivot axis - 25° angle turn

Note

Not all companies have the same method of measuring truck angles(eg. if it is measured differently, a 50° truck can be named 40°($90-50=40$)).

As the pivot axis goes further above 45° , the more downward force is requested to make the hanger turn, until 90° when it is impossible to turn the hanger with the deck. Inverse, the closer to 0° it gets, the easier it is to lean. In this situation is assumed that the bushings, tightness and board-width remain constant .



Possible Problems

Trucks squeak

This sound usually comes from the pivot rotating in the pivot-cup. It's fixable by a variety of methods, such as applying wax, soap, graphite powder or cooking oil to the cup.

It's recommended you don't use petroleum-based products as they can degrade the pivot cup and bushings.

Trucks rattle

In general ,this sound comes from the top washer. It's given by the rider's weight compressing the bottom bushing. This creates a gap between the top bushing and the cup washer allowing the washer to clatter against the kingpin. It can be fix by tightening the kingpin, but this can change the turn characteristics.

Other clatters can be from the deck-bolts that are loose, is better to check that they are snug. As maintainance, it is necessary to check the deck-bolts .

The bearing spacers can be another potential source of clatter. Sometimes, they can rattle between bearings. If the wheels are as tight as possible without the bearings binding or compressing the spacers, it shouldn't be any problem. If the wheels still rattle the spacer may not be the right width, or it was compressed. In any case the best is to replace them. Most fleetness available wheels require either a 10.16 mm or a 7,62 mm spacer.

Wheel-bite

Wheel-bite means when a turn causes a wheel coming into collision with the deck, usually this stops the board suddenly. This has to be tested before riding any board. It can be prevented by keeping the kingpin tight enough to avert the hanger from leaning far enough for it to bite. If it is very tight , it can create an unsafe steering capability of the board.

Solutions

1. Risers -place in between the base-plate and deck, this will put the wheels further from the board
2. Sand wheel-wells -the place where the wheels would hit the board.
3. Smaller wheels -the lower radius can give enough room for a full turn potential.
4. Cutouts - remove the section of board that has any chance of hitting the wheel

Note

There is not a general rule, between the manufacturers , to place the wheel-wells in the same position. Not all trucks have the axle in the same position relatively to the board-bolts, nor pivot on the same axis. Also, the wheel size drifts the contact point. The bigger wheels contact closer to the truck so they require larger cutouts. This cutouts may create a weak-point so it is not recommended to do this without reinforcing it somehow, or unless the board has more than 9-ply-woods.

Trucks

Turning the Trucks

More turn Among riders, this is a frequent desire. It can be achieved by five methods.

1. Higher angle baseplates - this can be done to both ends, or just to the nose.
2. Risers - insert them and it will increase board's leverage over the bushings
3. Installing softer bushings - small cost with sometimes great results, some riders like different hardnesses
4. Angled risers/wedges -insert them and the pivot-axis of the truck will change. Thin side out results in more turn per board lean (see wedge in the image number)
5. Shorter wheelbase - this means drilling extra holes. This decreases the turn radius of the board and also decrease board's flexibility.
6. Loosen the kingpins - easy method but is limited

More stability This is also a common wish and it has various ways to be solved.

1. Angled risers/wedges - by inserting them it will change truck's pivot-axis. Thin side in will make less turn per board lean. This method asks the usage of a lower angle baseplate because it accession of the board's leverage over the bushings (check the wedge diagram below)
2. Flip the hangers (see image nr.....)
3. The wheelbase -lengthen it. This may ask drilling extra holes and it is not the best solution because the flexibility of the board increases.
4. Lower angle baseplates. Can be done to both ends, or just to the tail.
5. Lower the board (see image nr.....)
6. Tighten the kingpins - it shouldn't be over-done, it still needst to be able to steer around obstacles and it may reduce traction.
7. Place harder bushings- what is too hard depends on rider weight,pivot axis, board width and hanger width.
8. Remove risers, this will lower the board's leverage over the bushings.To help reducing the vibration , a thin gasket would be a good solution. Also, it is better to check the wheelbite before riding.

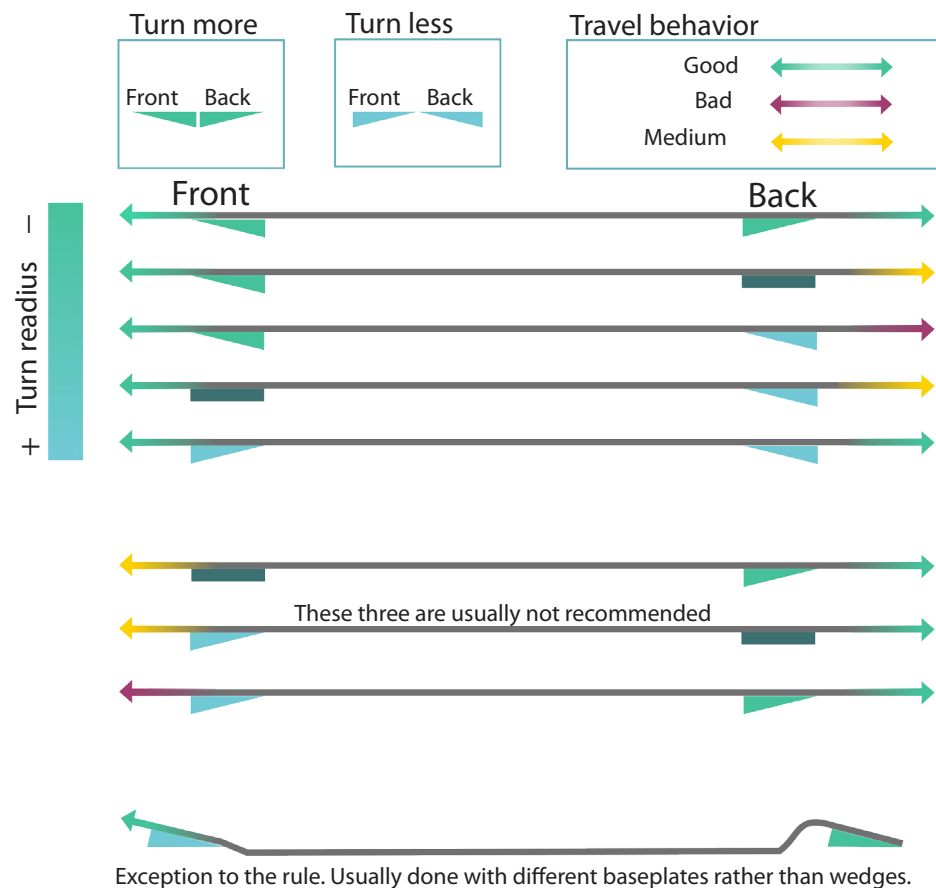


Image 70

Trucks

.....

This is a method that works only with some hangers and it involves undoing the kingpin, take the hanger and the hanger and turning it over and bolting it back to the base plate. It requires an axle that is displaced from the pivot-axis. This axle offset is usually referred to as 'caster'.

The short explanation of what does this "flip the hanger" means is that it helps increasing stability and lowers the ride height.

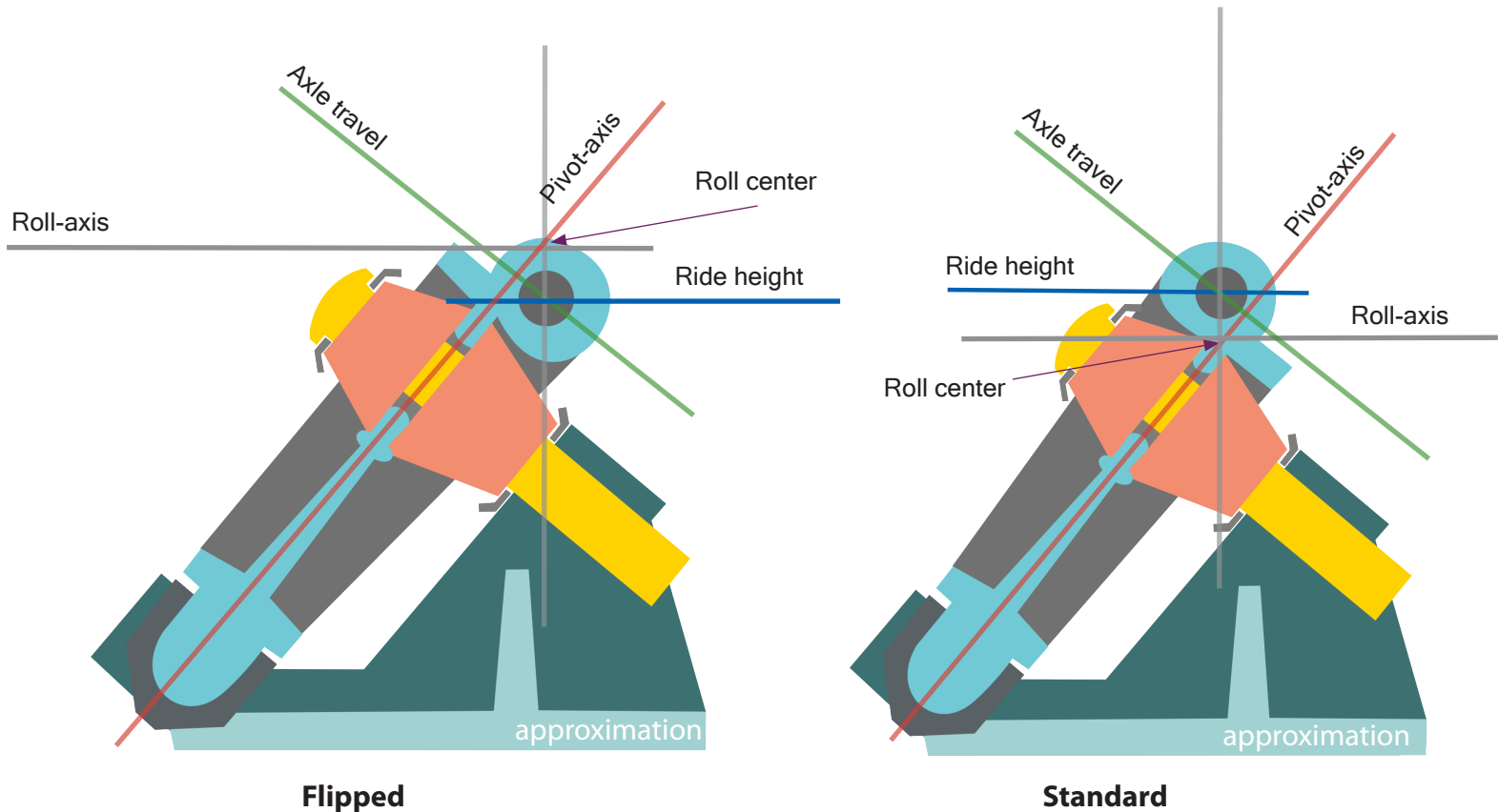


Image 71

The long explanation would be that it also makes the following:

1. Lowers the ride height -it is necessary in this situation to check for wheel-bite before riding
2. Arises axle's up-down leverage over the bushings.
3. Changes the behavior of the axle's torque leverage on the bushings.
4. Moves the roll-axis of the board.
5. Dispatches the board's centerline when turning (comparatively to the wheels).
6. Drifts the axle further from the pivot.
7. It reduces a little bit the distance between axles.

Trucks

does: change the hanger's resistance to lean

does not: change the pivot-axis angle
directly reduce the board's leverage over the bushings

How to know which side is used?

The width markings can identify the different sides of hangers. Some manufacturers cast on the front of the hanger: 125, 150 or 180. When it can be seen easily the hanger is in its standard or un-flipped state. Some manufacturers mark with F and R the different sides of the hanger. R is for the regular side (referred to response) and F for flipped side (referred to fast).

Mixing Base Plates

Usually and preferable is that any hanger can be put on any baseplate. This would be possible if all hangers have the same pivot to bushing seat measurement. This would allow a high level of customization and so, the riders can choose any combination they want with any hanger width and pivot axis.

An effective way to provide stability to the tail without sacrificing too much turn radius would be to have a high angle front truck and a low angle back truck. A lot of riders prefer this feeling but it produces a strangely going backwards board. Having baseplates and hangers interchangeable would be easy to ride with different baseplates (that keep board's height down) rather than wedges.

Note (mixing angles):

A lower truck with lower angle requires less force to make it lean, when the bushings are the same. This is bad for traction because it can lead to the front outside-of-turn wheel lifting. It can be fixed by running looser bushings in the front and/or tighter the bushings in the tail.

In the appendix is attached a chart that explains how to determine the overall ride height of the truck. This is made based on combinations between hanger and baseplate.

Lowering The Board

A way is by reducing the height of the standing platform comparative to the trucks will increase the stability.

Methods

Lowering- the platform has to be build lower then the mounting position of the truck (there are a lot of variety of methods to do this)

Dropthrough- first it has to be cut a slot between the board's bolt holes and then drop the baseplate through the top of the board

Doubledrop, this is a combination of the two above. It can provide more foot-room and a different board-feel as the required bends can be smaller.

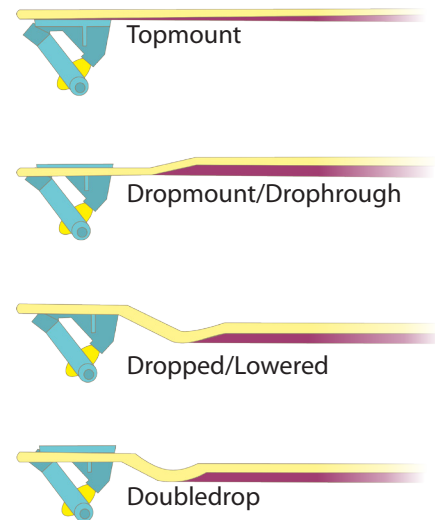


Image 72

Effects

What do this method actually do?

Shortly, it increases the board's stability, without directly reducing the potential to turn.

