

— Design Projects & Advanced CAD and CAM —

Bike Light Project and Detail Design for Manufacture

Javier Rodriguez Blasco



Bike Light Project

— Kind of bicycle chosen: **Racing Bike** —

The first point to analyse in relation to the racing bicycles is the context in which they are used, what are the clothes that riders are usually wearing as well as the environment, accessories features and aim of this kind of bikes.



Smooth shapes to "cut" the air



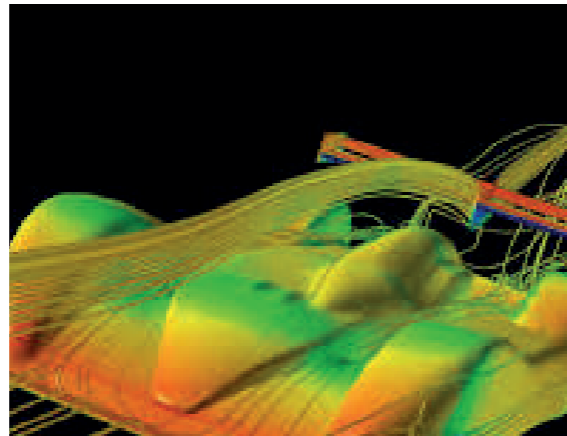
Sportive stuff that make a more comfortable racing



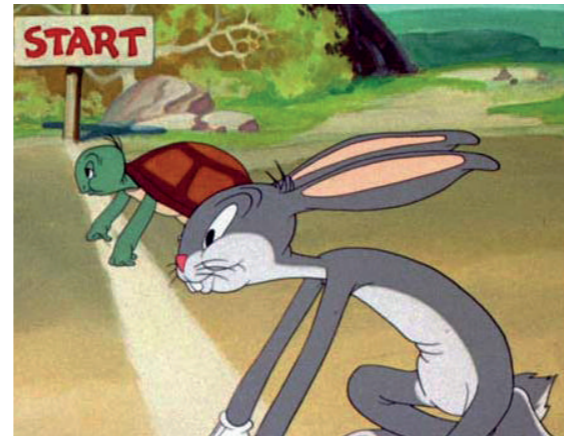
Lightness as one of the main features



Long distances to run



Dynamic shapes



Competitiveness



High speeds



Considerable time riding the bike



Bike Light Project - RACING BIKE

— Racing bikes aesthetics —

Racing bikes, also known as road bikes, are bicycles designed for competitive road cycling. These kind of bicycles have very important characteristics, the **weight and the stiffness**, which determine the efficiency of the power from a rider's pedal strokes to the wheels. Specially in this bike market bicycles may **sacrifice comfort for speed**.



Technical parts of a racing bike



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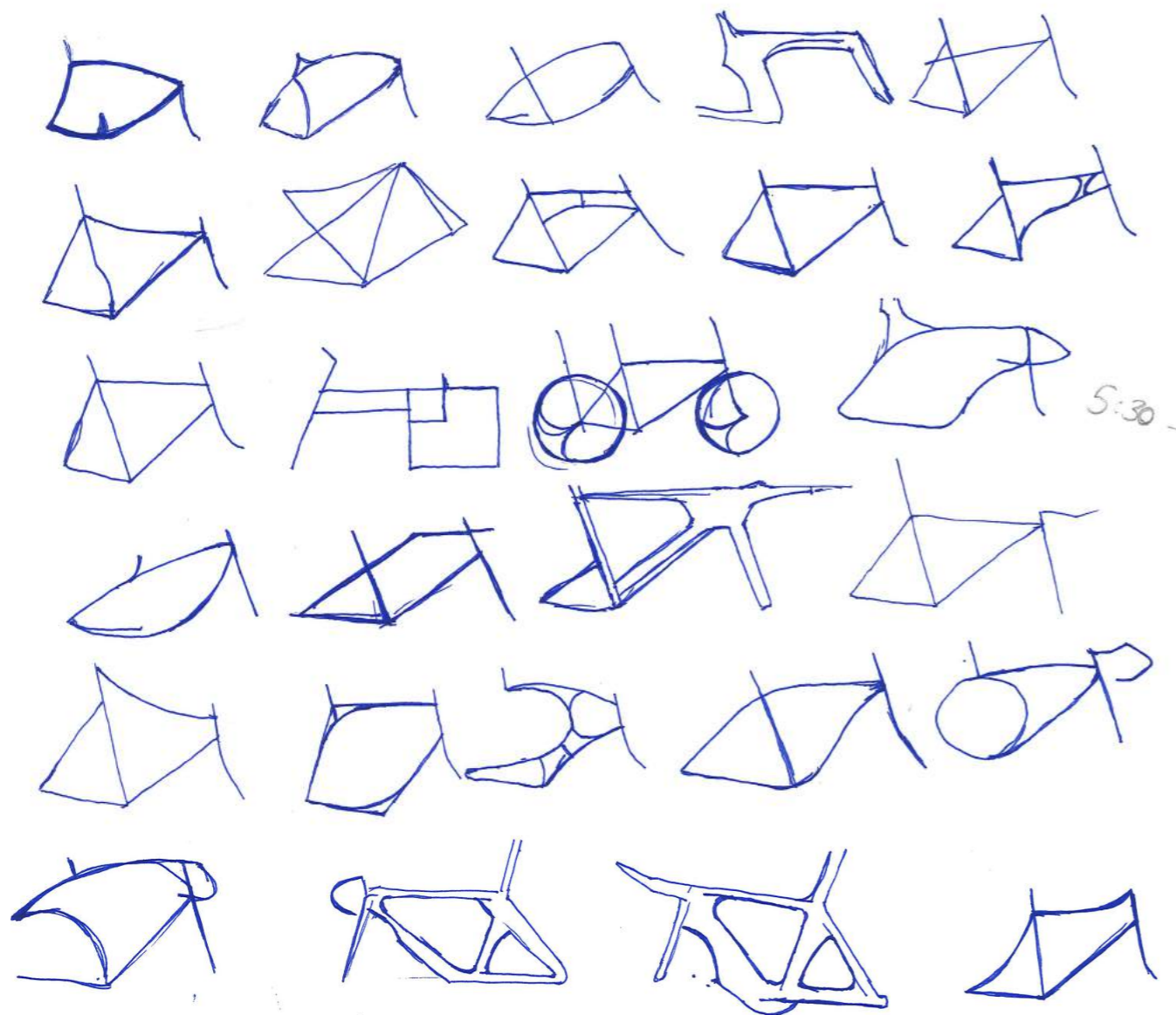
— Racing bikes aesthetics / Market research —

The next step was to research examples, taking reference in the library books. Some of them caught my attention, specially because of the fluid shape frame that they presented, like the Corima Cougar bike and the **Bianchi C-4 Project**. They have very dynamic shapes, including elements that the thin wheel to reduce de draft makes this kind of bicycles very elegant from my point of view.

After this stage of the racing bikes selection I keep with the research on Internet, where I found as well a lot of examples to get inspired.

From this point what I did was to **analyse forms, shapes** that this bicycles had. Like I said previously all of them present a very aerodynamic shape that transmit movement, lightness, elements position that makes the racer to be in a non drag stance in order to gain the maximum speed as possible. (On a racing bicycle, a reasonably fit rider can ride at 40 km/h (25 mph) on flat ground for short periods)

Shapes / Front views analysis



Next step I did was to **draw** some of the **bicycles frames** I had in order to get a **better conception** about how racing bikes are, and from this shapes I observed this features below-mentioned

Features observed:

- Fluid, smooth shapes
- Aerodynamic
- Light weight
- Low spoke count in wheels -> air drag reduction
- Light curves
- Unconstant sections
- Colours contrast
- Thin wheels -> less drag
- Elegant line
- Special handlebar
- Internal parts shown (like in the saddle)



Bianchi C-4 Project



Thonet Concept Bike



Peugeot bike



Sablière bike



Corima Cougar



Lotus Sport 110

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— Bianchi C-4 Project —



Once made the previous analysis and studies in order to get some conception about the market and shapes, I decided to choose this bike, the **Bianchi C-4 Project**

Why? Because I got impressed because of its **superb design**, the **magnific profile** and the **elegance** that this bike is able to pass on to me.

I loved since the first moment these **smooth curves**, they are changing from convex to concave in a very mild way.

One aspect that I liked to much from this bike is that the top tube of the frame has a **decreasing curve**, something very unusual at least in all the bikes I saw in my research, so it attracted me also.

The mix of the **materials are exquisite**, including the whole frame in **varnished carbon**, as well the settle, adding the **chromium finishing** in the handlebar tube.



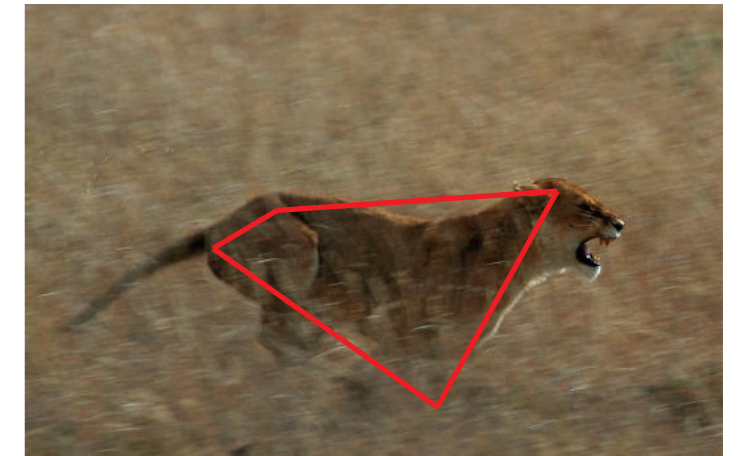
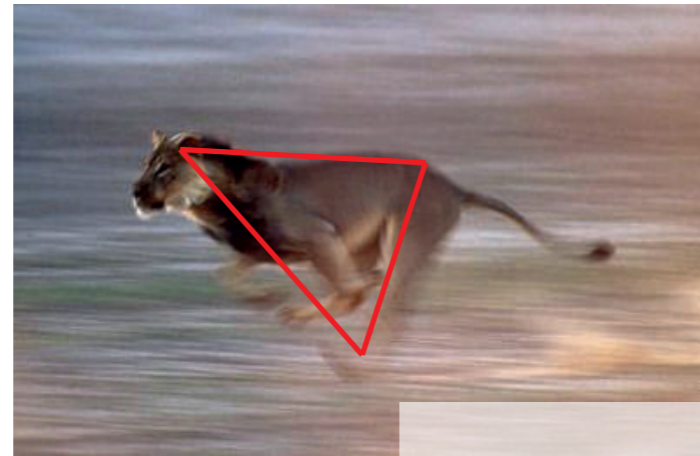
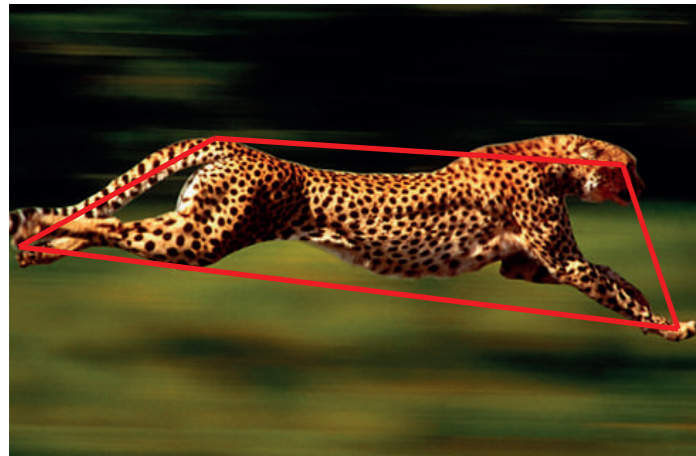
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— Animals comparison —

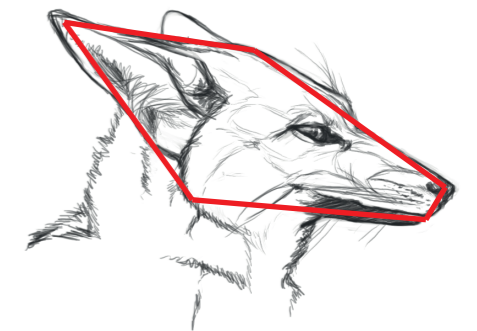
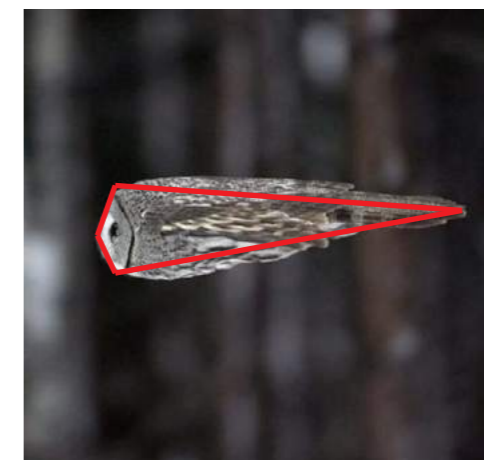
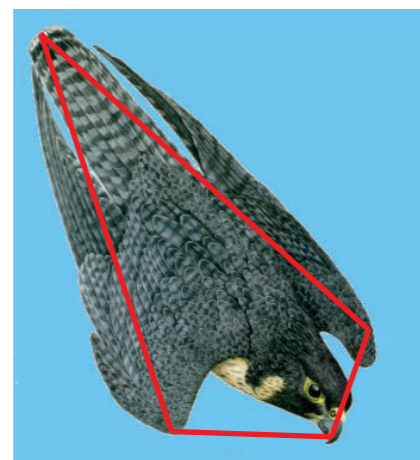
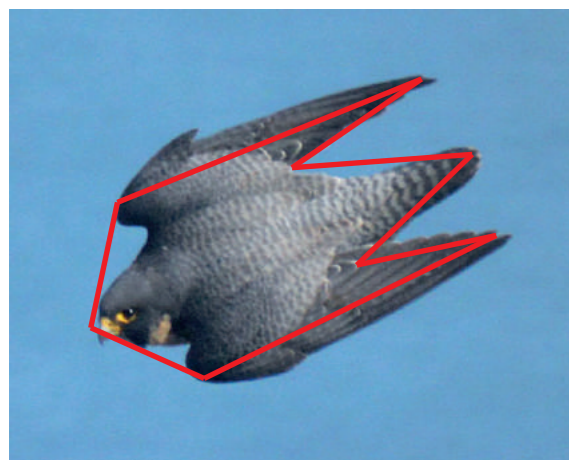
When I studied racing bicycle aesthetics, some frames reminded me animal shapes, so considering the chosen bike I wanted to analyse animals structures. I saw a relation with fish shapes, which are very **dynamic** and with shapes that allow a very good and **light displacement**. With this in my mind I thought as well about investigating the structure shapes of another animals (air or land) when they are running or having very **high speed** in their movement.

Then I analysed when animals are in a high speed and the structure of animals that are aerodynamic or hardly present drag in their movements, like the fish.

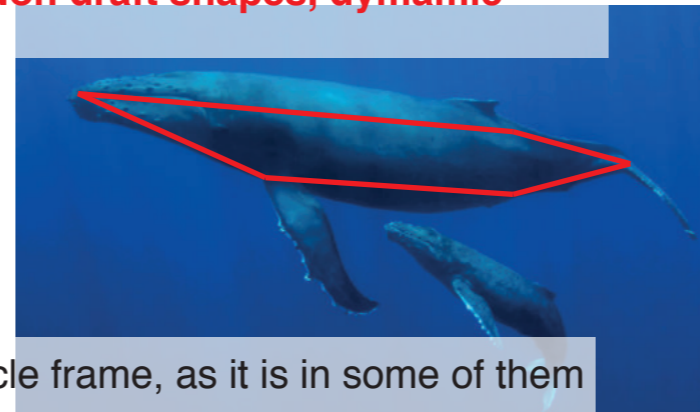
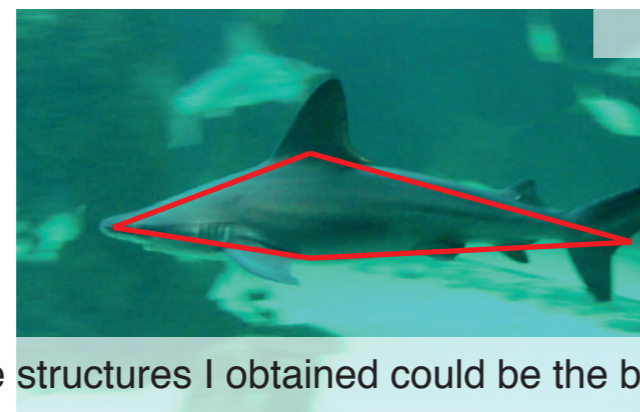
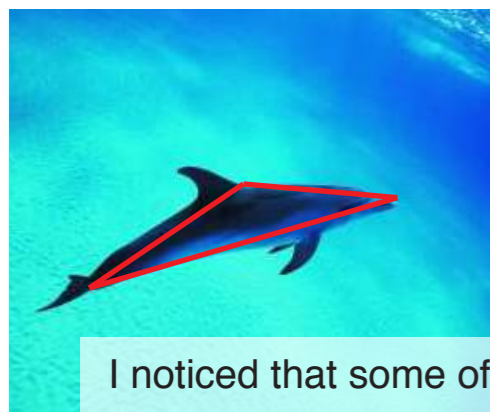
I decided this because my brief is related with racing bikes, which we want to be aerodynamic, fast and elegant at the same time, so **what example could be better than the very nature?** So then I tried to find more ideas about how to transmit speed, aerodynamic and styling.



Shapes structures at high speed



Non draft shapes, dynamic



I noticed that some of the structures I obtained could be the bicycle frame, as it is in some of them

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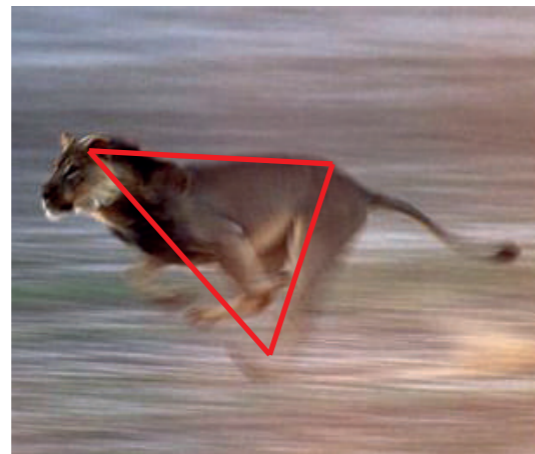
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— Design Directions —

4 different concepts: The next step was to think in four different concepts or design directions, so I part from my research and the examples I found previously to determine what concepts I should choose. So then these were:

Animals structures | sea → + smooth, + fluid shapes
land, air → dynamical structures in high speed

As I said previously the animal relation development could provide fantastic aesthetic to an aerofoil product



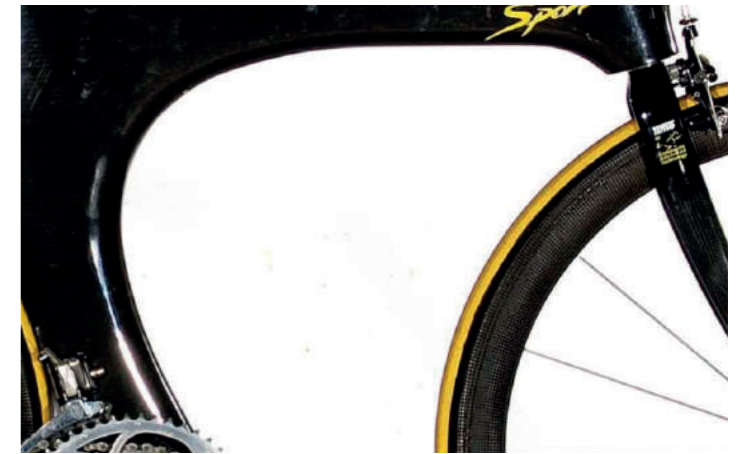
Show structure

In some examples is possible to see how support parts, structure is shown, giving a modern and avant-garde aspect to the product



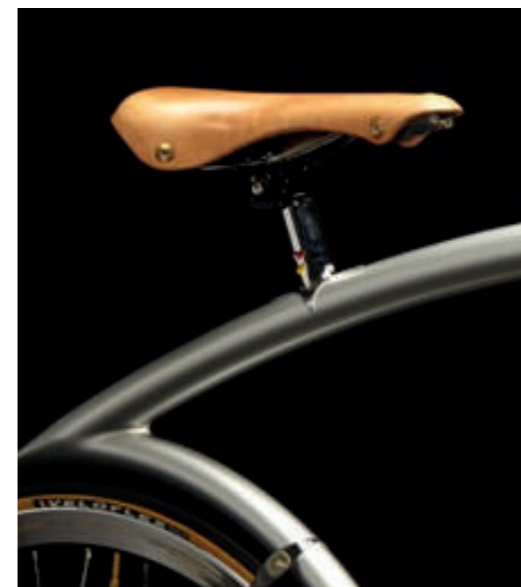
Exaggerated curves to give expression

Some bicycles own very exhuberant curves that convey a good feeling, in other words, they give a lot of expression



Floating elements

Some elements seem to be in suspension, out of the rest of the shape providing a floating sensation



So after these four concepts, I wanted to take just one that would result of the mix of two of them: **Animals structures + Show structure**

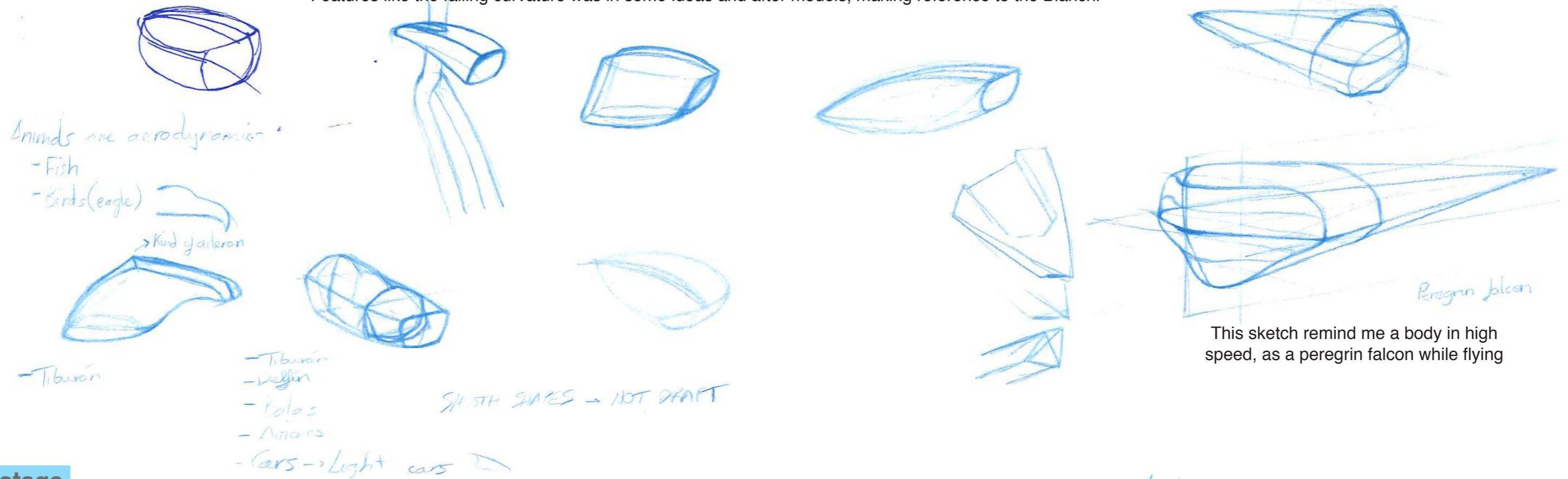
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Sketches of main ideas