And the long answer... it does the following:

1. Lower the height of the ride.
2. It reduces directly the leverage of the board over the bushings.
3. Makes the wheels to get closer to the board and if so, maybe it will be needed to make cut-outs.
4. Modifies the platform's distance from the roll-axis.
5. Moves the centerline of the board towards the outside of a turn.
6. Reduces traction.
7. Increases drift controllability.

Notes (dropping through)

It is better to use washers under the deck-bolt nuts because the weight of the rider is at the moment on a much smaller surface area of the deck. For this is required to make cut-outs and this can be a weak point. Also this depends on the rider's weight so it is better to make it to a deck that doesn't have less than 9-plywoods or it can be made but with reinforcements. The mounting styles have different names and they change frequently and to all appearances will probably evolve over time.

Bushings

Some bottom bushings are taller than most. In general, for the rest of the bushings, this difference should be compensated somehow. Generally, is inserted an additional flat washer on the baseplate side of the bottom bushing. It is another possibility, but this may require a longer kingpin than the standard one, and is to use a bottom bushing on the top. Sometimes bushings require flat washers or different sized cup washers. Also, the top cup-washer can also be used upside-down. Some riders are fans of using flat washers all-round.

Why different bushings?

Because they change the performance of a truck in the easiest and most effective way. And, is the cheapest method too and many riders are happy about that. The advantage is that it doesn't change the ride height as the wedging does. What is affecting the behaviour of the bushings is the hardness (measured by a durometer) and their shape.

The bushing shapes have different "lean resistance curves". These are used as a measure on how much harder they have become to compress the further over the deck leans. The conical bushings are offering a relatively flat resistance curve. The soft durometer bushing don't offer resistance to lean as much as the higher durometer bushings.

Trucks

Which durometer is the right one depends first on rider's weight and on the type of riding he wants to make. But also have to be taken into consideration the following: pivot-axis angle, hanger/deck width and the wheelbase. Rebound means how bouncy the bushing is and in general, is better to have a high amount of rebound and this characteristic of a bushing slowly degrades with use.

23- 45 kg 73-80a Durometer
34- 57 kg 78-82a Durometer
45- 66 kg 80-85a Durometer
57- 80 kg 80-87a Durometer
66- 88 kg 82-90a Durometer
80- 100 kg 85-93a Durometer
90- 102 kg 90-93a Durometer
>102 kg 90-97a Durometer

Kingpins



Grade 8
Image 73

Some riders use mostly 3/8"-24tpi bolts of corresponding length as a king pin. It has to be used grade 8 bolts, identified by six lines on the head, as in the lateral picture. Some riders are fans like to use kingpins with the nut on the hanger-side of the truck. If there are longer bolts is better to take into consideration that the kingpin is not where it can hit things on the road.

Maintenance

All trucks are designed to last. But for safety is better to regularly check the components. The following components are the most important and the ones that usually fray.

Pivot cups In the pivot is a hole that at some point will enlarge. It takes a long time until it does but when it gets bad it causes stability problems. It is important that a pivot cup not be outworn. If the pivot is loose, it may cause the trucks to wobble at high speeds.

King pins Are the ones that actually hold the truck together and these confront a lot of force and vibration. The problem is that it's almost impossible to evaluate their condition so it is better to prevent any accidents and change them every year.

Nuts The kingpin and axle nuts have a nylon locking mechanism. It is used to stop them to get loose or tight during riding. When it is taken on and off the thread, the nylon's ability to grip the thread degrades. This slow degradation, meaning the nylon can't do its job anymore, can make components fall off. It is advisable to check the condition of axle nuts while making the maintenance of the bearings, as taking them off to check them will get them out quicker. When the nylon is degraded the solution is to get new nuts and fortunately they are cheap and easy to find. The kingpin is 3/8-24tpi and the axle is 5/16-24tpi.

Trucks

Bushings The rebound of the bushings will degrade with use, this is unavoidable as the molecular chains slowly break when they get stretched and compressed. While low rebound isn't necessarily a serious problem, the truck will feel and perform better if the bushings are replaced when they loose rebound.

Bushing types

Barrel



offer the deepest turn
rebound with limited resistance



different from cone bushing



offers the same level of resistance
throughout the whole turn of the trucks
dimensions 75a/81.5a /85a /90a

Image 74

Cone



offer the softest feeling turn
resistance for a stable ride



focuses the contact from the
hanger and the further the truck
leans over builds up resistance
dimensions 75a/81.5a /85a /90a



Image 77

Stepped Cone



offer smooth increased resistance
while turning
more control



gives a more precise fit to keep
the bushing in place
dimensions 75a/81.5a /85a /90a



Image 75

Stepped barrel



offer smooth increased resistance while turning
more control



gives a more precise fit to keep
the bushing in place
dimensions 75a/81.5a /85a /90a



Image 78

Double stepped barrel



double stepped shape
offer optimal control
the ride nice and soft



oversized shape
offer soft ride with a lot of rebound
dimensions 75a/81.5a /85a /90a



Image 76

Inspiration

- Spider web
- Honeycomb
- Leaf & tree branches

Many of the world's most amazing structures are not made by human beings at all. But many designers were inspired by these structures and apply them on their products. In this chapter are presented the inspiring organisms, their structure and related inspired products application ideas.

The inspiring organism

Spider web



Image 79

The spider begins its web with a single thread being the basis of the rest of the structure. To start constructing this bridge, the spider has a starting point and releases a certain length of thread in the wind. The free end of the thread has to catch another point of attachment. The spider assures that the thread is attached to something and then starts going up the silk, attaching the thread to the starting point.

When finishing building all the radius threads, the spider places more nonstick silk to make an auxiliary spiral. It makes this in order to extend from the center of the web to the extremes of the web. Then it spirals in on the web and is using the auxiliary spiral as a reference. The auxiliary spiral is eaten by the spider, in the end resulting a web with non-sticky radius threads, for moving around, and a sticky spiral for catching insects.

Honeycomb



Image 80

A honeycomb is a structure of hexagonal wax cells and it is constructed by honey bees in their nests. Their aim is to shelter their larvae and store pollen and honey. The axes of honeycomb cells are always quasi-horizontal and the non-angled rows of honeycomb cells are aligned horizontally. Each cell has two vertical walls, 'floors' and 'ceilings' made of two angled walls.

The cells are slightly angled upwards around 10 degrees. The honeycomb is made of hexagons and the scientists say that there are two possible reasons for that: one is that the hexagonal structure is using the minimum quantity of material to create a rack of cells within a given volume and the second is that the hexagonal shape simply results from bees putting cells together. It can be similar to the soap bubbles conglomerate.

Leaf



A leaf is an organ of a plant and its shape and structure vary from species to species depending on the climate, available light, available nutrients, and so on. Leaves are important investments for the plants that are bearing them and as well as their strategies dealing with pressure, protective circumstances or seasonal conditions.

Image 81

Spider web structure

In a study made by two physicists from the Ochanomizu University in Tokyo, Japan, that are studying the structural properties of the spider web is explained "*Although the orb web of a spider is a lightweight structure, it seems to be a highly optimized structure, presumably as a result of evolution from the Jurassic period or earlier*" [Yuko Aoyanagi and Ko Okumura "Simple Model for the Mechanics of Spider Webs." Physical Review Letters 104, 2010]

They say that the spider web seems to resist different loads, wind for example, and also resist efficiently to insect impact and even if some threads are broken, it can catch the prey. This study is a great inspiration for longboard trucks design because in this case is needed resistance and in the same time light weight. Is the perfect structure to be studied and further more will be presented the mechanical and structural properties of this spider web and how and why to be applied in the new design.

A lot of research was made on spider silk as a high-performance fiber, but less about the structural mechanical properties of this webs. As the most well known web forms, orb webs have characteristics that are common to many spider species, meaning that they evolved by natural selection. That is why these unique structural characteristics of spider webs, is applied in design areas like bridges, buildings shelters or textile structures..

Orb webs are made of two kinds of threads: radial threads (radiate to extremes from the center of the web) and the spiral threads (connect the radial threads to form circular design). Scientists say that the radial threads are significantly stronger than spiral threads, because of the radial threads are much thicker, better structure and chemical composition.

The inspiration for the new design is related to three facts of the spider web structural properties:

- 1 When the spider completed the web the entire structure is under tension. The force distribution in such way the radial threads, located at the fringe of the web, are the ones with maximum force.
- 2 Without reducing strength of the web, spiders can change the number of threads.
- 3 If one of the spiral threads is damaged, the force distribution remains unchanged and the web retains its strength. This differs from the most elastic material structures. There, when damage appears the force distribution and a stress concentration occurs near the damage so it weakens the entire structure.

Scientists 'blame' these features to the web's hierarchical design and for this project's theme it is an inspired and functional idea to be applied. The three characteristics can be used in the trucks design due to the fact that a big amount of tension is applied on its structural components and is very important that the entire trucks to resist to high applied forces when riding.

Spider web structure

This strategy is inspiring longboards' trucks design and it can be the solution to the question 'How can trucks be created using the least amount of material and manufacturing? These pieces may hold their structure without any additional adhesives using only tension from string?'. The product will be inspired by the strong and lightweight nature of spider webs and finally may answer to these questions.

Bioinspired products and application ideas

Many designers applied this idea of spider web structure in many domains as: buildings, fabrics that absorb impact, bridges and bridge pillars, shelters, fence between two streets for absorbing the impact, furniture. this strategy seems interesting for sectors like construction, clothing, manufacturing or transportation.

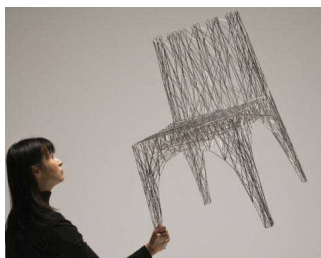


Image 82

Spider Chair by Jun Hashimoto

This chair is designed like a spider web. It is unique with a modern look and also comfortable when used. The light weight (approx. 2.1 kilograms) allows a person to hold the chair with just one hand. The chair is made from stainless steel wire of approx. 140 meters length and the diameter of 1.5 millimeters.



Image 83

Tomas Saraceno

The structures present an alternative architectural floating and suspended structures, gardens and shelters built of ropes, swaying bubbles and organic materials hanging in air. The installations show the strength and flexibility of spider webs, bubbles making the viewer to think to another way of living, interaction and feeling.



Image 84

Webb Bridge at Melbourne Docklands

This bridge dedicated to pedestrians and cyclists and is located across the Yarra River in Melbourne, Australia. It is made of recycled material from an old rail bridge. The bridge has distinct sections: a long existing structure and a new one that is curved. They sections are joined through a curved and sinuous form.

Reflection

As it can be seen the spider web is used in many complex structures and this is the main reason for being an inspiration for the new trucks. The trucks need resistance which brings safety first on the list of designing requirements. The spider web can solve this problem because of its structure. Another advantage using this structure may be the hollow spaces between threads that help the rider to have more speed and also the lightweight which is a very important aspect on the requirements list.

Honeycomb structure

The basis of developing honeycomb structured panels started with innovations in motor vehicles technology , in aircraft design and light-weight structures.

The advantage

- low weight
- great structural strength
- anti-shock properties
- optimal ratio of weight to load-bearing capacity and bending strength
- aesthetic properties
- adaptable to individual requirements regarding strength

The honeycombs are often used in design and architecture because of their bending strength. This composite material is made of a honeycomb core and external facing. This gives the opportunity to be adapted to individual requirements regarding strength and materials.

Another advantage of using this structure is that it has low weight and great structural strength. Honeycomb structures are used as shock-absorbent layers in sportsgear, sport shoes fabrication and automobile construction. And this is because of their anti-shock properties.



Image 85

The aesthetic properties of these structures have increased valued. It can be custom made for a variety of design puposes because of the its various aesthetic possibilities to be from transparent to translucent, catching the eye or directing the gaze.

HONEYCOMB STRUCTURE

Bioinspired products and application ideas



Image 86

Wooden surfboard by Mike Grobelny

The surfboard is representing a conflict between industry and environment, meaning that the culture of surfing represents the symbol of a connection with nature and this is in contradiction with the surf boards' manufacturing process which uses toxic materials that harms the environments but also the manufacturers. These synthetic materials provide performance that many users are looking for and this performance cannot be achieved using natural materials. The product is using natural materials, a honeycomb structure that is replacing the general used structure and together with the beautiful shape changes the first impression of a short-living sport product into a valuable artefact.

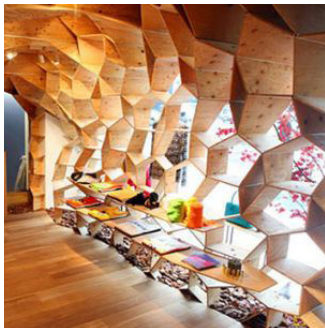


Image 87

The Lucien Pellat-Finet store by Kengo Kuma

The store has a trippy and organic interior design and is characterized by a transformation of plywood fashioned shelves into a honeycomb configuration. The lively feel of the design makes a warm atmosphere, like a womb, that is contrasting with the clothes' patterns sold inside the store.

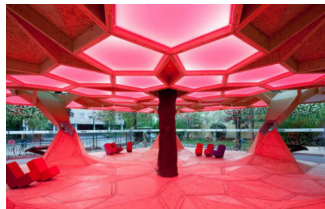


Image 88

Transparent Honeycomb Pavilion

This structure is made by an architecture firm in collaboration with designer Holger Hoffman. It is a partially transparent honeycomb pavilion made of a polygons and it was built around pre-existing trees maintaining a connection with nature and also to maximizing the space.

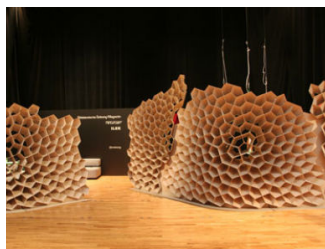


Image 89

MDF Honeycomb Wall

This honeycomb-inspired MDF wall is acting as a display stand for exhibitions. Each cell is angled in a unique direction providing a defined focal point, focusing the gaze of viewers to specific objects behind the wall.

Honeycomb structure



Image 90

Honeycomb-Shaped Green Roof in a Campus International School

The concept is a new structure with a green roof constructed after honeycomb. Some of the hexagonal shapes of the green roof will be transparent allowing light send forth into a learning area situated below.

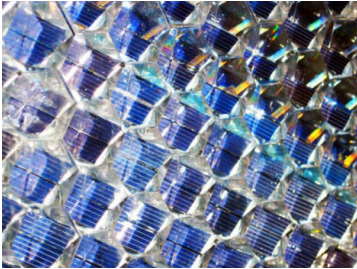


Image 91

Honeycomb-Shaped Solar Panels

This design is ment to amplify solar energy twice its normal strength. These are energy generating windows and they are composed of honeycomb patterned acrylic built-in with tiny solar panels. These honeycomb-shaped prisms are focusing sunlight to accumulate as much of it as possible.

Below are presented pictures with products from other areas of industry that have the design inspired by honeycomb.



Image 92

Urban Shelter Concept
by BROISSIN Architects



Image 93

Peace Bridge by Santiago Calatrava

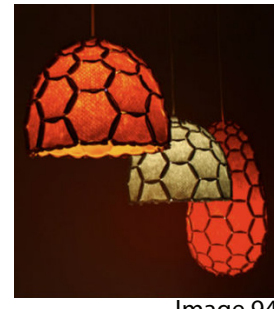


Image 94

Honeycomb Lamp
Shades by Design-
Tree



Image 95

Honeycomb Bracelet by
Andrea Rivera Hurtado

Reflection

The honeycomb structure may be implemented in the new design for hanger surface of hanger and baseplate. A mixture between hallow and full cells offer resistance (the full ones) and the air goes through the trucks so the riding has more speed (because of the hallow ones)..

Leaf structure

The leaf has on its surface veins which represent the vascular tissue and are situated in a spongy layer. In the pictures situated below are examples of patterns with ramification of these veins. The entire arrangement and leaf's organs are called Venation.

The difference between the organs of venation is made only by size and position, and are the following: the midvein, veins, veinlets and veinulcts.



Arcuate



Cross-venate



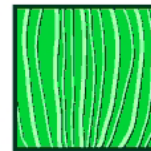
Dichotomous



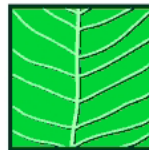
Longitudinal



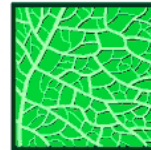
Palmate



Parallel



Pinnate



Reticulate



Rotate

Image 96

Three principal modes of venation

1. Reticulate

Are frequent reunions of its branching veins building an irregular net-work.

2. Parallel-veined

Are always connected by simple transverse veinlets. Can be straight, curved, placed parallel, or side by side, running until the peak of the leaf, or to the extremes. In parallel-veined venation the veins can be: straight, curved or transverse.

3. Fork-veined

Are divided and subdivided in a furcate manner without re-uniting.

The leaf structure is an inspiration for the new product because of its net-work of veins that are keeping the entire leaf together and form a very thin but powerful layer. The inspiration is focused here in the usage of less material but with insertion of 'veins' in the truck construction.

Leaf and tree structure

Bioinspired products and application ideas

Many industrial designers implement in their design the leaf structure. It has a wide application in the transportation area, electric power construction, and communication networks. The leaf geometry provides safety and cost-effective flexibility for networks.

Similar to the leaf structure is also the tree branches structure. As there are more products inspired from them than from leaf vein structure, further will be presented design ideas based on tree branches arrangement.



Image 97

Forest Chair by Janus et Cie

The chair combines the organic idea of forest with the high manufacturing technology of powder-coated die-cast aluminum. The comfortable chair is also unique by remembering the feeling of sunlight going through tree's branches. The structure of branches seem fragile but actually the back rest is strong because of the many ramifications and in the same it looks very elegant.

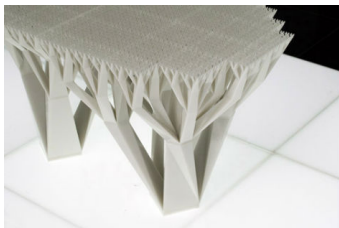


Image 98

Fractal Table by Platform Wertel Oberfell

Simulating the growth patterns seen in nature, this table has tree-like shank that grows into smaller branches until they make a flat surface at the top, copying a pollard. The table has only two legs that sustain the entire table.



Image 99

'Tote' Restaurant

This restaurant is made after the existing building that makes its foundational base. The idea of the restaurant is to extend the canopy forest inside the building. Structures are resistant and sustain the entire ceiling. The lighting makes forest like shading and shadowing for elegant impact. The idea is to place tree-like structure overtop the existing building.

Reflection

The tree and leaf have in common the structure of branches and veins that lift and sustain a big weight and a wide surface. It seems impossible such fragile elements to sustain such big amount of weight and this can be applied also on longboarding: 'How can that small trucks sustain the weight of a rider?' The trucks may be designed in such a way that can be lighter and in the same time as resistant or much more than the ones on the market.

Detailing

The process of finding the form of different elements is presented and explained. The choice of materials is built , focusing on the aesthetics and technical aspects. Also, a finite element analysis is conducted in order to evaluate the ssustaining tructure and see where it has weak spots that need to be taken into account. An estimation of the production cost is made to have an overview on the production costs and a selling price.

Elements

The concept is assembling and dissassembling with no tools, lighter and stronger structure without changing the mounting system , all the solutions fitting riders' wishes in the best way. The number of components is the same but the structure design is changed and the kingpin nut shape is opimized. It is decided that only the hanger shape should be analyzed and re-design its structure ,the other elements remaining the same because there is no need of improvement yet- the majority of elements are changeble and need to be changed perodically.

Needed Hardware

- Deck
- 2 Trucks
- 2 Risers
- 4 Wheels
- 2 Kingpins
- 4 Wheel bearings
- 8 Speed rings
- 8 3mm Allen bolts
- 4 Lock nuts
- 2 Kingpin lock nuts

Sketches and evaluation

- Hanger and axles
- Kingpin lock nut

Detailed elements

- Hanger and axles
- Pivot cup
- Baseplate
- Bushing
- Kingpin lock nut
- Deck
- Wheels

As previously presented, there are three point of inspiration for the hangers structure and the following pages will introduce sketches with different types of structures that may be used in the final design. The different proposals are analized, rated and than compared ,in the end deciding the final concept. The five categories of evaluation cover technical and design aspects and are: aesthetics, complexity of manufacturing process, user reliability ,costs efficiency and weight. By 'user reliability' menaing that the structure looks reliable for the rider, if he would think is sustaining or not.

Hanger and axles

Based on the inspiration elements ,three proposals of hangers structure are compared and evaluate by using plus, minus and zero.The plus is for good, the minus for poor and zero for average .

Spider web structure

Spider web segment

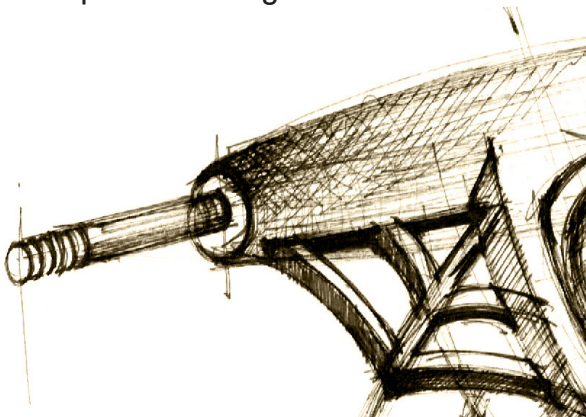


Image 100

Extremity Oriented
Circular Threads

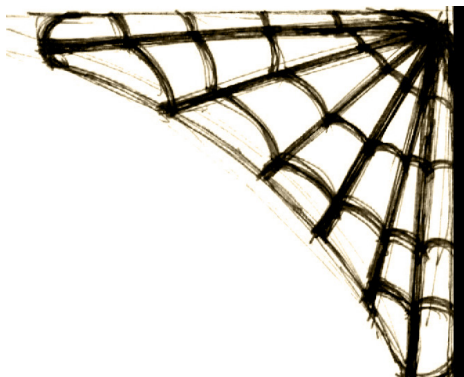


Image 101

Core Oriented
Circular Threads

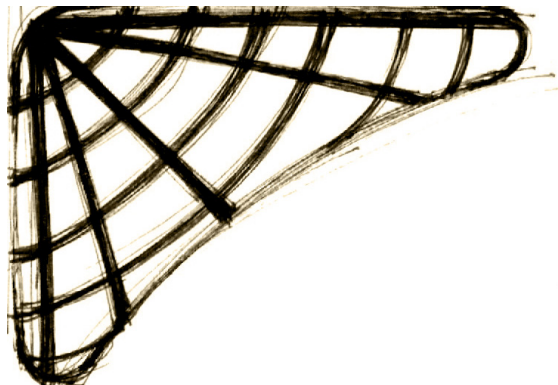


Image 102

Description	Spider web segment	Extremity Oriented Circular Threads	Core Oriented Circular Threads
Reliability	+	+	-
Aesthetics	+	+	0
Complexity of manu- facturing process	+	-	-
Cost efficiency	+	-	-
Weight	0	0	0
Continue?	yes	no	no

Hanger and axles

Honeycomb structure

Diagonal disposal

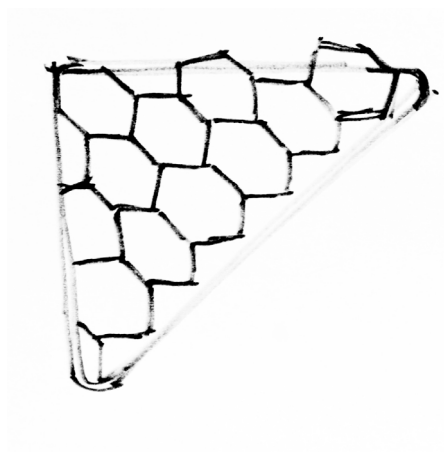


Image 103

Horizontal disposal



Image 104

Vertical disposal

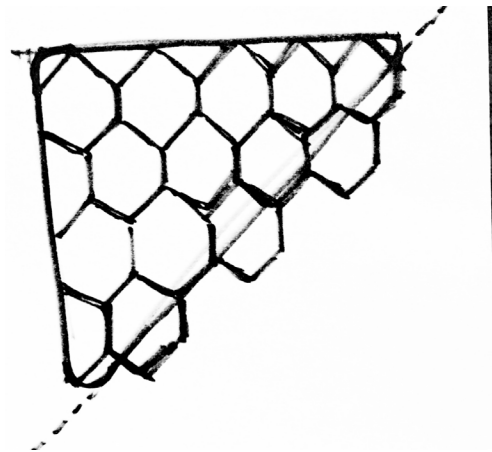
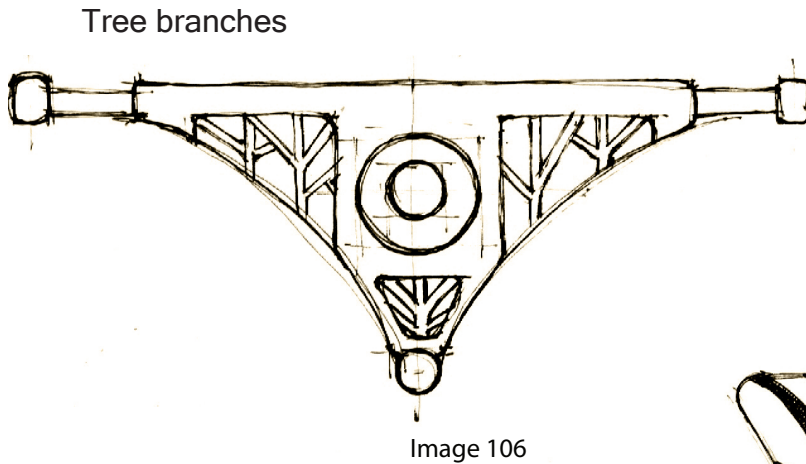


Image 105

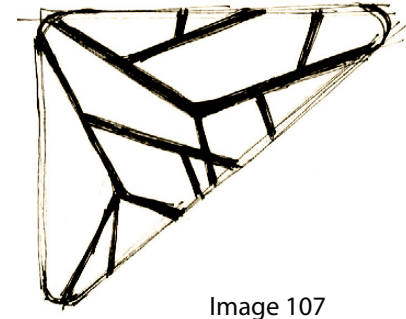
Description	Diagonal disposal	Horizontal disposal	Vertical cells
Reliability	-	+	0
Aesthetics	0	+	+
Complexity of manufacturing process	0	-	-
Cost efficiency	+	-	0
Weight	+	-	0
Continue?	yes	no	no

Hanger and axles

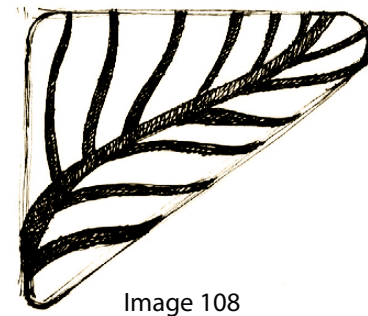
Leaf/tree structure



Straight venation



Curved venation



Description	Tree branches	Straight venation	Curved venation
Reliability	+	0	+
Aesthetics	+	+	-
Complexity of manufacturing process	-	-	-
Cost efficiency	0	-	-
Weight	0	0	0
Continue?	yes	no	0

Final structure of the hanger

The three structures are again evaluated and rated in order to decide which is the one that fulfills entirely users' needs and requirements. The spider web has been the best rated and it will be used in the final design. Its structure is the most resistant, the web threads being oriented in the way the forces are applied. The leaf structure has the complexity of manufacturing to high and also doesn't look reliable. The honeycomb structure uses more material, and it is not optimizing the shape as much as the spider web, plus is more pattern oriented than function oriented.

Description	spider web	honeycomb	leaf/tree
Reliability	+	0	-
Aesthetics	+	0	0
Complexity of manufacturing process	0	-	-
Cost efficiency	0	-	-
Weight	+	0	0
Continue?	yes	no	no

In the end it is decided to use the spider web structure for the hanger and also it will be a permanent bond between the axle and hanger. This will make them very strong and there will be no play between the parts.