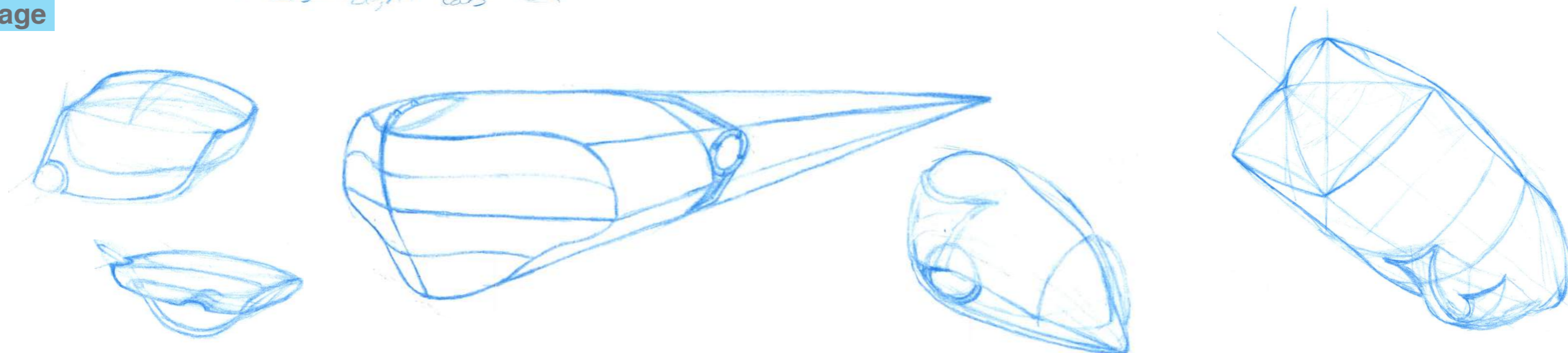
Trying to put in common the animal research and the Bianchi C-4 Project I started thinking in ideas that meet features of both concepts. So then I drew sketches from profiles obtained in the animals structures and from other bicycles influence, but trying to adapt to the bike brief.

1st stage

Features like the falling curvature was in some ideas and after models, making reference to the Bianchi



2nd stage



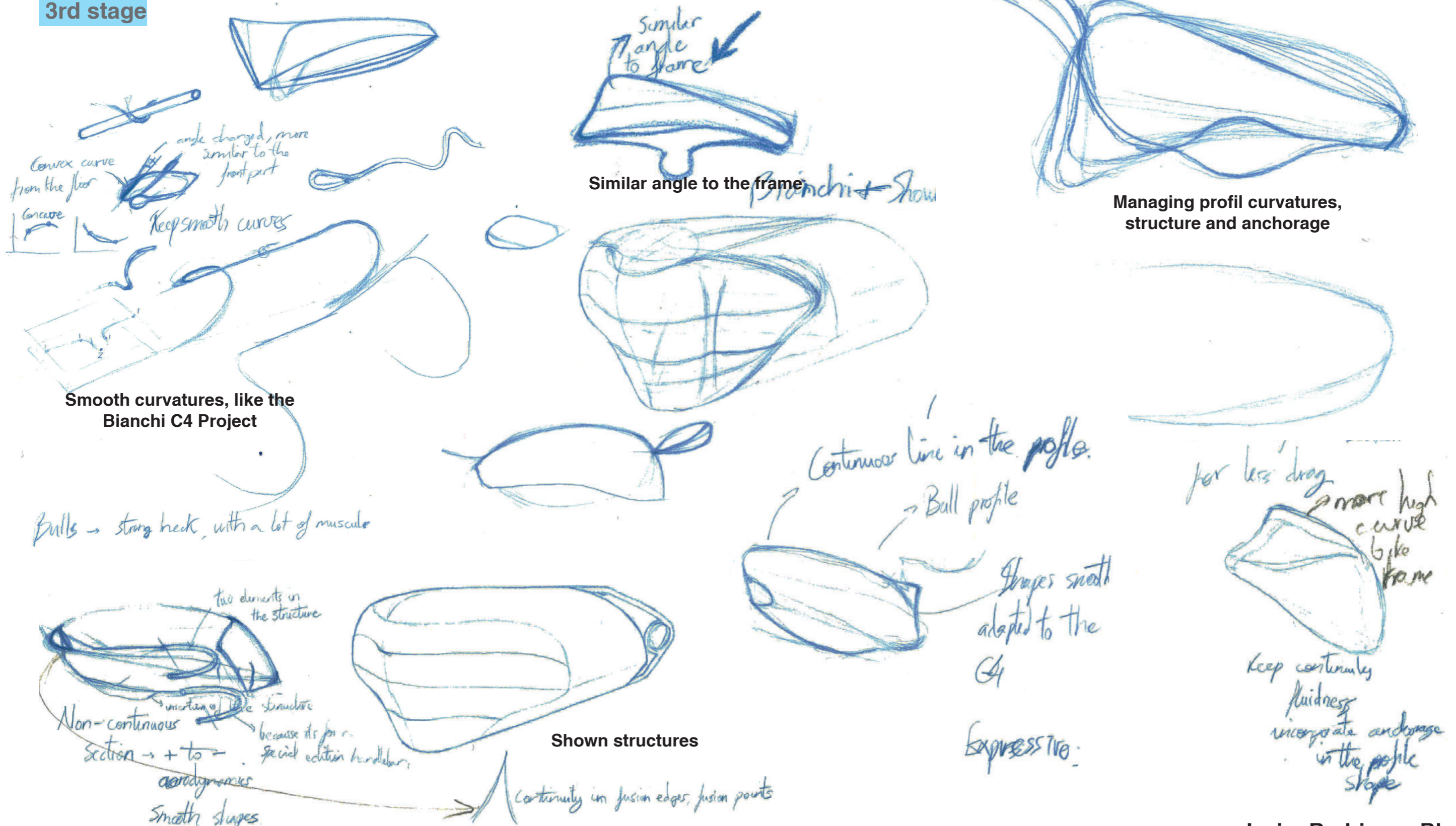
In this phase I tried to adapt to the brief of showed structure, so I came up making shells in them in order to make them lighter and show its internal parts and structure.

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Sketches of main ideas

In this third stage I tried to embody all the features I wanted my bike light to have, as aerodynamic shapes, shown structure and similarity with the Bianchi C-4 Project

3rd stage

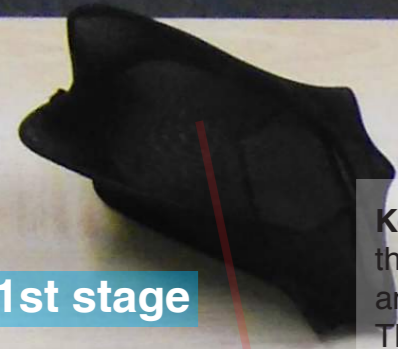


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— Models development —

All of them have been changed proportion in order to make sense with the real size they would have in the bike market

1st stage



Kept: Shape created with the leggings (it was dynamic and fluid). The most of the profile.
Changed: One part of the structure shown, the attachment and a handle, in order to adapt to the brief.

2nd stage



Kept: The general profile features, the continuity, fluidness.
Changed: Inferior section reduced for less drag. More high top curve, in order to make sense with the bike frame. Anchorage incorporated in the profile shape and sharper front part for giving a better styling (front view similar to a shark)

3rd stage



New model developed, which have a falling top curve in the profile like the bike frame. Relationship established with a bull profile which has a very similar curve, I embodied simplified bull shape incorporating showed frames as brief.



Kept: More or less the profile.
Changed: A shell for showing what before was covered for the frame to be attached. Has been changed his form adding more edges to create aerodynamics but with less fluency

Kept: Two elements for the attachment that join in the back.
Changed: A section that goes from plus to less, providing smooth shapes. A bit different profile with a more marked step for the structure insertion. This anchorage is special for a concrete handlebar edition.

Kept: The run from a frontal section to an end point.
Changed: Transformation: mix shape fluid(sea animals) / perspective of movement. A cut in the solid for the fram addition, with a spring for managing the strain and a handle on the front.

Kept: the body profile
Changed: The handle is lower in order to don't broke with the aesthetic, the anchorage has been reduce, but keeping the size for the handlebar tube. The front view has been changed with more high projections in order to eliminate edges and create smooth curves like the bike

Kept: The profile, because it was already dynamic
Changed: Higher angle to the front part, giving more aerodynamic. Cut on the bottom by a semicircular extrusion + structure that press the handlebar and the light cut, managing the strain of light and ending on the back of the light, adding easy anchorage and fluid profile

Kept: General profile and semi-circular cut extrusion.
Changed: The edges in front part have been deleted to adapt the shape to the bike given. The angle of the back face is similar to the front face. A cut in the middle back part to change the anchorage direction that in this case it goes to the front part



New model developed from the concret bike decision, so considering convex and concave curves combination y made this model that attach to the handlebar focus the light in the ground. Share fluency and elegance of Bianchi

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Final design

Trying to incorporate in all of them the features of the Bianchi C4 Project, which has an atypical design because of his profile, which has an appreciable falling curve to achieve the aerodynamic sought in this kind of bicycles. this has an exquisite, superb design with this mix of convex and concave curves, being all of them smooth. These aspects of smoothness and non drag aspect is what I wanted to embody in my lights bikes, so I made changes in my existing models in order to add a visible relationship between the light and the bike, making them coherent together.



This final design comes from the **mix of three** predecessors.

From the first one I took the dynamic of these **incomings** in the top part.

It's taken the **anchorage system** of the number 2 adapted to the **anchorage shape** of number 3.

It **share the most of profile** with the third one, because it share features and curves with the bike, but the top concave curve of the number 3 was converted in a convex curve, creating a solid body in the profile without considering the anchorage.

So then, the handle was set in one side of the model, because I didn't want to broke the body profile.