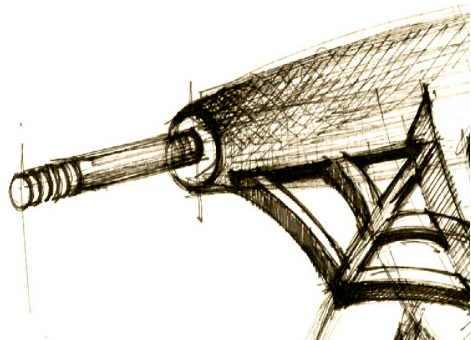


Image 109

King pin nut

The aim of re-designing the kingpin nut is to make it easy to loosen and tighten when it is needed very fast and easy ,without using any tool. The nut has been through the process an important aspect to focus on because since the beginning the interviewed users implied to improve somehow its function and also the aesthetics.By brainstorming, various ideas are sketched and four proposals are chosen.The minimalistic look and integrated design has to be taken into consideration when evaluating the solution.Also , the ergonomic aspects of hand position and unscrewing method are analyzed.

two handles

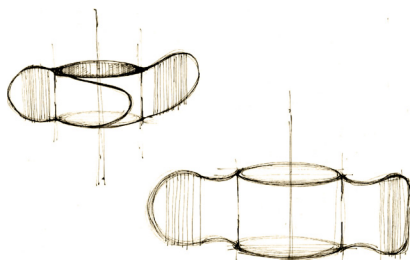


Image 110

teardrop

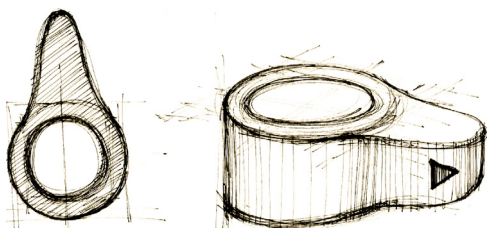


Image 111

one hook one handle

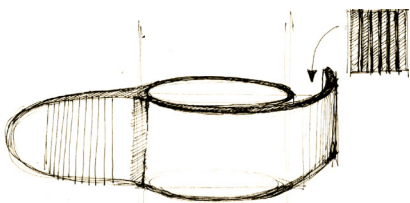


Image 112

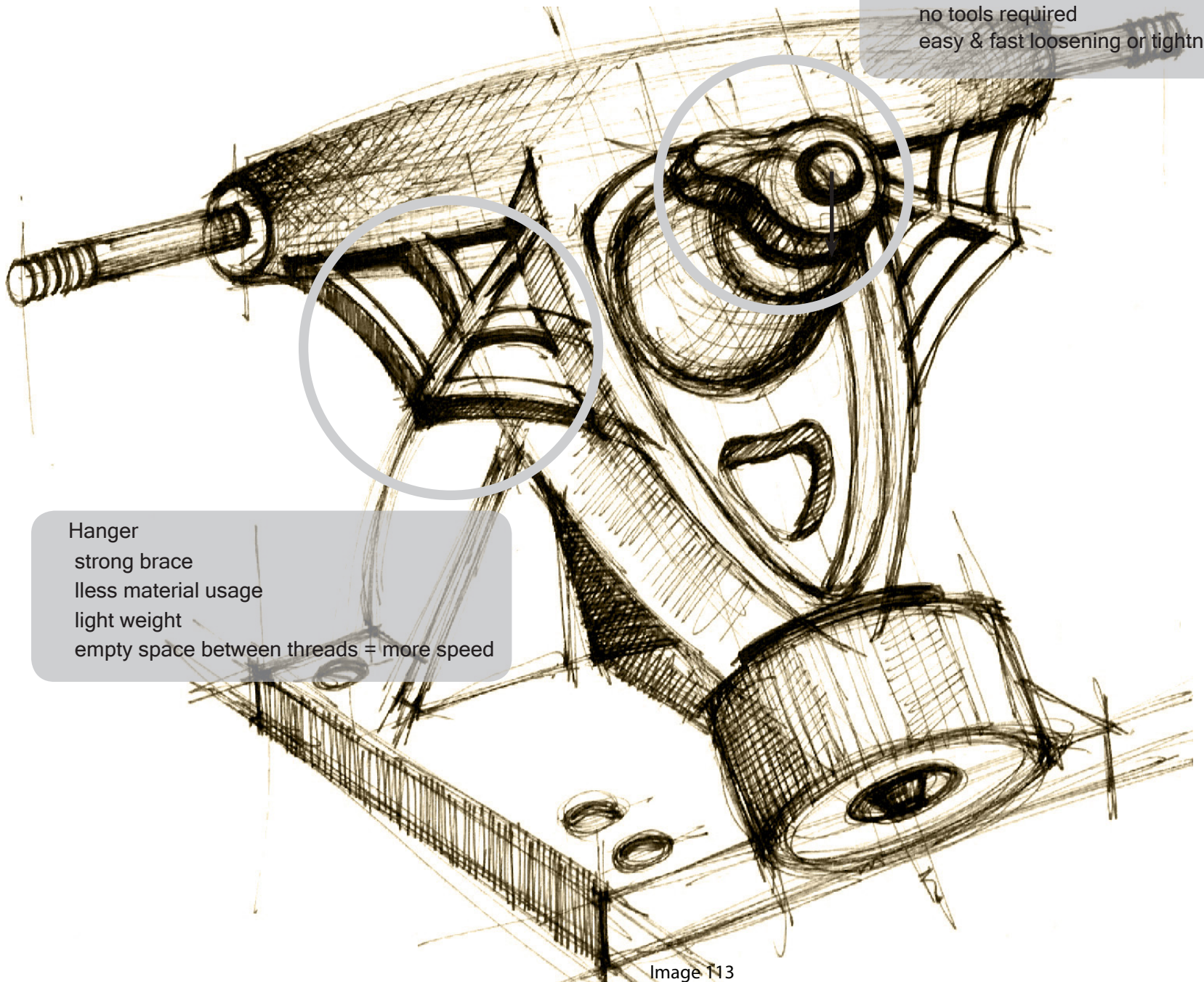
Description	two handles	teardrop	one hook one handle
Reliability	0	+	-
Aesthetics	-	+	0
Complexity of manufacturing process	0	+	-
Cost efficiency	0	+	-
Weight	0	0	0
Continue?	no	yes	no

Concept screening

Selection criteria		Honey Truck	Spider Truck	Feather Truck	Reference
Ease of Assembling/Disassembling		0	+	0	0
Cost efficiency		0	+	-	0
Safe hardware		0	-	+	0
Ease of manufacturing		-	0	-	0
Durable		+	+	0	0
Aesthetic		+	0	+	0
Resistant Structure		0	+	0	0
Effortless adjustments		-	+	-	0
Market share		0	+	0	0
Functional		0	+	0	0
	Pluses	2	7	2	
	Minuses	2	1	3	
	Sames	6	2	5	
	Net	0	6	-1	
	Rank	2	1	3	
	Continue?	No	Yes	No	

The idea

Kinking locking nut
ergonomic shape
no tools required
easy & fast loosening or tightening

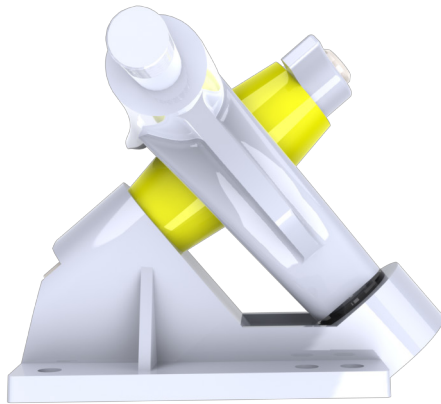
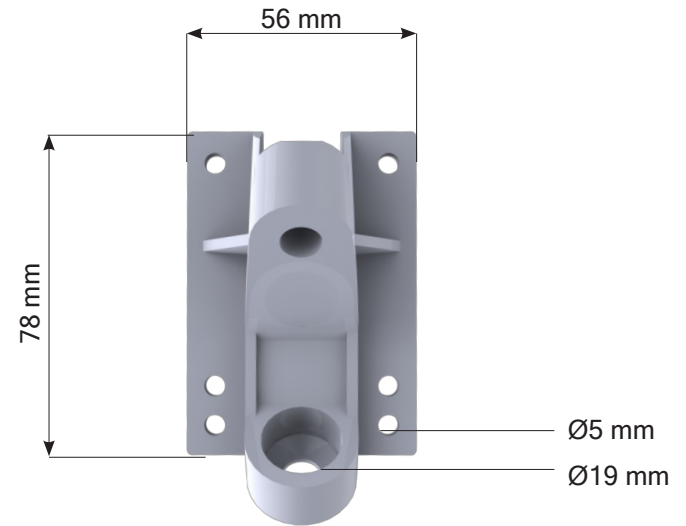
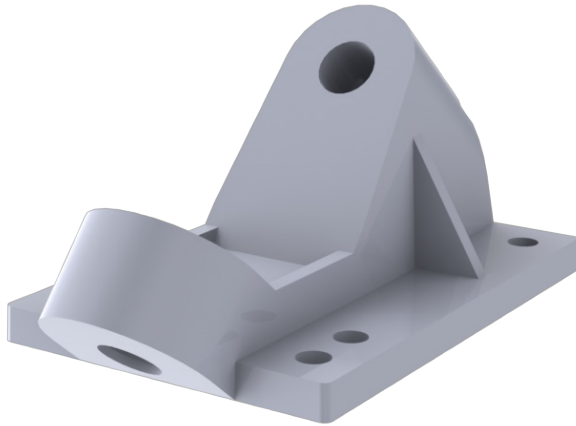


Hanger
strong brace
less material usage
light weight
empty space between threads = more speed

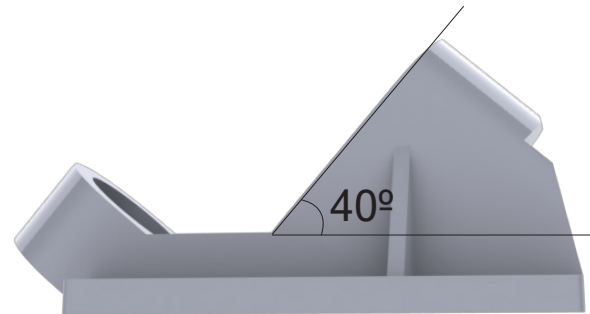
Image T13

Element specifications

Baseplate



Assemble view



Data sheet

Function

is the part of the truck that mounts directly onto the deck depending on the angle, the rider can adjust his board to have more/ less aggressive turning radius

Manufacturing Casting

Colours

black
dark grey
white

Material aluminium alloy

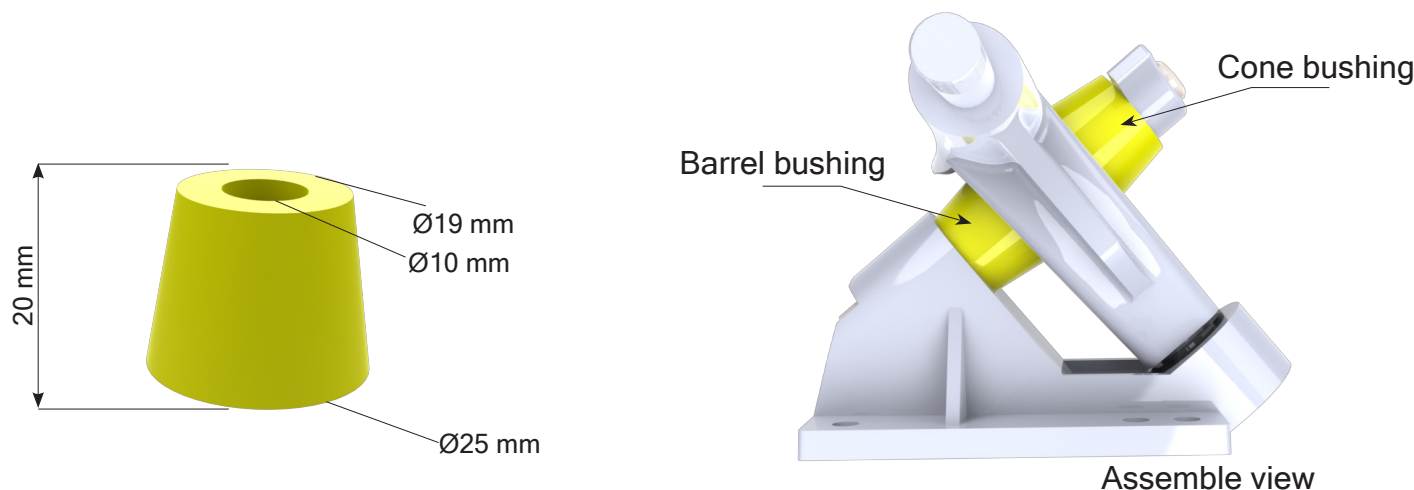
Mounting

Tool: Screwdriver

The mounting is made from the top, the baseplate is secured with four bolts that go through the deck and baseplate. This mounting solution gives maximum support.

Element specifications

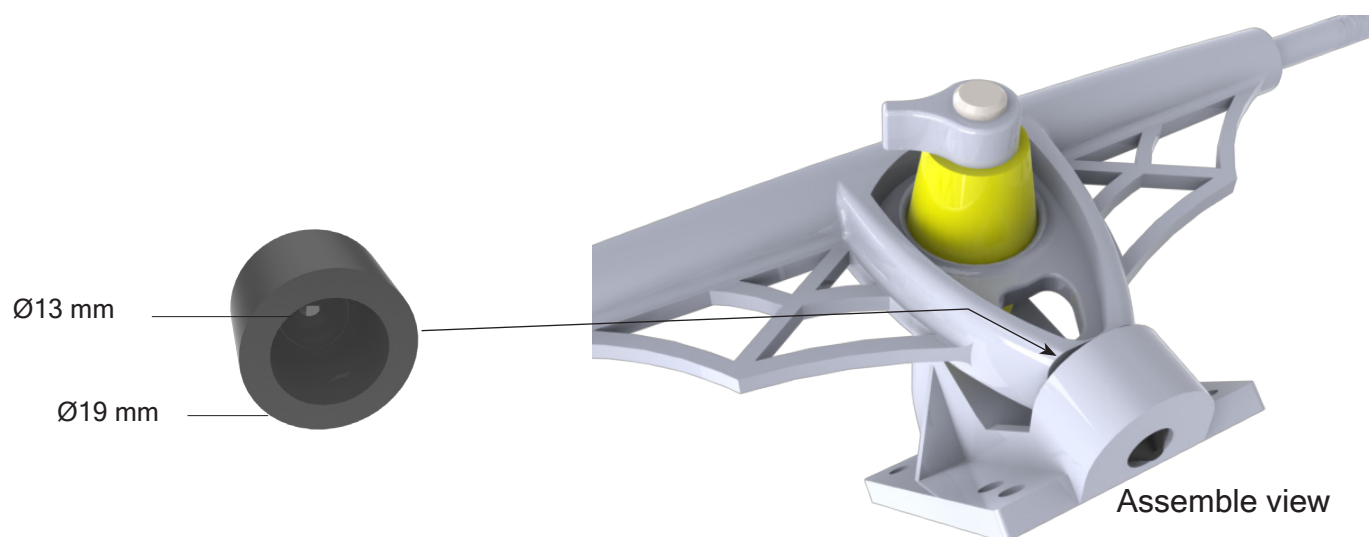
Bushing



Data sheet

Function	Colours	Mounting
affect how easily the hangar can turn	Customizable	Barrel bushing is placed at the bottom and the cone bushing on top
can have various shapes and durometers	Material	
dampen vibrations	PU	
Manufacturing	Injection moulding	

Pivot cup

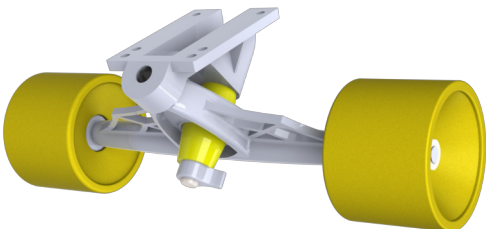
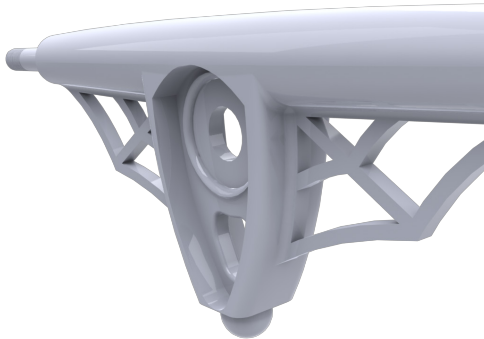
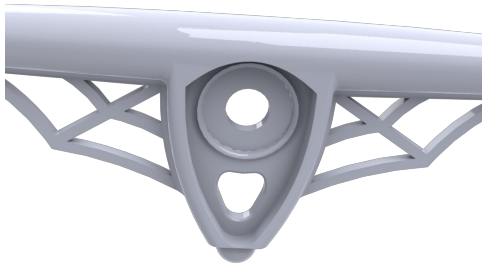
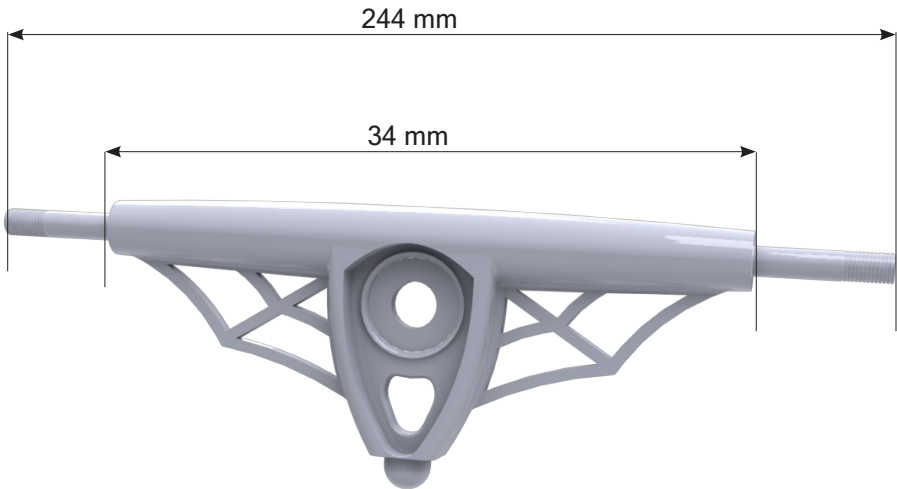


Data sheet

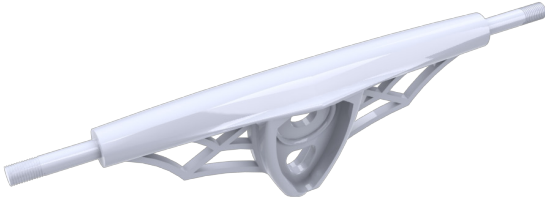
Function	Colours	Mounting
affect the trucks performance	black	Introduce the hanger into the cup-like section where the it makes contact with the baseplate
should be close-fitting to minimize movement in hanger	Hardness	
	90A~100A	
	Material	
	PU	
Manufacturing	Injection moulding	

Element specifications

Hanger and axles



Assemble view

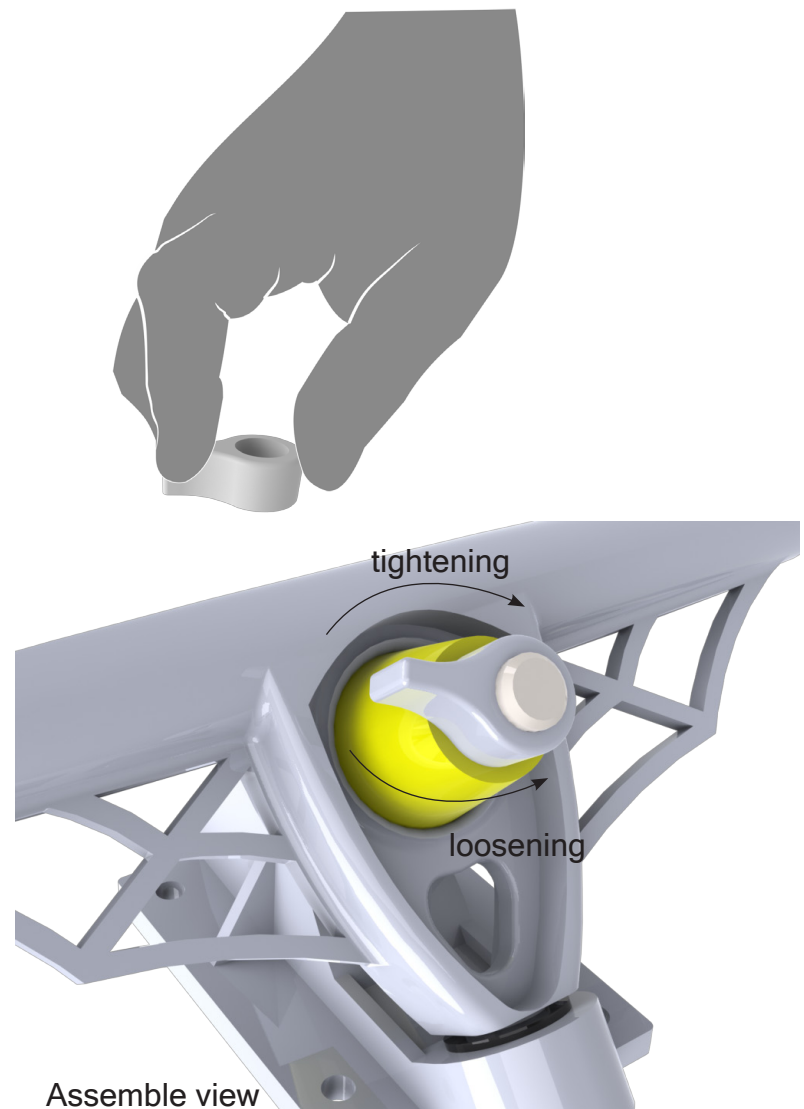
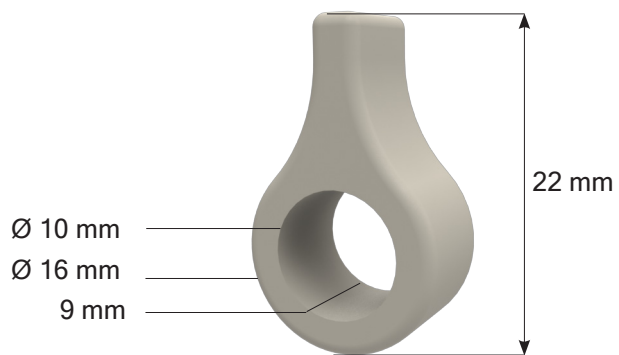


Data sheet

Function	Colours	Mounting
Holds the axle Control over speed and direction Providing riders a stable base for carving	black white grey	the pivot is placed in the pivot cup attach to the baseplate place the barrel bushing, than the hanger, next the cone bushing and thorough all fit in the kingpin kingpin is secured screwing the nut
Material	Titanium alloy	
Manufacturing	computer numerical control (CNC) precision mills	

Element specifications

King pin lock nut



Data sheet

Function

tightening or loosening the kingpin gives the board better clearance and a tighter or wider turning radius

Material Stainless Steel

Colours
Customizable

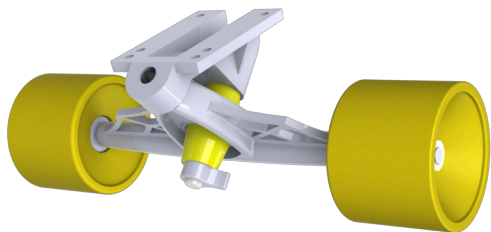
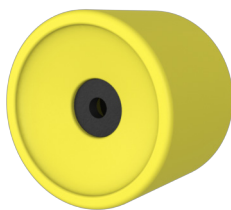
Manufacturing
Casting

Mounting

Tools: not needed
Introduce the nut onto the king pin
Tighten the kingpin nut with the hand until reaching high resistance

Element specifications

Wheels



Assemble view

Data sheet

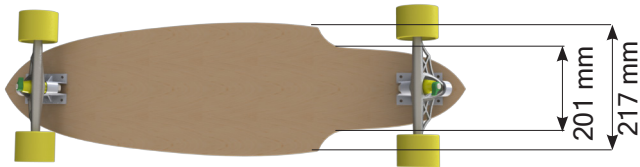
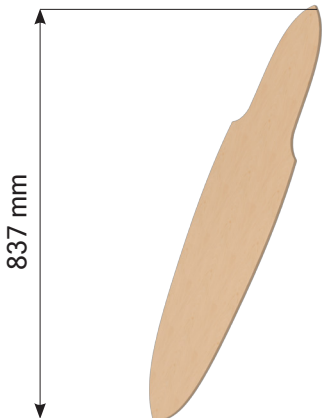
Function
Square Lip
rotates on the axial
bearing
facilitating movement while
supporting a load on the
board
Material
PU casting

Hardness: 75A-85A

Manufacturing
polyurethane mixture is poured
into aluminum molds
harden into a
solid
wheel slug is cut to shape by
hand
sidewalls and tread are cut
into the wheel with a blade

Colours
Customizable
Mounting
tool needed
fit in the speed ring on
the axle
fit in another speed ring
mount the axle nut
introduce the wheel

Deck



Assemble view

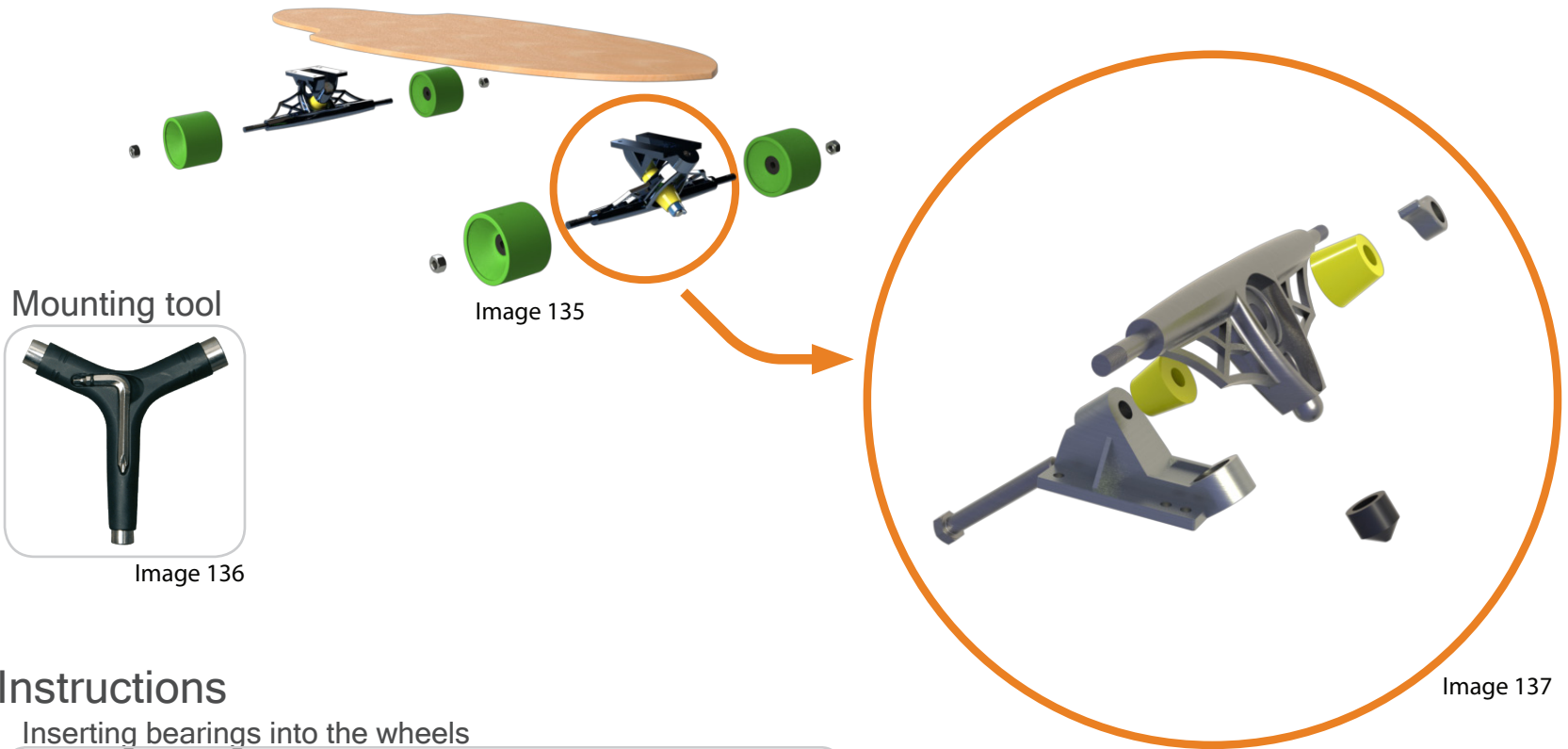
Data sheet

Function
supports the load of the rider
trucks connected through bolts to the deck
Material
maple
bamboo
ash tree