Since the top view a cut was made in order to put the handle that continues with the smooth curve. I tried to transmit all this features in order to get the purpose before mentioned, and give the same sensation that the bike has, this futuristic view as well



Here it's possible to see the falling curve such characteristic of the Bianchi frame



This completely braking curve in the profile is taken from the bicycle, that has the same curve between frame and seat tube



Finally as last feature is showed the top view, in which we can see the handle as a showed structure part, like it happens in the bicycle seat structure

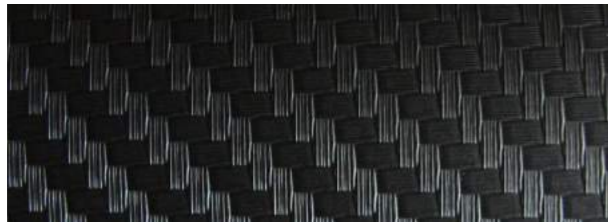
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Final design

Material choices

The materials explored for this final design are these ones because this are materials very ralted with design, speed, power, lightness, robusness, supertub and interior and exterior resistance features within a product



Carbon fiber



Black/coloured ABS



Chromium plating



Agglomerated cork

Renderers

In this render the materials chosen are:
Agglomerated cork for the top piece,
Plastic ABS for the bottom piece.
Cooper for the frame or structure (anchorage system and handle)



In this one the materials chosen are:
Agglomerated cork for the top piece,
Plastic ABS for the bottom piece.
Carbon fiber for the frame or structure (anchorage system and handle)



In the other one the materials chosen are:
Carbon fiber for the top piece,
Plastic ABS for the bottom piece.
Carbon fiber for the frame or structure (anchorage system and handle)



In this render the materials chosen are:
Carbon fiber for the top piece,
Varnished carbon for the bottom piece.
Chromium finishing for the structure (anchorage system and handle)



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— Final design in context —

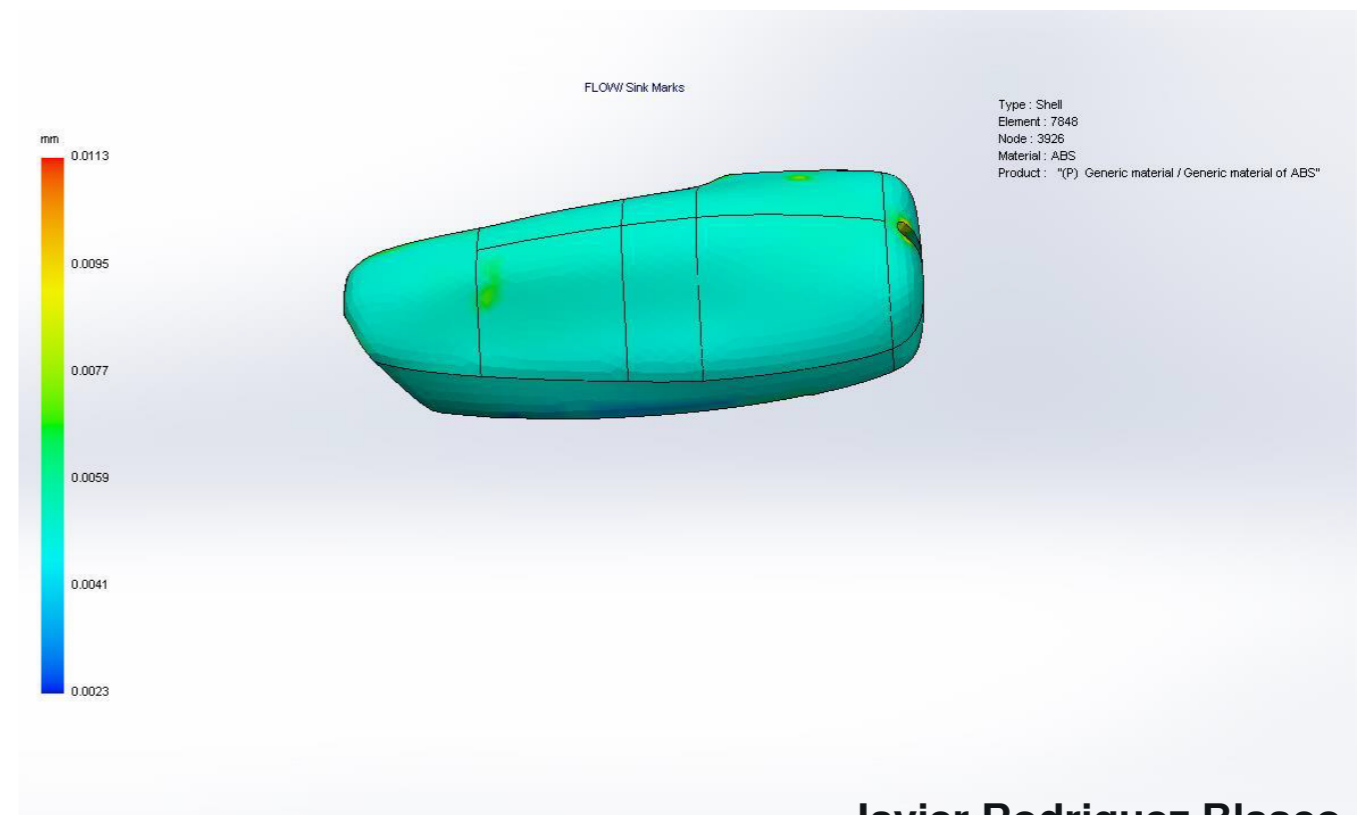
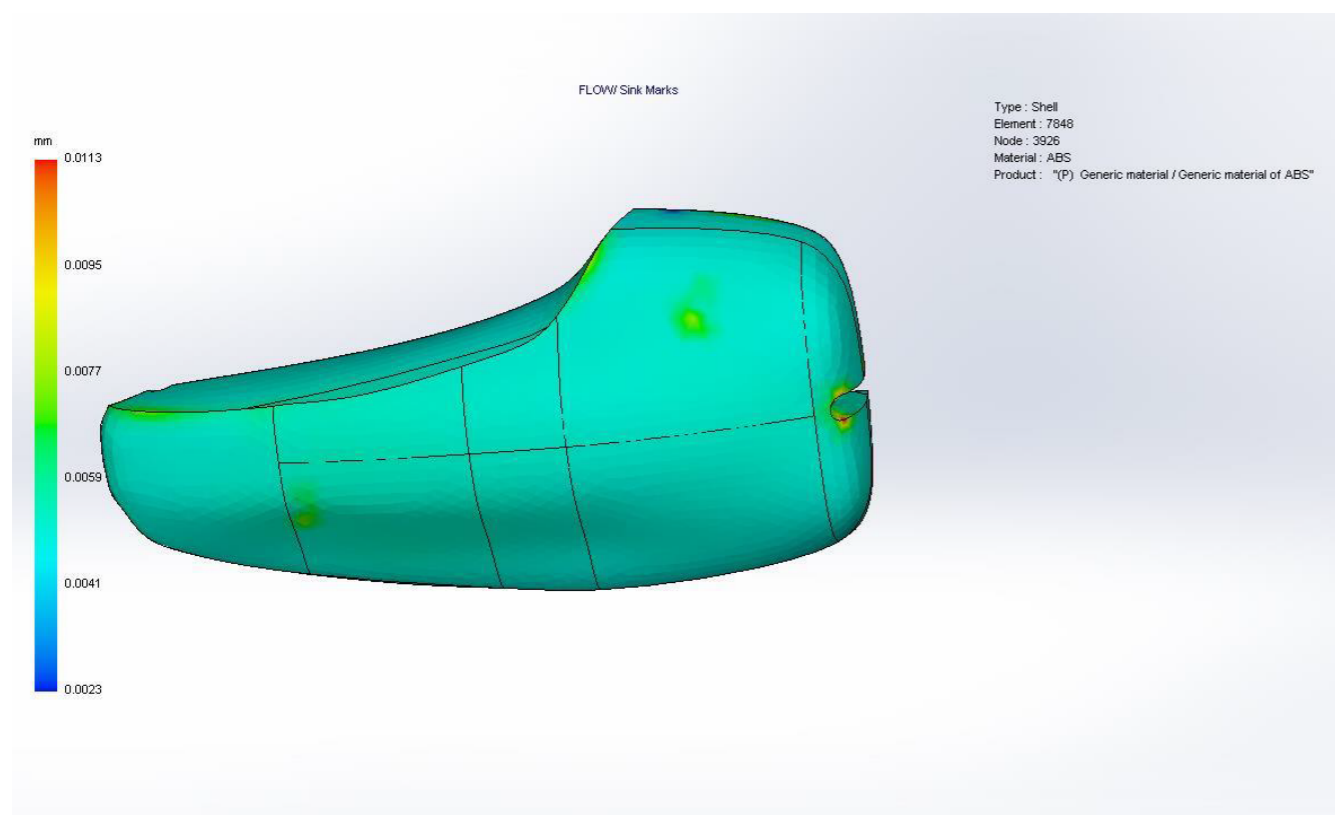
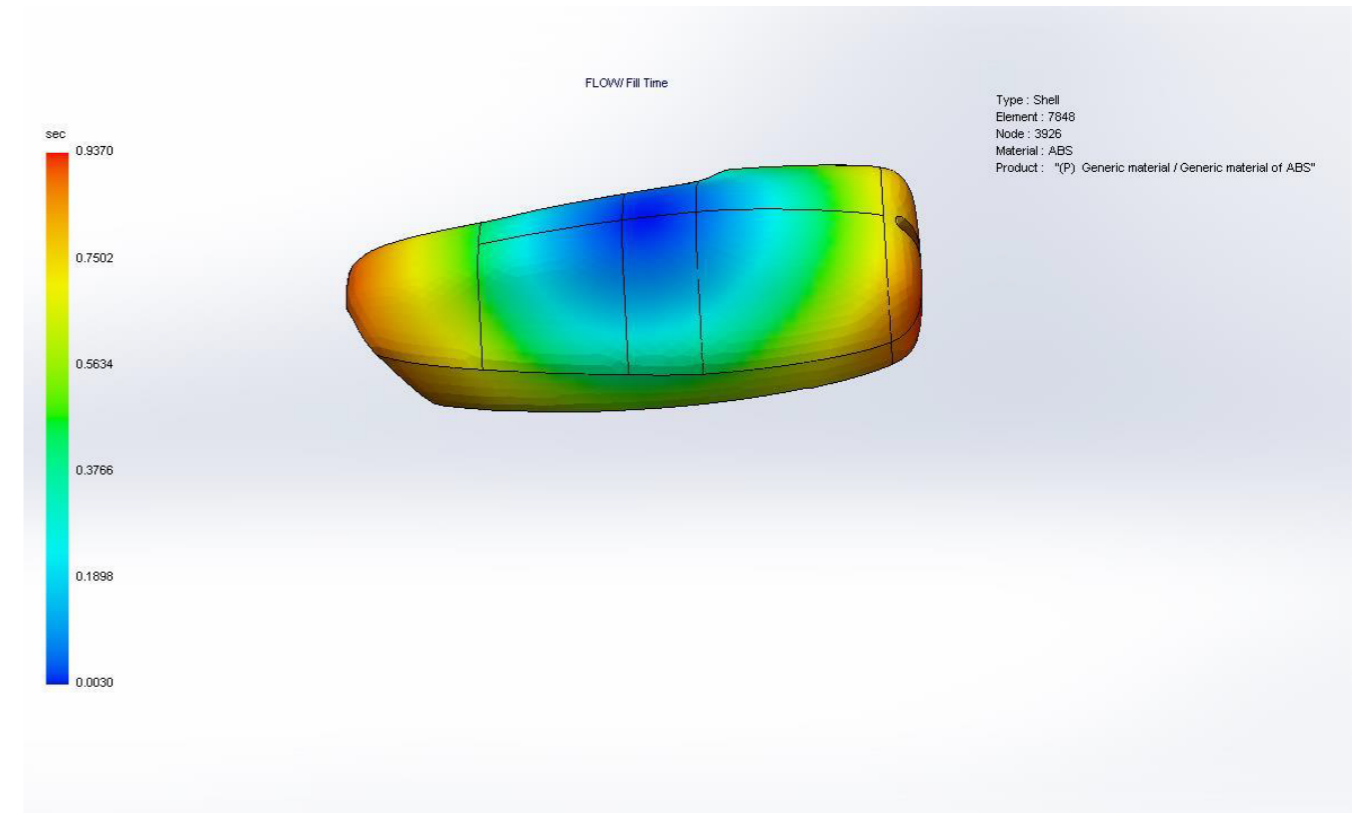
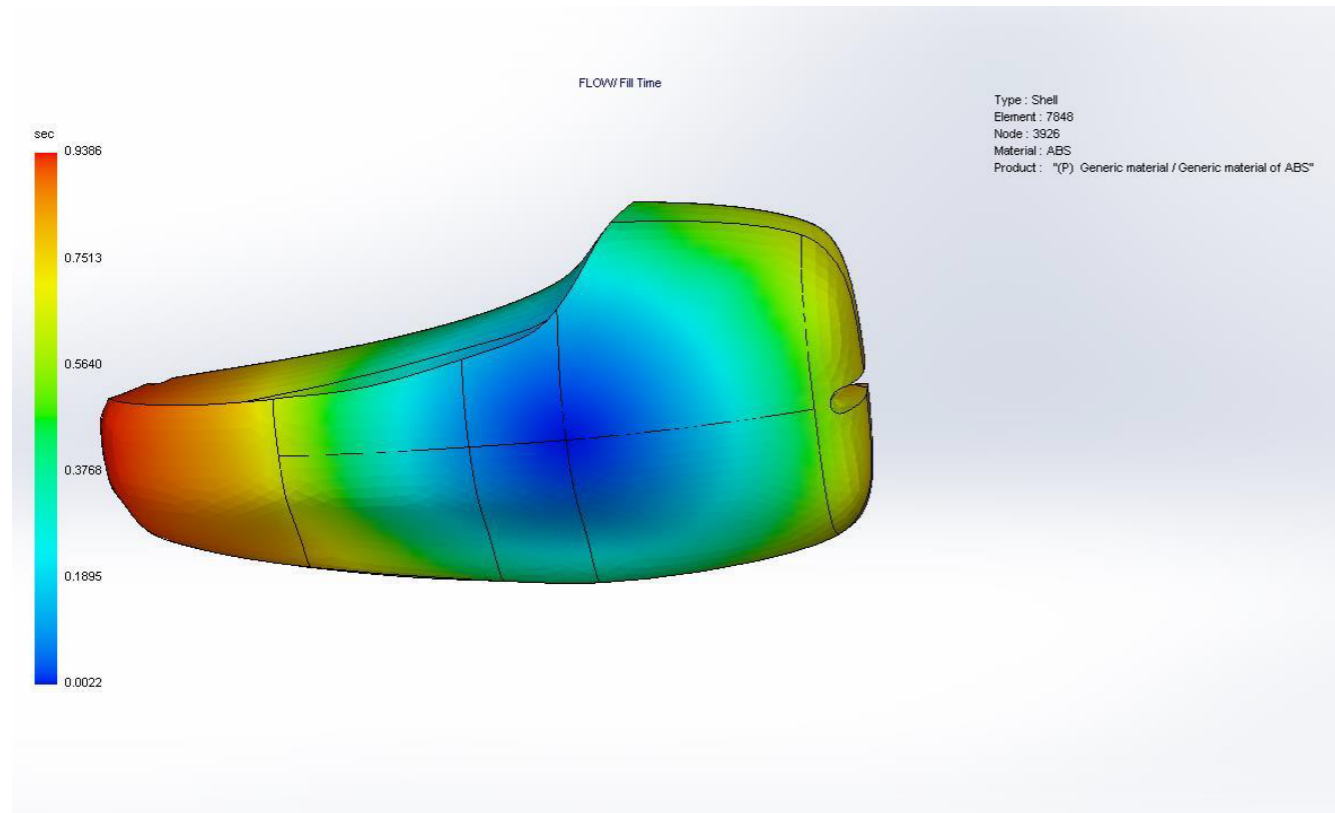