Colours
original maple color
customizable back side

Manufacturing
9-11 plies of wood, glued and pressed
together
shaping: sawed into the desired
outline
sanding : smooth surface and
edges

Assembling method



Instructions

Inserting bearings into the wheels

- Push the bearings into wheels and snap them in to the place

Attaching wheels to trucks

- Hold the truck vertically
- Insert a washer then the wheel then another washer
- Tighten the kingpin nut with the hand until reaching high resistance
- Repeat for the remaining wheels
- Start tightening the nut with the fingers first. It will avoid cross threading
- When sure that the nut is not binding on the axel threading, use the nut driver
- Assure that wheel spins freely and there is not any wobble as the wheel spins

Mounting trucks on the deck

- Determine which holes are appropriate for the trucks and deck
- Place both trucks outward, so the pivot bolt is pointed inward
- Align the holes of the trucks to the ones of the deck and note them
- Orient the trucks to allow access to the deck holes noted earlier
- Flip the truck down onto the deck. The adequate screwholes are accessible
- Lift up the deck and tighten with the hand the screws from underneath
- Tight the truck bolts evenly using the Allen wrench

Hardware

- Deck
- 2 Trucks
- 2 Risers
- 4 Wheels
- 2 Kingpins
- 4 Wheel bearings
- 8 Speed rings
- 8 3mm Allen bolts
- 4 Lock nuts
- 2 Kingpin lock nuts
- 2 Top cup washer
- 2 Lower cup washer

Material and manufacturing

Material for the hanger and axles

The choice of material is related to shock-resistance, lightness, appearance, price therefore following limitations and relations of the material are introduced:

- it has to be strong
- it has to resist corrosion
- it has to be lightweighted
- relation between Elastic limit (Mpa)/ density (kg/m³)
- relation between Young modulus (GPa)/ density (kg/m³)/cost
- tensile strength (Mpa)/ density (kg/m³)/cost

Looking at the mechanical properties as the cost and other aspect and narrowing down the suggested materials a solution of using Titanium is reached. The thickness made in places that matter for example, the hanger beam between the axles and rear is supporting legs on the baseplate. Using Titanium gives trucks more strength than they need. This feature is made just in case, as a caution. If the titanium axles and kingpin will be made from this material, will be twice as strong as stainless parts and half the weight of steel.

Titanium alloys vs. Steel

Comparing to Steel -used in almost all the trucks on the market, the Titanium tensile strength is much greater, that a steel kingpin would break before a titanium one can sufficiently flex. The idea is that if the titanium bends where the steel breaks it is obvious that most of the riders would rather ride a bent kingpin than a broken one. Anyhow, this is a matter of personal preference. The new material is intended to be seen as another option on the market, it is for the riders to have a choice.

Manufacturing method

An important step is to choose the correct manufacturing process for the trucks' components. In relation to this, a number of factors have to be taken into consideration:

- the thickness and the shape of the piece: many manufacturing processes are limited by the thickness and shape
- the cost: how much money can be invested
- the material used: specific materials are produced by specific processes
- the quantity of manufactured products: it is a large or a small series of production

Since the production quantity is wanted to be high, the price is wanted to be affordable and the shape allows this. The manufacturing process for the hanger and axles is CNC-computer numerical control machine tools. It is a new and precise method to manufacture the hanger. The rest of the elements are made by casting, injection molding, etc.

Cost calculations

For cost calculations of producing each element there are a number of factors that have to be taken into account. Some of the elements are bought directly from the manufacturers(e.g. bushings ,bearings, pivot cup, kingpins,etc)and the other elements can be estimated.The total cost cannot be calculated due to the lack of information but the factors that are involved will be described as it follows..

Making calculations on the cost gives the opportunity to see if the product is competitive and if the new product is profitable to be launched on the market. In the diagram are presented the final cost calculations.

There are five aspects that have to be taken into account when calculating the total cost of each piece:

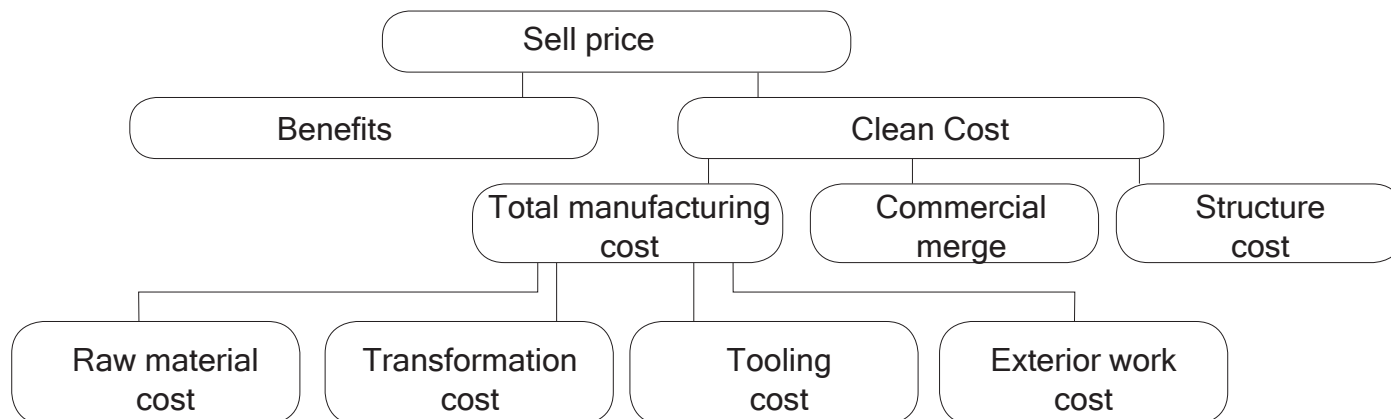
Raw material cost: depending on the type and loss of the material and also the volume of each piece.

Hourly rate:costs related to operators, consumed energy, the machines,the consumables and so on.

Processing costs:time of process, setting up the machineries that are used

Tools cost: is resulting from the calculation of maintainance, tooling cost and the number of pieces to be produced.

Final cost: Depends on the sum of all factors calculated previously which is the total cost of production and also on the final price of the element which is made after adding aspects like structure cost,commercial marginsetc. [Rosato Dominik V.,Rosato DonaldV.,Rosato Marlene G.,2000, Instituto Nacional de Estadistica 2011, CES edupack 2005]



Raw material cost : density, volume, price

Transformation cost: machining time, preparing time

Tooling cost: number of elements produced, costs of the mold and machineries

Exterior work cost: extra external work

Cost calculations

Elements Price

Elements	No. of Elements	Price per piece (€)	Total
King pins	2	0.8	1.6
King pin lock nuts	2	0.4 -1.21	0.8 -2.42
Hangers with axles	2	8.07-16.15	16.14-32.3
Pivot cups	2	0.56	1.12
Baseplates	2	5.49-7.1	10.98-14.2
Top cup washer	2	0.56	1.12
Lower cup washer	2	0.56	1.12

Total price for two trucks : 32.88 € -53.88 € (estimation)

The bushings, king pin, pivot cup, top and lower cup washer, baseplate have the price as there are sold on internet directly from the manufacturers. The price is per unit but it has to be taken into consideration that there have to be ordered 100 or 500 units and such.

The price is calculated for two trucks because it cannot be sold just one, always are sold as a pair.

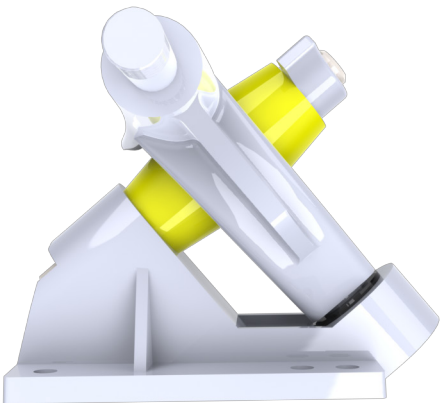


Image 138

Life cycle

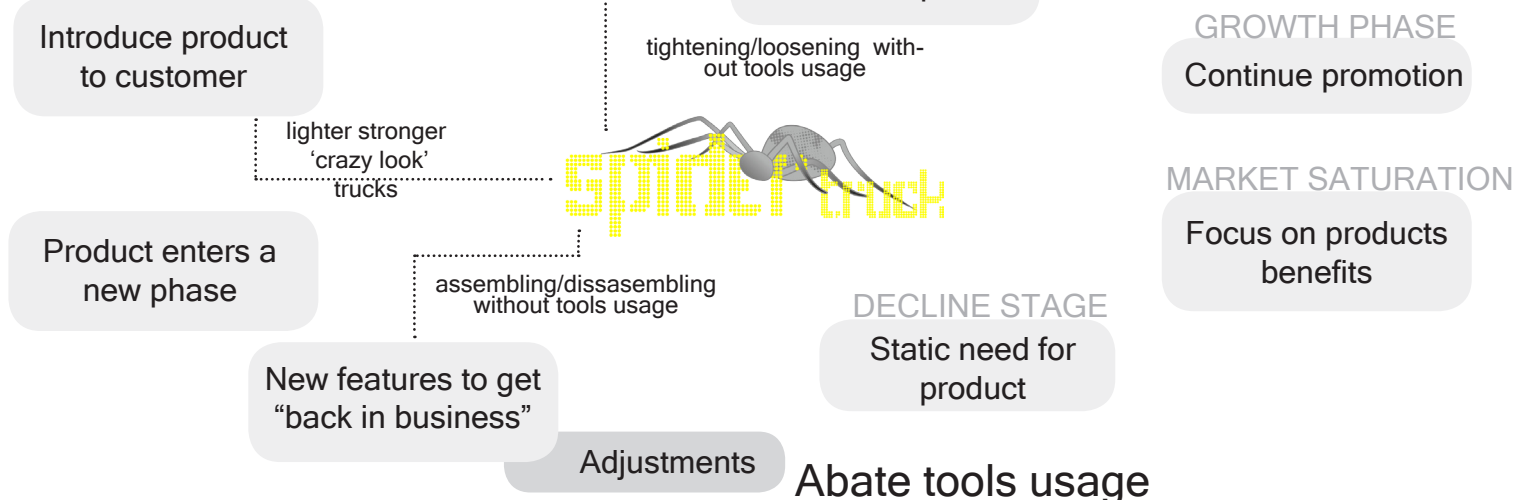
One of the tasks during the design process is to understand the longboard business and get knowledge about the market where it activates, in the end being able to offer marketing strategies solutions for the future. In this section, the product is evaluated and the final proposal is presented in relation to its feasibility, market potential and future development.

The life cycle helps the student and the possible investor to understand product's life cycle and realize when it is time to introduce and withdraw the product from the market. Also, it helps understanding products position on the market compared to competitors and in the end product's success or failure. In the diagram below, the life cycle has seven stages: product introduction, product growth (monitor competition and continue promotion) followed by product maturity (focus on product benefits), product decline, getting back in business when new features are implemented.

In the beginning, when the product is introduced to the customers, the feature having to times lighter weight but stronger trucks structure with a new hanger design give the product the opportunity to enter on the market.

From the competition point of view, the product has a strong position because of its unique feature of loosening or tightening the kingpin nut without any tools. There is no competitor having this feature yet. The new lock nut can be also customized which is an important design parameter in this market. The riders can now adjust their riding type easy and fast without carrying any tools and also can customize the locknut, becoming co-designers. The brand can be stamped or the logo can be integrated onto surface. After the decline stage, new uses have to be discovered in order to get back in business. New limitations have to be set so the system can adjust to these limitations and can be upgraded. The mounting solution using no tools may be one feature that can be implemented. The longboard hardware remains the same and only the bolts assembling has to be changed and from this feature win both customer and company. The company disambles the payment for mounting work and for the user the assembling is just simpler and there are no tools involved. This upgrade is helpful and needed because fast, easy mounting and dismounting trucks is important when it comes to transportation because the longboard occupies a lot of space and this feature will reduce it.

Target: longboard aficionados



Presentation



Trucks



Image 139

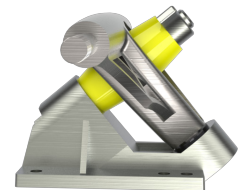


Image 140



Image 141

Wheels mounted

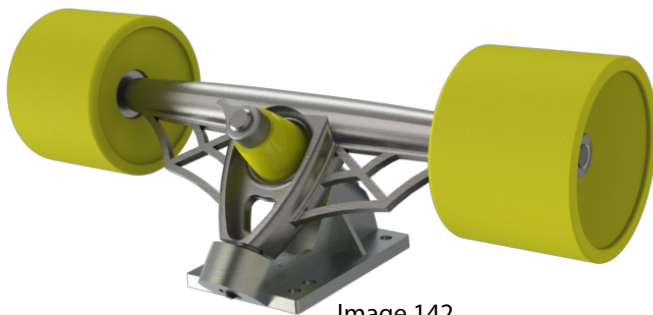


Image 142



Image 143

Complete Longboard



Image 144

Front view

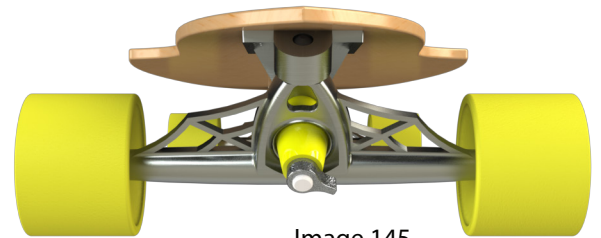


Image 145

Back view



Image 147

Usage

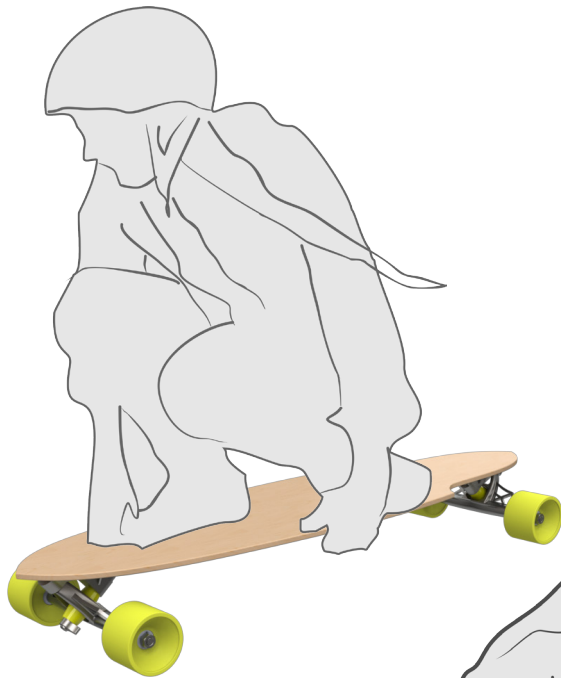


Image 148

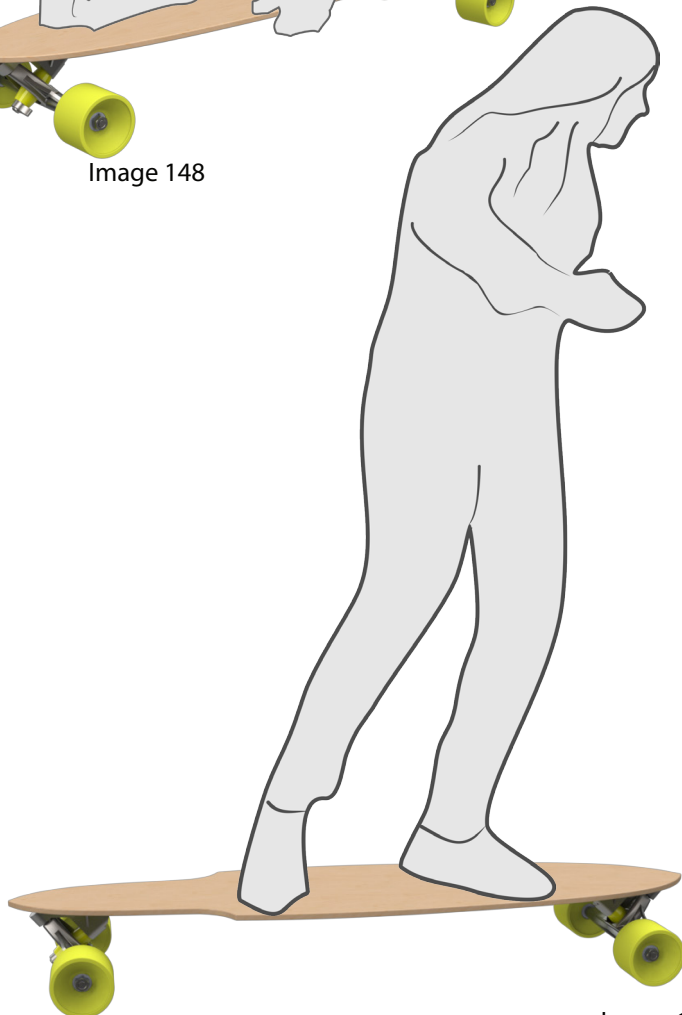


Image 150

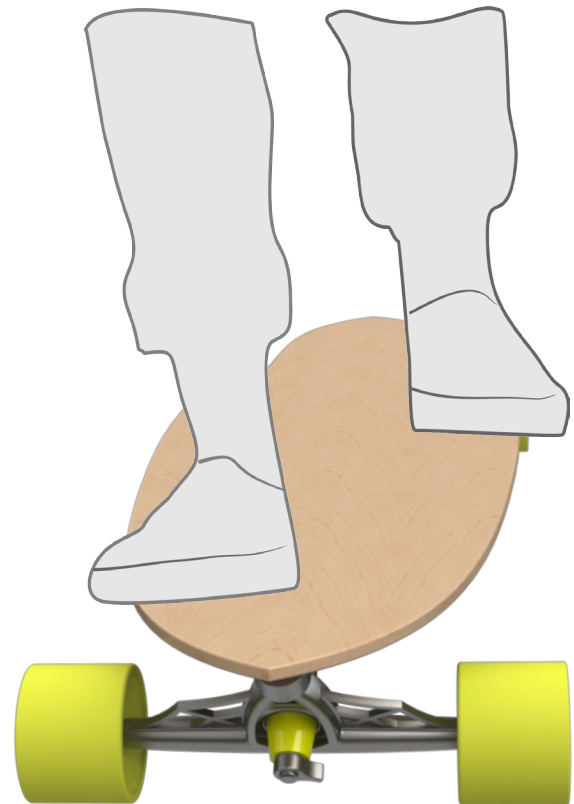


Image 149

Evaluation

Conclusion

One of the aims of this project is to gain as much knowledge about longboarding and get to know the culture that stands at the base of this active sport. The given assignment was a great opportunity to get to know the users and how they interact between them, what is their daily life and mostly how they collaborate with a designer when it comes to designing of their favorite product. One of the key points stated in the beginning was that the users want more functionality in the same time shocking through aesthetics. Also, the fast adjustment of the king pin was on top of the requirements list. The solution reached in the end fulfils the demands given in the first interviews with the riders.

The fast and easy adjustment of the king pin nut and the spider web structure which sustains the applied force over the hanger are the most important features related to the final design. The structure satisfies the riders needs aesthetically-by having a shocking and unique look, and also by functionality- made of titanium alloy, which is two times stronger and in the same time lighter than the mostly steel used in the longboard industry. The latter feature generates also highr speed when riding, the hanger surface being minimized.

Also a various costumization opportunities exist in this assamble, the hanger and axles,baseplate come in four basic colors which can be mixt with the bushing's neon colors in the end offering users the possibility of glamorizing their longboard as they want. The neon colors were a demand ,set in the analysis phase of the project, by the users and it was taking into account in the development of the final concept. Another customization option can be the king pin adjuting nut that now has a complex function and is emerging by its colorful look but also it has a functional characteristic having an ergonomic shape. This enables the user to set his next type of riding fast and easy by just loosening or tightening the king pin nut.

.....

The new design differs from what is available on the market right now. The titanium usage is applied on some of the trucks but the price is high. The material is expansive but has a greater value than the aluminium alloys or stainless steel used in the common trucks. This feature is made just to offer another option for the users to choose from, it is not the best solution. The riders don't afford always to buy the best hardware because of the high price. That is why the target for this product may be also them but also the riders who are ready to spend more money on higher quality and resistance .

The situated interviews, the internet sites and books are a big help when it comes to analyse this active sport. There is a huge amount of information and many details have to be taken into account when designing a new product in this area. Furthermore, it has been a great opportunity to create from scratch and from users demands such a product and during the process to be able to ask for feedback from the users. This helped a lot the design flow and also in taking decisions when there was not enough knowledge. Developing a competitive product is not implying only functional and aesthetic aspects, but also the manufacturing and all the process untill is ready to be produce. The investors and the company that will produce Spider trucks have to make profit and manufacture this product with low costs.

Reflection

Product

Although the product design is finished, the development is a neverending process and therefore some aspects that are still to be developed.

The next step would be to simplify the trucks mounting and dismounting. Many users are complaining that they are not able to transport their longboard because of the space that it occupies. A new solution would be the fast assembly and disassembly of the trucks from the deck. This will also help in changing the hardware for different types of riding- riders prefer to have specialized hardware for each riding type they do. This implies also safety which many riders are taking into consideration and are aware of it. The fast mounting and dismounting may diminish the strength of assembly but this is to be further researched.

The concepts that were sketched can be improved and applied on other type of hangers. The honeycomb and the leaf structure can be analyzed more, apply the pattern smart on the hanger and in the end have a strong structure as the spider web. It may be also a good marketing proposal to have a line of longboards that are inspired by nature and also have the construction that emulates the organisms features and construction pattern.

The cost evaluations are estimations as it is a lack of knowledge and information to calculate the actual cost. But an estimation of the components gives an idea of a selling price and if the product is competitive and profitable for the future investors. By having to calculate the cost, some research was made in the production methods and manufacturing area so there is a certain amount of awareness of problems that may occur when it comes to design some parts and could be improved in the future.

Process Getting to know the users of this active sport was interesting. Many crazy ideas, many opinions and interviewing methods came along the process. These riders helped a lot during the process report giving feedback and suggesting different concepts.

The entire analysis and research process was complex, long and many small details had to be taken into consideration as history and culture, upcoming trends, music and competitions and the most important get to know in depth the longboard and how it reacts to applied forces. It was a big amount of information and during the process it was getting frustrating because many solutions were already made or the simplest way of designing the hanger was already done so the focus had to be moved in another direction. Testing the new product was not possible due to the complexity of construction but some models were made with the structure pattern and also some studies were made upon the king pin ergonomic shapes. In relation with FEM analysis, it is a very useful method to validate a design. Many times happens to design a whole product and in the end realizing that it is not feasible.

In conclusion, the semester has given a new perspective in design process; a combination of research, design and technique which is not always taken into account when designing new products.

List of references

[Bustin Longboards,2012]

All You Need to Know About Longboard Wheels from Bustin Boards Custom Longboards | Bustin Longboards

NYC - Longboarding News for the Evolving Skater

Available: <http://blog.bustinboards.com/?p=2316>

Visited: 20.02.2012

[ASM International, 2012]

Titanium and Titanium Alloys Subject Guide | Information Resources | ASM International

Available: <http://www.asminternational.org/portal/site/www/SubjectGuideltem/?vgnnextoid=bb53b4d68558d210VgnVCM100000621e010aRCRD>

Visited: 20.06.2012

[Randal Skateboard Trucks, 2012]

Randal Skateboard Trucks - Made In America Since 1978

Available: http://www.randal.com/parts_bases.html#tikingpin

Visited: 15.03.2012

[Telegraph, 2012]

Scientists uncover strength of spider web design - Telegraph

Available: <http://www.telegraph.co.uk/science/9056006/Scientists-uncover-strength-of-spider-web-design.html>

Visited: 15.06.2012

[MIT news, 2012]

How spider webs achieve their strength - MIT News Office

Available: <http://web.mit.edu/newsoffice/2012/spider-web-strength-0202.html>

Visited: 21.06.2012

[Skateslate,2012]

SKATE[SLATE] - You Are What You Skate

Available: <http://www.skateslate.com/you-are-what-you-skate/>

Visited: 03.04.2012

[MuirSkate longboard shop,2012]

Loaded Dervish Longboard Skateboard Deck w/ Grip (Free Shipping) | MuirSkate.com

Available: <http://www.muirskate.com/longboard/decks/734/Loaded-Dervish-Longboard-Skateboard-Deck-w-Grip.html>

Visited: 03.07.2012

[Mindtools,2012]

Mind Tools - Management Training, Leadership Training and Career Training

Available: <http://www.mindtools.com/>

Visited: 03.03.2012

[Silverfishlongboarding,2012]

Truck Angles

Available: <http://www.silverfishlongboarding.com/forum/longboard-skateboarding-trucks-bushings/142748-truck-angles.html>

Visited: 04.05.2012

List of references

[MuirSkate, 2012]

Part 2: Cruising Trucks - Longboard Guide | MuirSkate.com

Available: <http://www.muirskate.com/longboard-guide/cruising-carving/trucks>

Visited: 20.02.2012

[Longboard:Source,2009]

Trucks explained... « Longboard:Source Workshop

Available: <http://www.longboardsource.co.uk/workshop/?p=59>

Visited: 20.05.2012

The History Of Skateboarding In Less Than 1700 Words

Available: <http://www.interlog.com/mbrooke/history.htm>

Visited: 01.03.2012

[New creative Sports goods Co., 2012]

Our Ability

Available: <http://www.longboard-truck.com/ability.html>

Visited: 03.04.2012

[Studie Guide 2011]

Studie Guide, paper to guide through the semester perios and design process

[CES Edupack 2005]

CES Edupack 2005, Program to determine material

[It's all about Boards]

Available: <http://longboardgirlscrew.com/2011/09/its-all-about-boards/>

Visited: 21.02.2012

The following articles have not been used as direct source, but are used to get some background knowledge:

[BETTER COLLABORATIVE PROJECTS WITH THE INDUSTRY, 2010]

Kaare Eriksen¹, Finn Kehlet Schou² and Thomas Arvid Jaeger³, Aalborg University, Denmark

[SEMI SCIENTIFIC ATTITUDES THROUGH PROCESS REPORTING ON KNOWLEDGE PRODUCTION, 2010]

Christian Tollestrup

Associate Professor, Department of Architecture, Design & Media technology, Aalborg