In this one is showed the final model incorporated to the bike, so we can see the proportion as well as the profile and aesthetic both together

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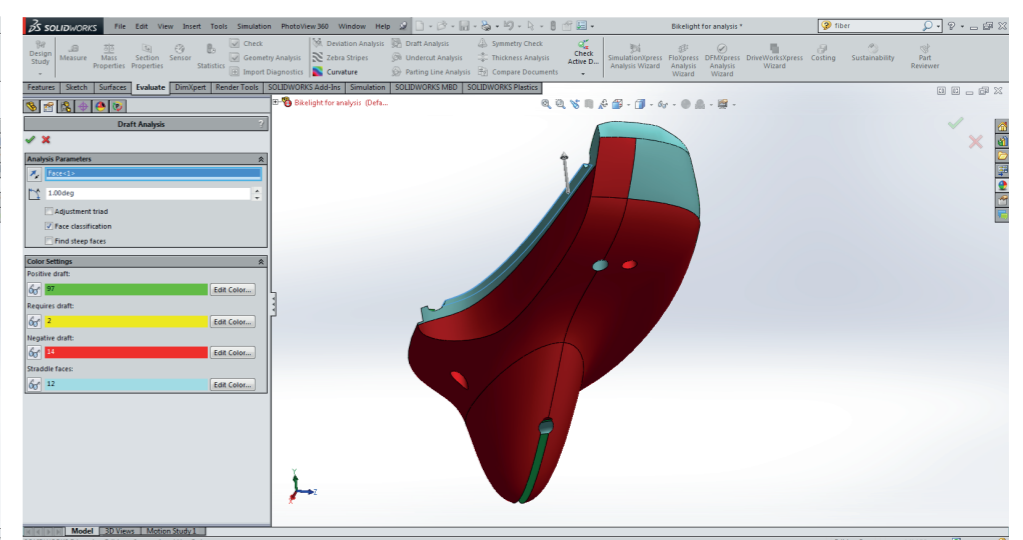
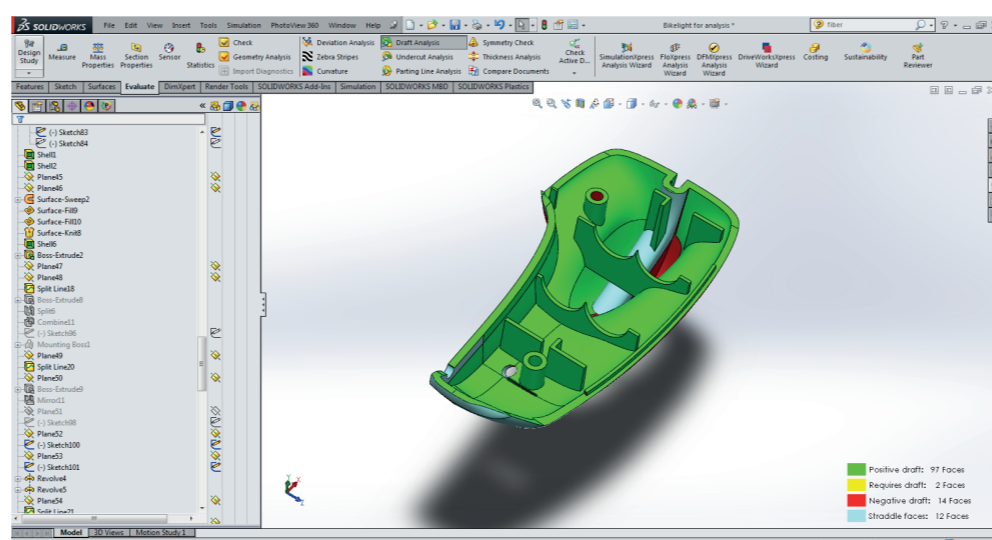
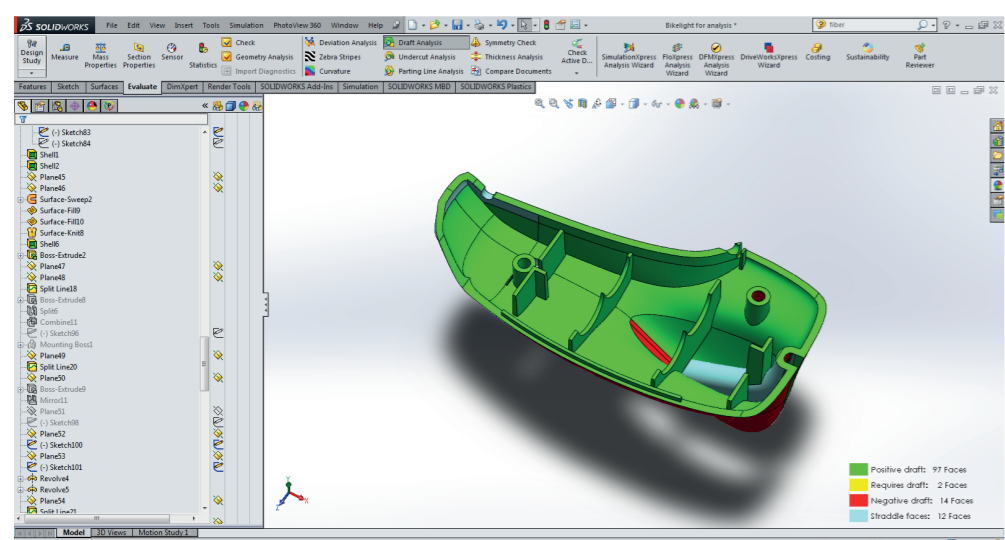
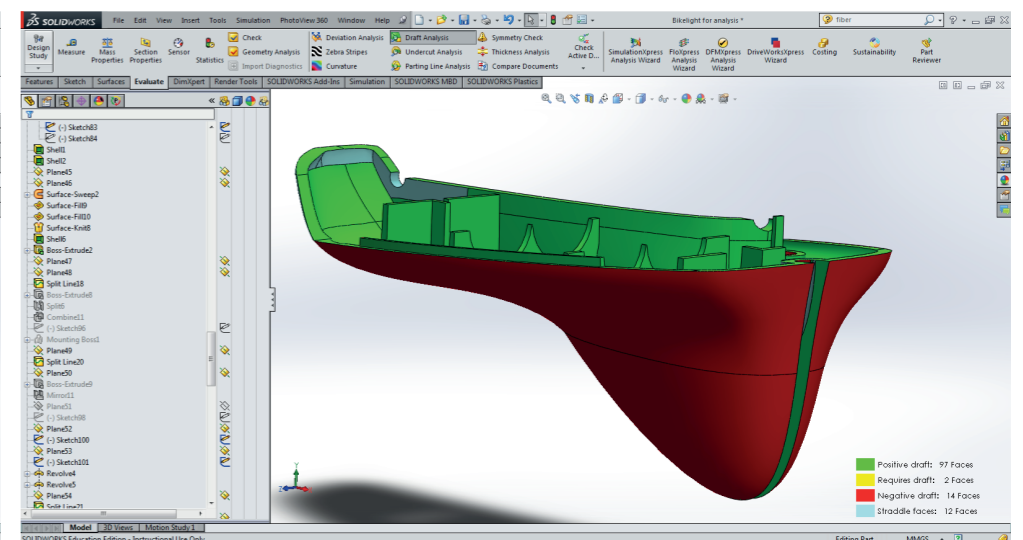
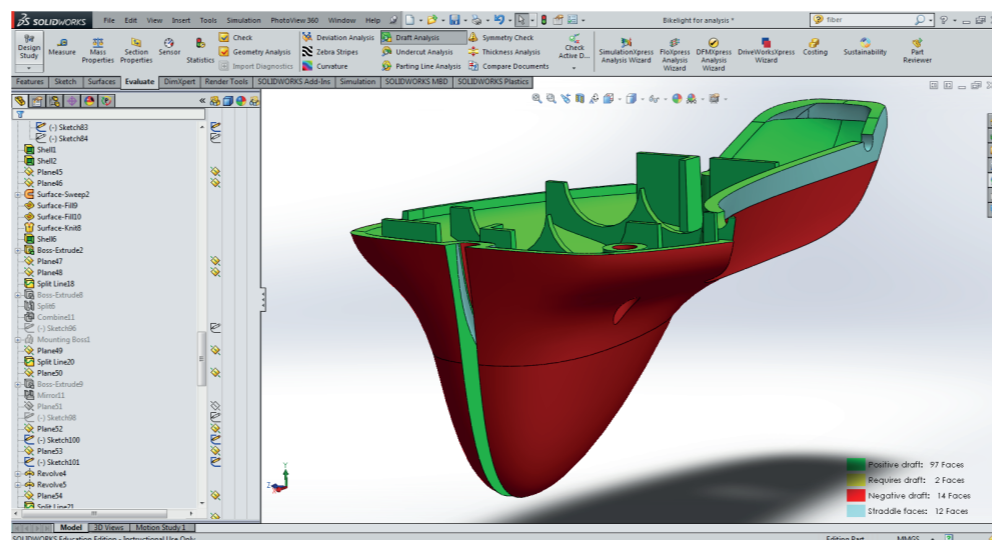
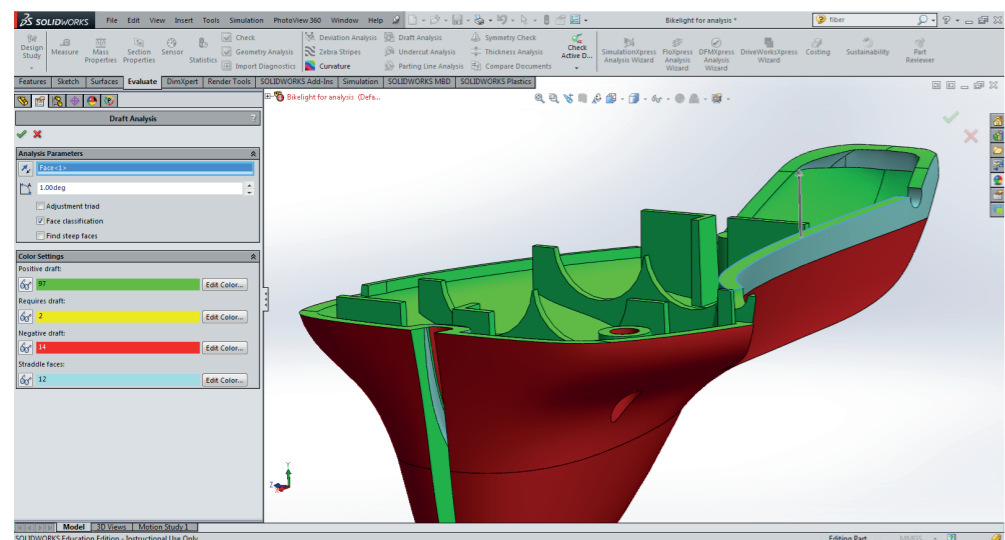
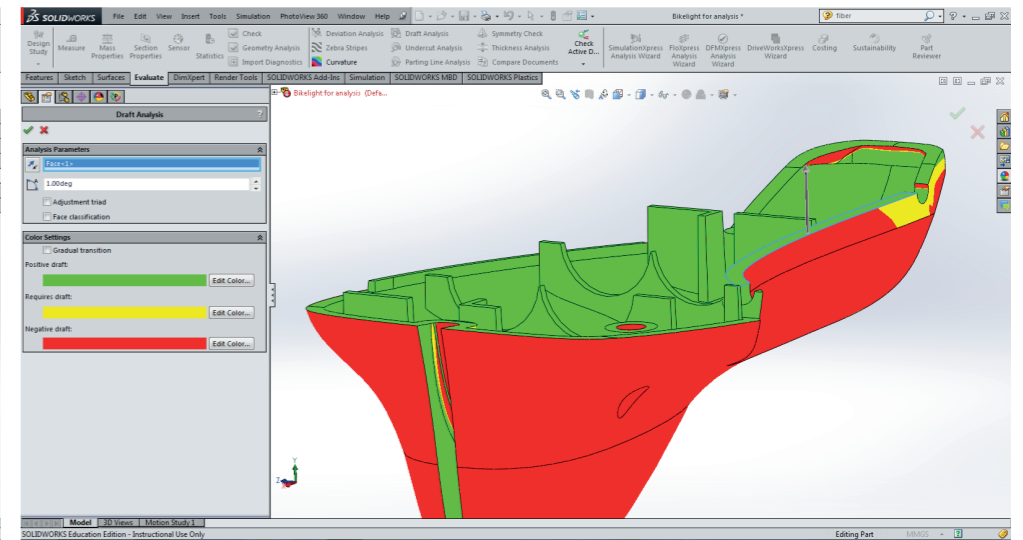
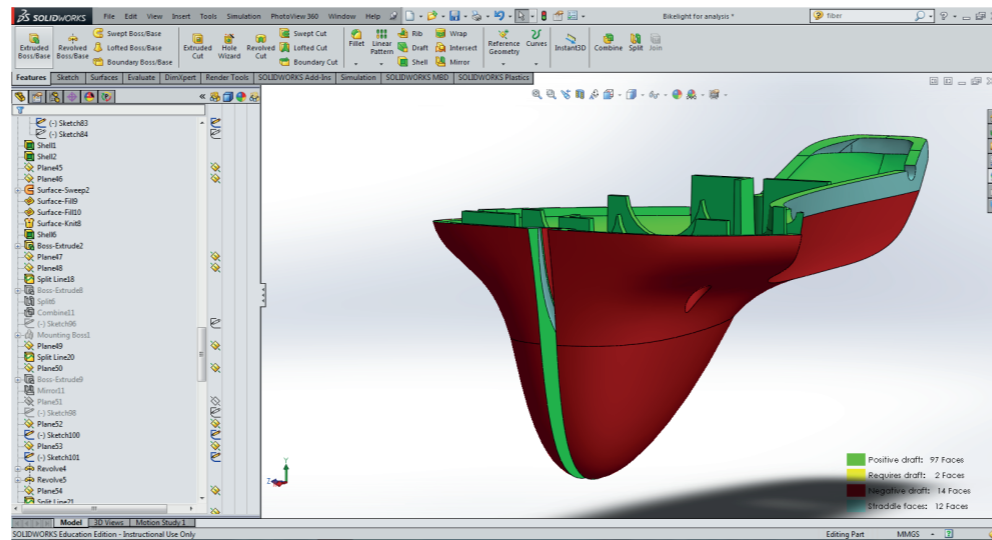
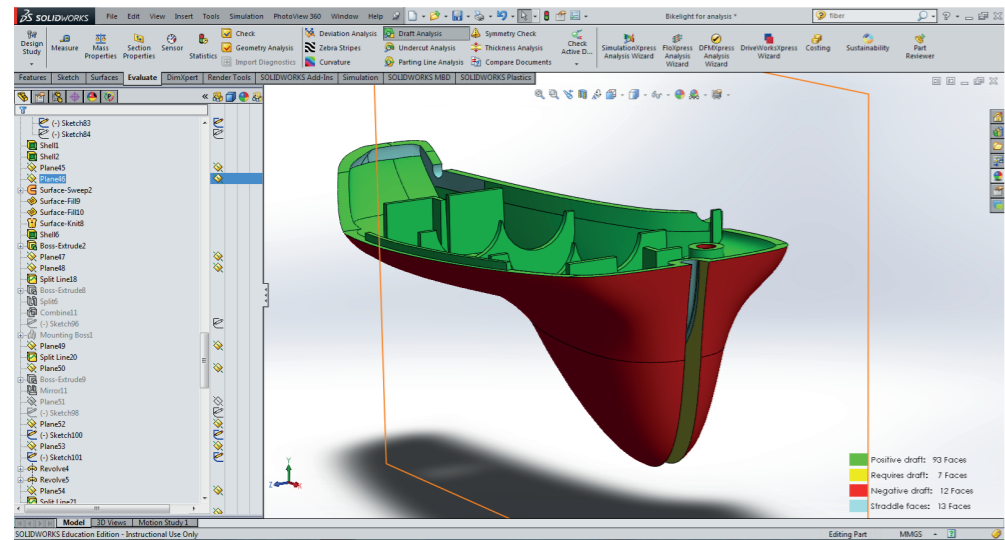
Bike Light for Manufacture