University, cht@create.aau.dk

List of figures

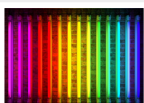
Image 1- 8	http://longboardgirlscrew.com/2011/09/its-all-about-boards/
Image 9 - 42	own sketch
Image 43	http://www.beastcoastlongboarding.com/2010/01/31/interview-with-brian-petrie-of-earthwing/
Image 44	https://www.jazzygearsports.com/SearchResults.asp?mfg=Honey+Skateboards
Image 45	http://www.obbconline.com/obbc-summer-update/
Image 46	http://www.hawaiiisurf.com/earthwing-miniglider-intp-p-061291.html
Image 47	http://www.muiskate.com/longboard/completes/1589/Honey-2011-AMP-6-Long-board-Skateboard-Custom-Complete.html
Image 48	http://www.ben-carlson.com/index.php?id=95
Image 49	http://www.ridefreeride.com/longboards/trucks/index.html
Image 50	http://www.silverfishlongboarding.com/forum/longboarding-photos/115009-bear-truck-logo.html
Image 51	http://skately.com/library/brands/paris-trucks
Image 52	http://www.longboardtrip.com/partners/
Image 53	http://www.atbshop.co.uk/longboards/randal-truck-co-randal-r2-raw-180-trucks
Image 54	http://www.beartrucks.com/grizzly.html
Image 55	http://socalskateshop.com/index.php?l=product_list&c=260
Image 56	http://www.cre8ivesk8.com.au/default.asp?PageID=54&CatID=40&ProductID=196
Image 57	http://www.axsgear.com/blog/vintage-skateboard-history/logan-interviews-logan-earth-ski/
Image 58	http://photography.nationalgeographic.com/photography/enlarge/waikiki-surf-boards_pod_image.html
Image 59 - 64	own photo
Image 65	own photo
Image 66 - 68	own illustration
Image 69	http://www.randal.com/guides_faq.html
Image 70-72	own illustration
Image 73	http://www.randal.com/guides_faq.html
Image 74 -78	http://www.tntboardshop.com/skatelongboard-c-67.html
Image 79	http://digital-photography-school.com/how-to-photograph-a-spiders-web
Image 80	http://techpump101.blogspot.ro/2011/01/googles-tablet-optimized-os-android-30.html
Image 81	http://www.photo-dictionary.com/phrase/3394/chestnut-leaf.html
Image 82	http://www.designtopnews.com/furniture-design/the-spider-chair-by-jun-hashimoto/
Image 83	http://aajpress.wordpress.com/2011/10/13/tomas-saraceno-cloud-cities-hamburger-bahnhof-15-sep-tember-%E2%80%93-15-january-2012
Image 84	http://www.redbubble.com/people/australianimagery/works/268543-webb-bridge-melbourne
Image 85	http://designcrack.com/honeycomb-by-quinze-and-milan/
Image 86	http://www.designbuzz.com/toxin-free-wooden-surfboard-bears-striking-honeycomb-pattern.html
Image 87	http://www.designboom.com/weblog/cat/9/view/8699/kengo-kuma-lucien-pellat-finet-osaka-store.html

List of figures

Image 88	http://inhabitat.com/transparent-honeycomb-treehugger-pavilion-lights-up-the-night-in-germany/
Image 89	http://weburbanist.com/2011/01/17/faux-finishes-awesome-plywood-mdf-architecture/
Image 90	http://webecoist.momtastic.com/2012/04/16/beautifully-buzzworthy-12-designs-inspired-by-bees/
Image 91	http://webecoist.momtastic.com/2012/04/16/beautifully-buzzworthy-12-designs-inspired-by-bees/
Image 92	http://www.arkinet.com/articles/urban-shelter-de-broissin-arquitectos
Image 93	http://stupiddope.com/2012/03/27/peace-bridge-by-santiago-calatrava/
Image 94	http://webecoist.momtastic.com/2012/04/16/beautifully-buzzworthy-12-designs-inspired-by-bees/
Image 95	http://webecoist.momtastic.com/2012/04/16/beautifully-buzzworthy-12-designs-inspired-by-bees/
Image 96	http://indiahomeclub.com/botanical_garden/bot_leaf_venation.php
Image 97	http://kellylynnwaters.blogspot.ro/2008/11/forest-chair.html
Image 98	http://webecoist.momtastic.com/2012/01/30/branch-out-with-15-home-furnishings-inspired-by-trees/
Image 99	http://www.interiordesign.net/newproducts/10522-JANUS_et_Cie_Forest.php
Image 100 - 113	own sketch
Image 113 - 135	own illustration
Image 136	http://www.edgeboardshop.com/modules/store/Accessories_C12086.cfm?AttributeIDs=24701
Image 137	own illustration
Image 138 - 150	own illustration

Appendix Interview

With what you like to impress others? (make combinations of images; fill in (with words) the blank square with something you think is missing)



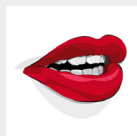
1



2



3



4



5



6



7



8



9



10

Where do sports go in the future? (make combinations of images; fill in (with words) the blank square with something you think is missing)



1



2



3



4



5



6



7

What bike combinations would you make for the best result in 'style & functionality' ?



1



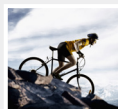
2



3



4



5



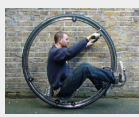
6



7



8



9



10



11



12



13

Appendix Interview

.....+ your longboard = love



1



2



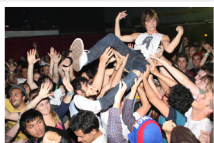
3



4



5



6



7



8



9



10



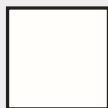
11



12



13



14

My new longboard ! (make combinations of images) the blank square is to write what you think is missing/can be added



1



2



3



5



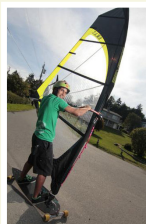
6



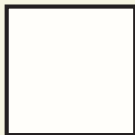
7



8



9



10

Appendix Interview

next accessory for my longboard

(make combinations of images) the blank square is to write what you think is missing/can be added



1



2



3



4



5



6



7



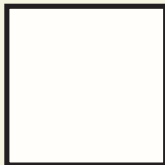
8



9



10



11

Appendix Questionnaire

About rider

How old are you?

Male? Female?

Occupation?

Name five words related to your lifestyle.

What are your hobbies?

What do you do in your spare time?

With what culture do you feel closer to?

Do you think that you are following the current tendencies in fashion/music/sports,etc.? From where do you get this information?

What brands do you like?

What do you find appealing and special about these brands?

What are the most important factors when you choose a product (related to longboard fashion)?

Is important to be up-to-date with the happenings in the longboard area and everything related to that?

About longboarding

What is your favorite type of riding?

What type of longboard you have now?

And the next one it would be what type?

What are the features that your looking at a longboard when you buy it?

What would be your demands for your next longboard?

What is your favorite spot for riding?

On what do you focus when you buy a longboard?

What accessories you change the most?

From where do you buy your accessories and board?

Is it difficult to purchase your desired longboard?

What graphics you would like to have on your longboard?

Would you apply a new feature to the longboard?

What is your opinion about : going “back to roots” in the means of longboard riding and longboard design?

Are you following the new trend when choosing your longboard?

Do you buy the newest products on the market?

What is your opinion about small scale longboard manufacturers and their products?

Would you buy a longboard?

You like custom made longboards or you prefer to buy from the big retailers?

What do you think about the Romanian longboard movement?

Appendix - Bill of material

The bill of material is organised in elements and assemblies on two levels.

Deck

2 x Trucks

2 x Hanger and axle

2 x Pivot bushing

2 x Lower cup washer

8 x 3mm Allen bolt

2 x Kingpin

2 x Top cup washer

2 x Kingpin lock nut

4 x Wheels

8 x Bearing

4 x Axle nut

4 x Axle Washer (speed rings)

8 x Speed Ring

4 x Bearing Spacer

4 x Lock nut

Appendix-Ride height of the truck

Below is a chart that explains how to determine the overall ride height of the truck. This is made based on combinations between hanger and baseplate.

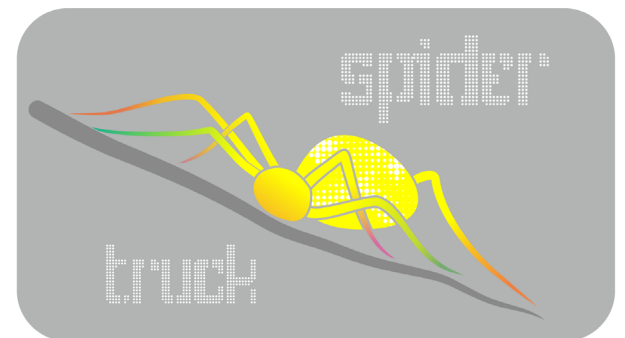
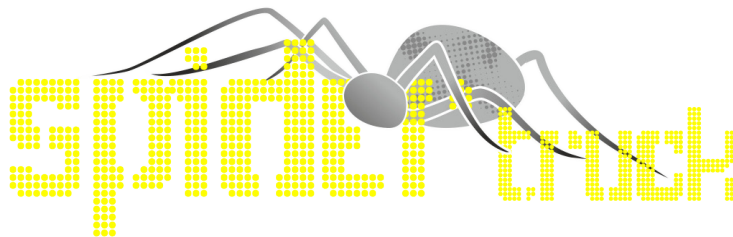
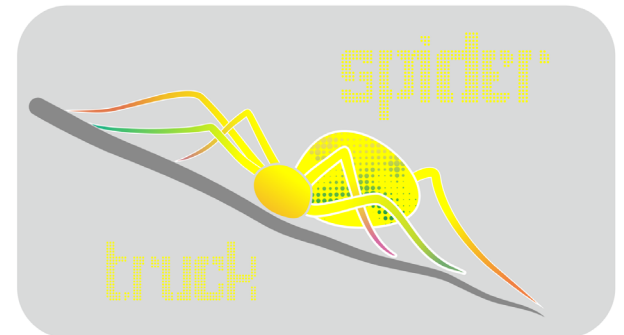
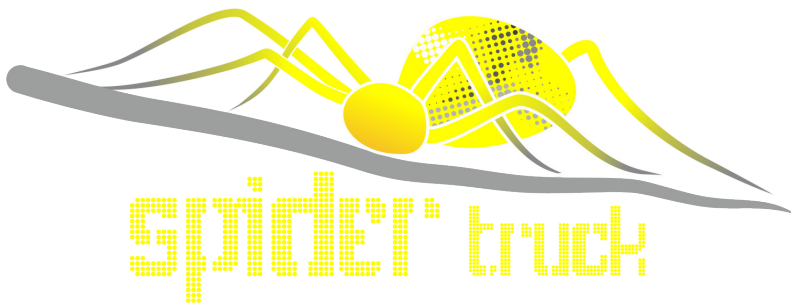
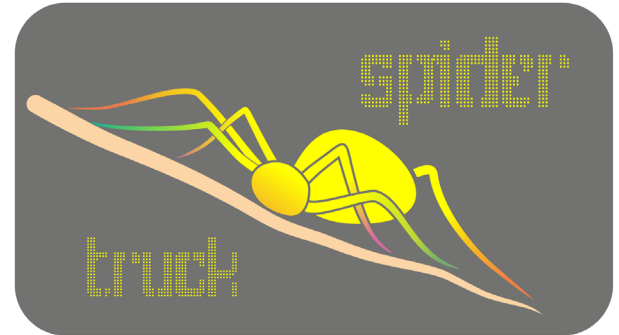
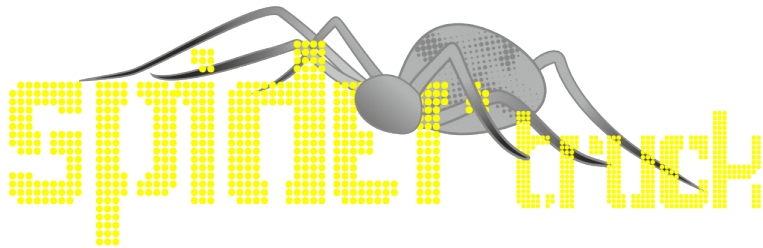
Distance		Baseplate Angles						
		28° C II	35° C II	42° R II	50° R II	50° C II	60° C II	
Hanger width	125 mm	Regular	60,96 mm	64.77 mm	58.42 mm	64.77 mm	66.04 mm	71.12 mm
		Flipped	54,61 mm	58.42 mm	50.8 mm	58.42 mm	63.5 mm	66.04 mm
	150 mm	Regular	60,96 mm	64.77 mm	58.42 mm	64.77 mm	66.04 mm	71.12 mm
		Flipped	54,61 mm	58.42 mm	50.8 mm	58.42 mm	63.5 mm	66.04 mm
	160 mm	Regular	59.69 mm	64.77 mm	59.69 mm	68.58 mm	68.58 mm	72.39 mm
		Flipped	59.69 mm	64.77 mm	59.69 mm	68.58 mm	68.58 mm	72.39 mm
	170 mm	Regular	66.04 mm	67.31 mm	62.23 mm	69.85 mm	72.39 mm	73.66 mm
		Flipped	58.42 mm	57.15 mm	57.15 mm	64.77 mm	67.31 mm	69.85 mm
	180 mm	Regular	60,96 mm	64.77 mm	58.42 mm	64.77 mm	66.04 mm	71.12 mm
		Flipped	54,61 mm	58.42 mm	50.8 mm	58.42 mm	63.5 mm	66.04 mm
	186 mm	Regular	66.04 mm	67.31 mm	62.23 mm	69.85 mm	72.39 mm	73.66 mm
		Flipped	58.42 mm	57.15 mm	57.15 mm	64.77 mm	67.31 mm	69.85 mm
	205 mm	Regular	66.04 mm	67.31 mm	62.23 mm	69.85 mm	72.39 mm	73.66 mm
		Flipped	58.42 mm	57.15 mm	57.15 mm	64.77 mm	67.31 mm	69.85 mm

Height is measured from bottom of baseplate to the center of the axle

Bottom bushing used R II Hangers Conical Bushings
C II Hangers Barrel Bushings

Small variations will appear due to the bushing compression

Appendix - Logo design





ARKITEKTUR & DESIGN