Short shot and sink marks



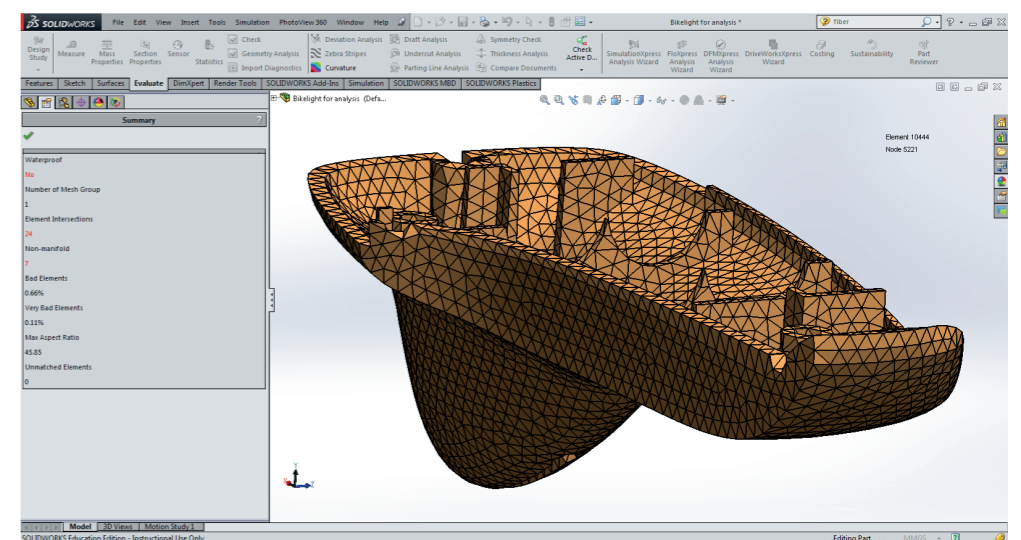
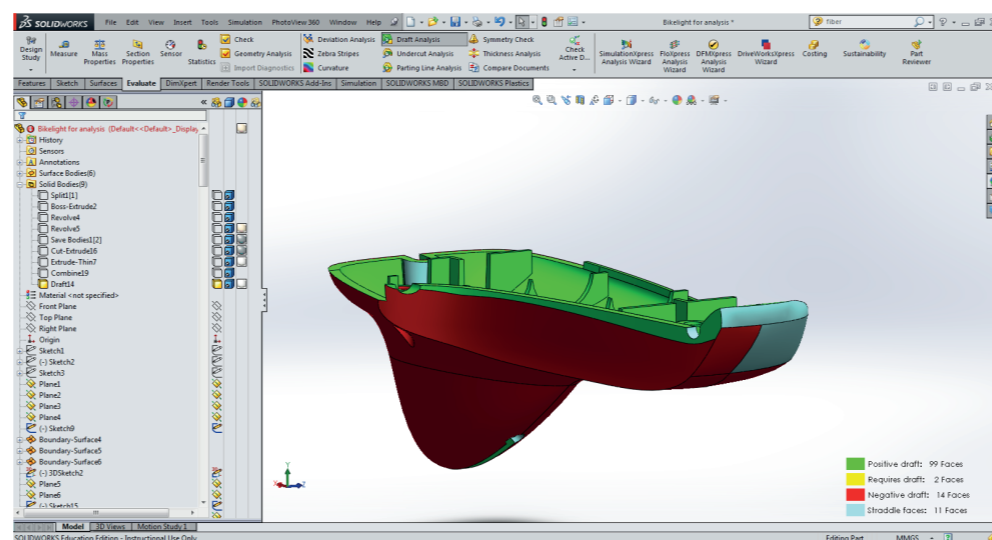
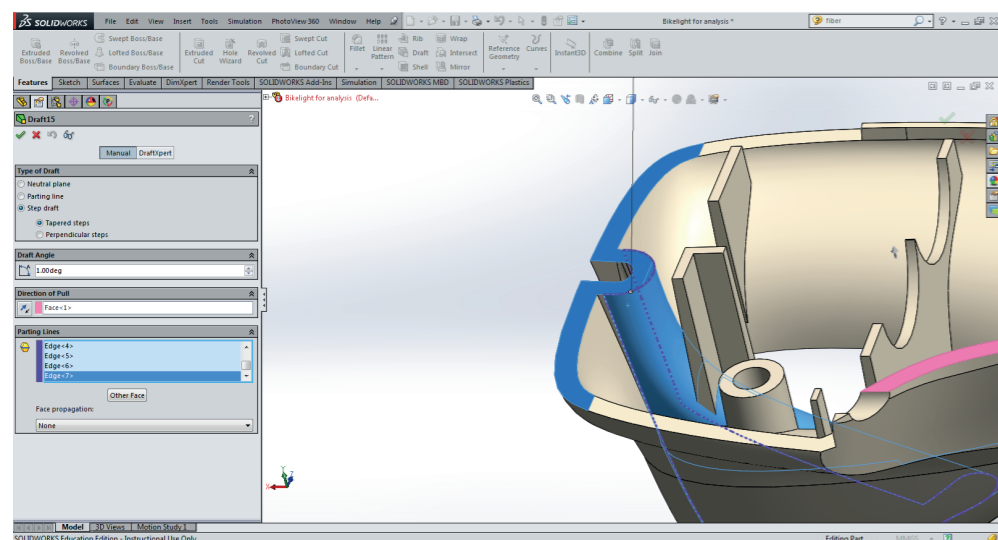
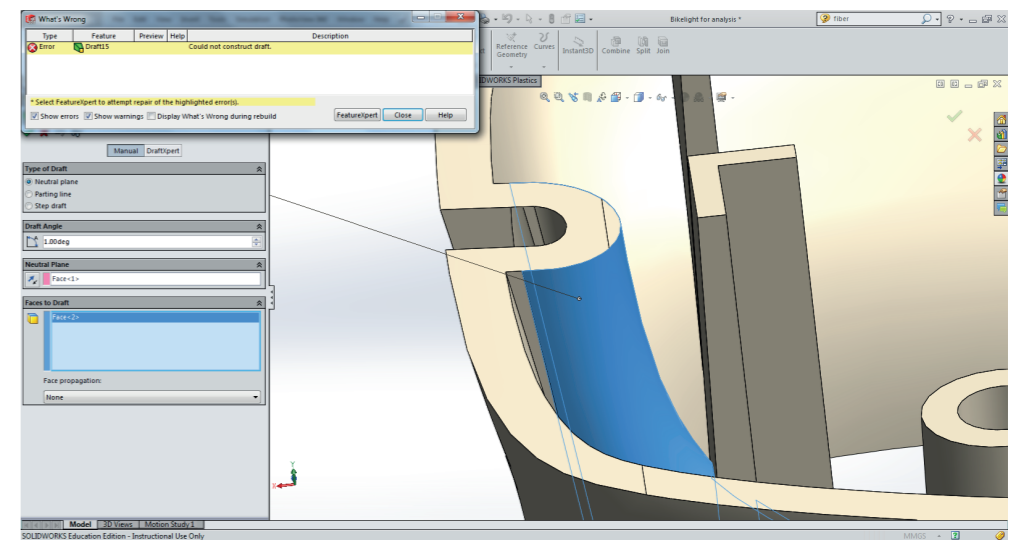
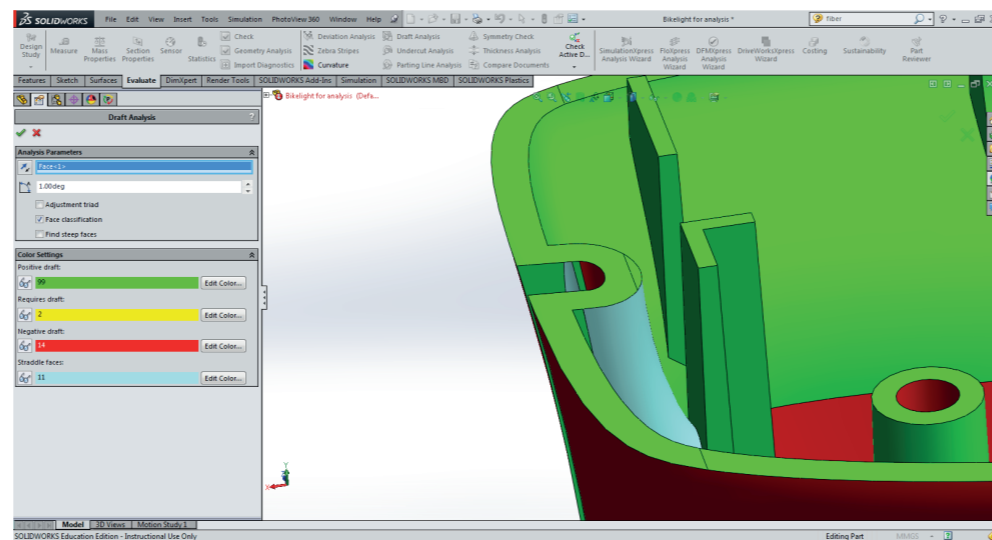
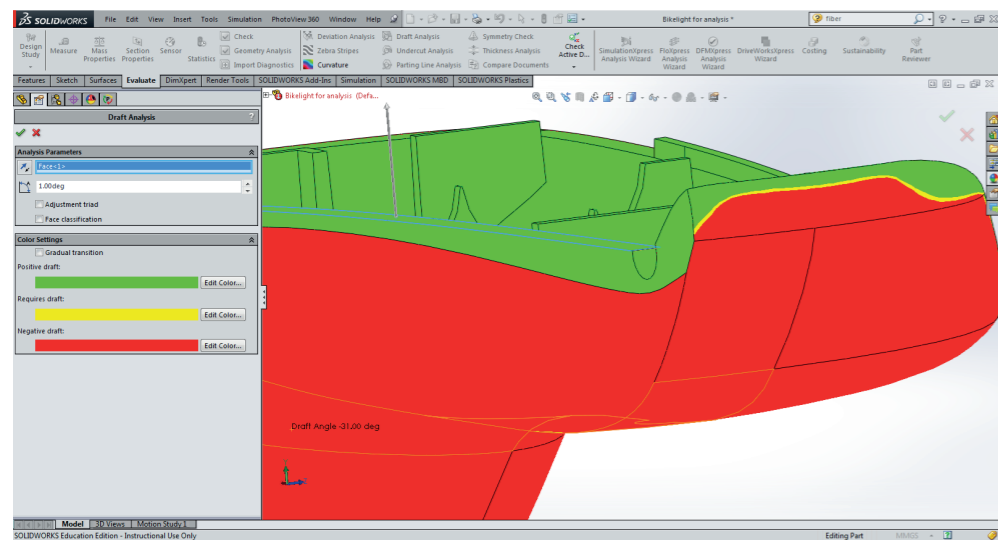
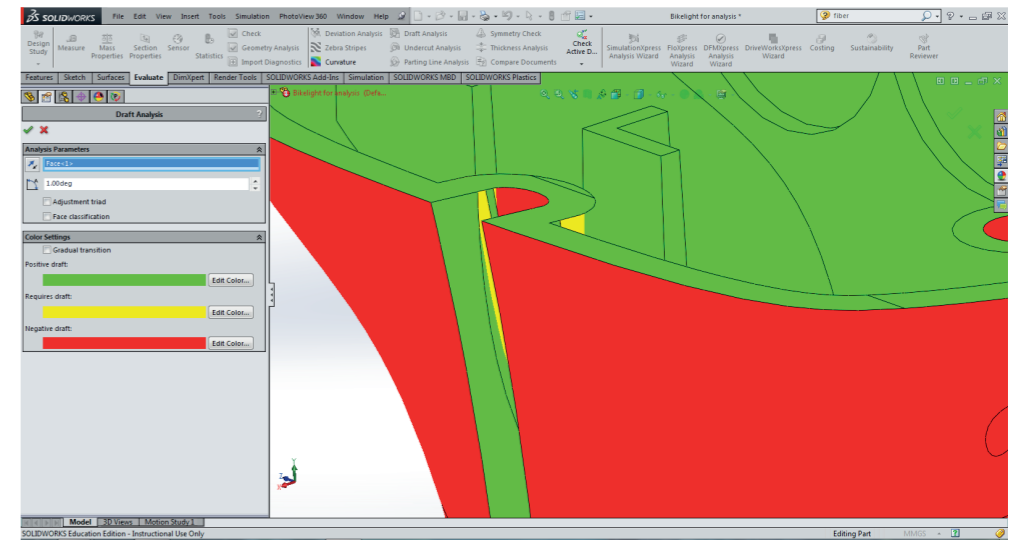
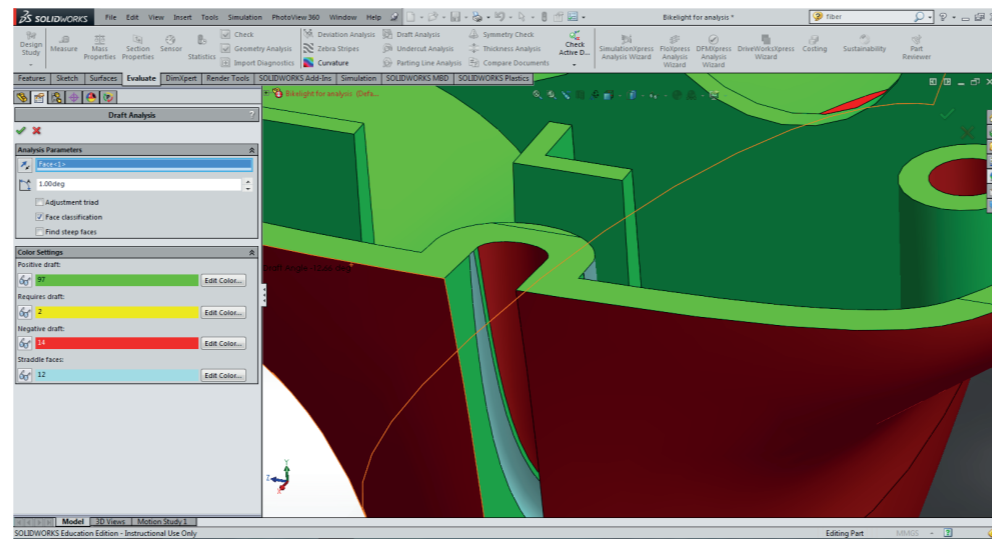
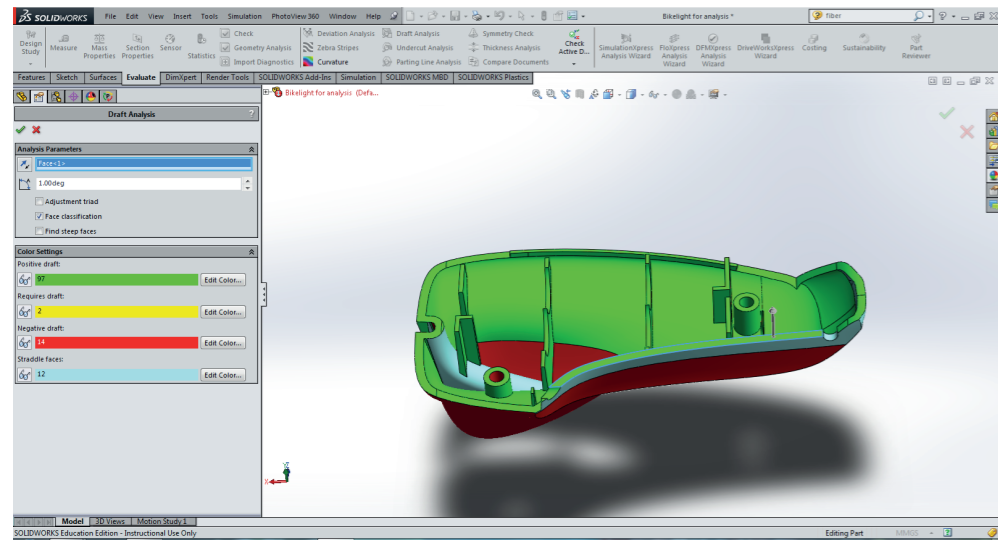
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— Draft analysis piece 1 —



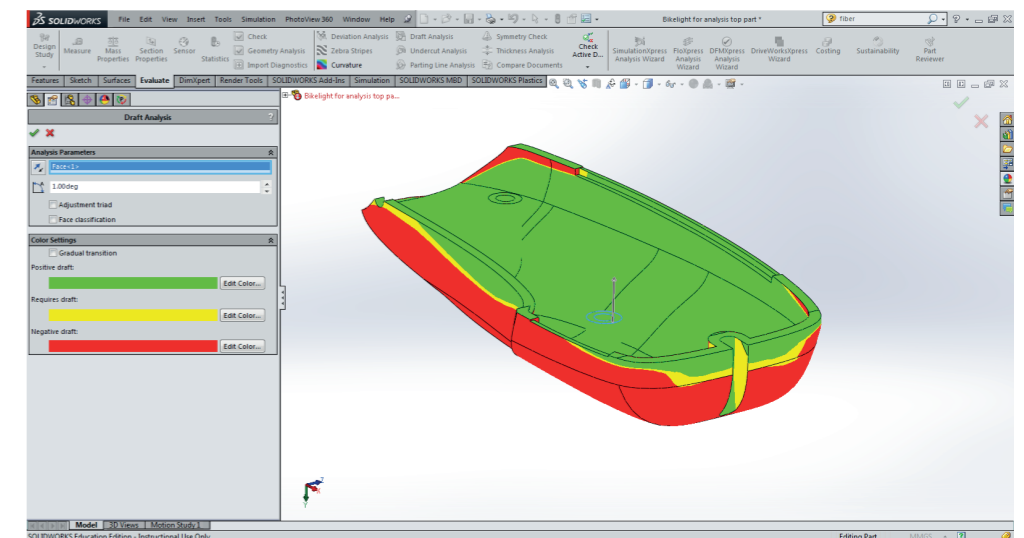
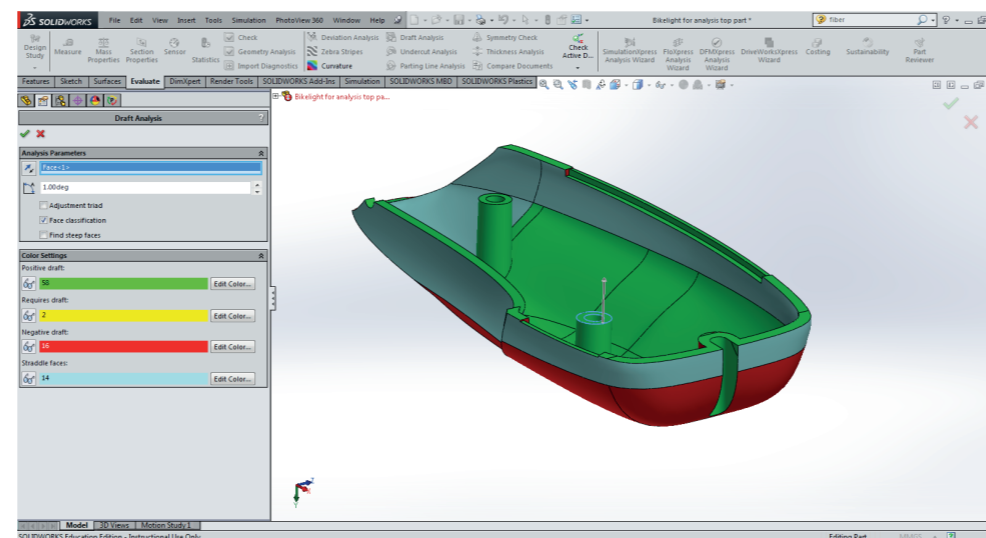
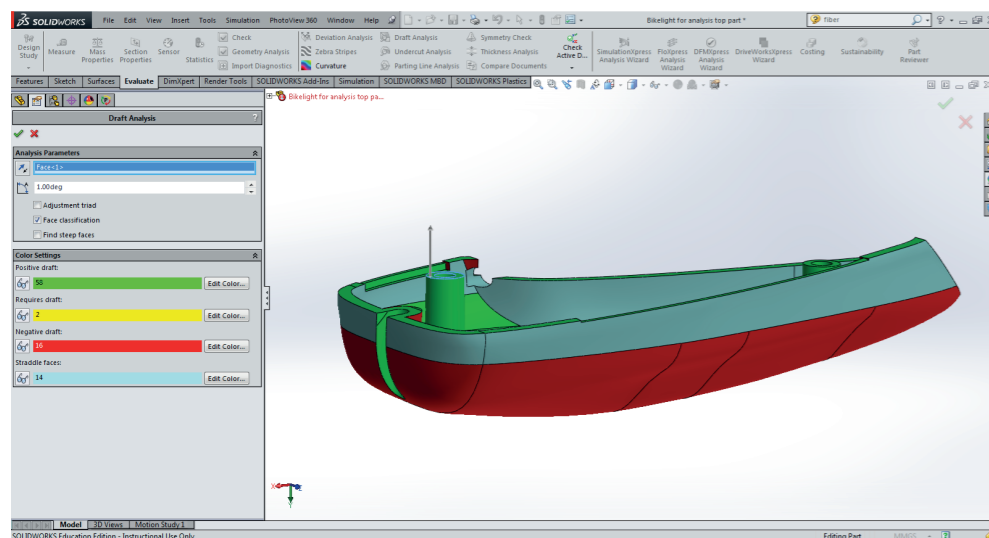
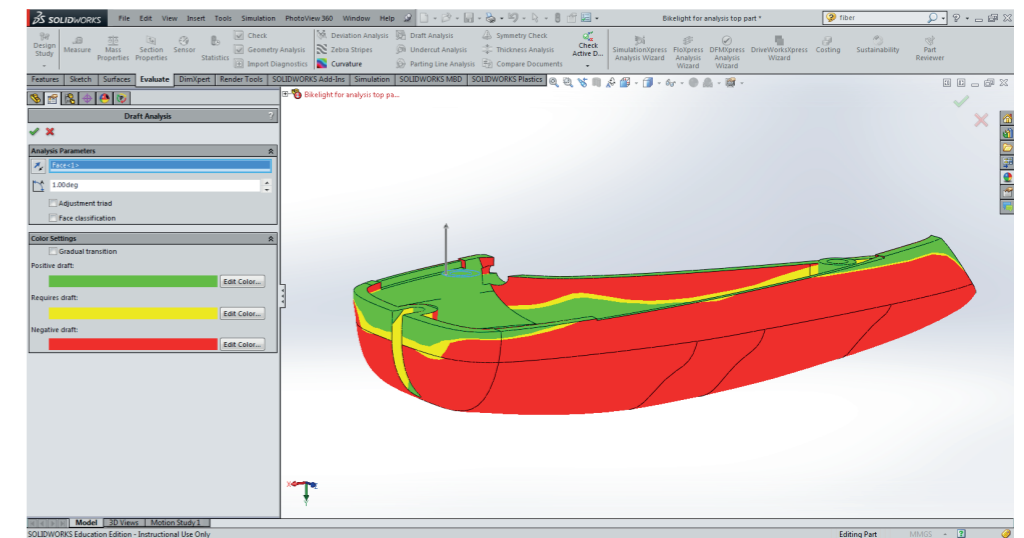
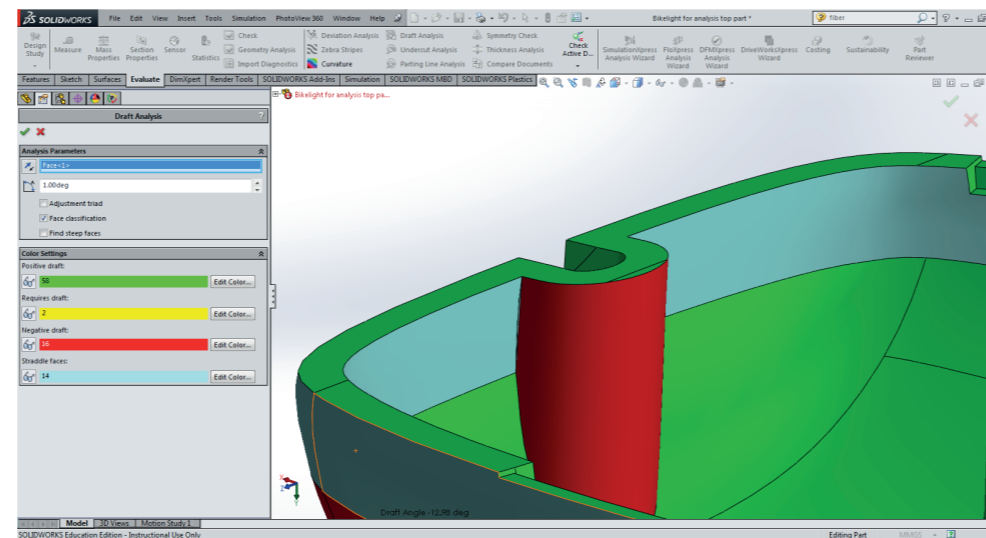
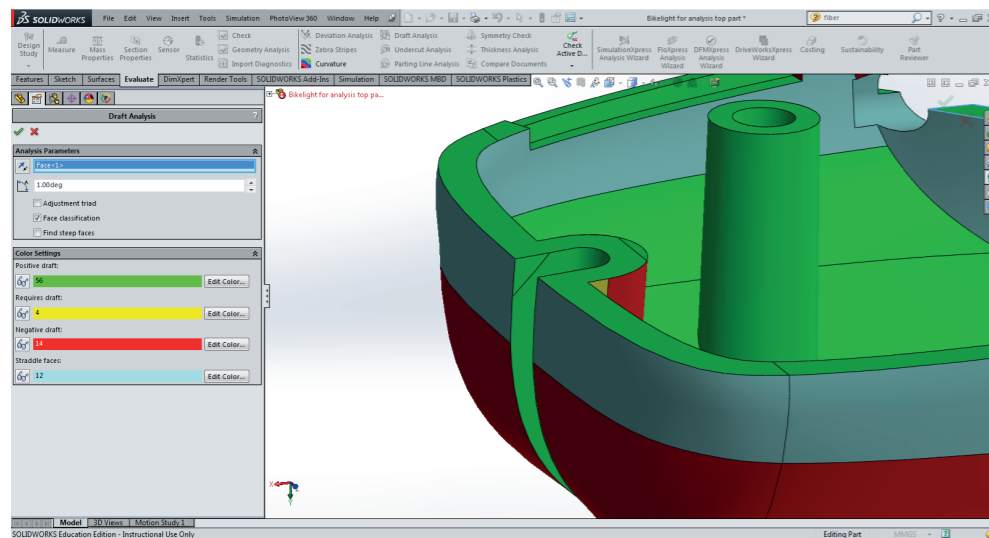
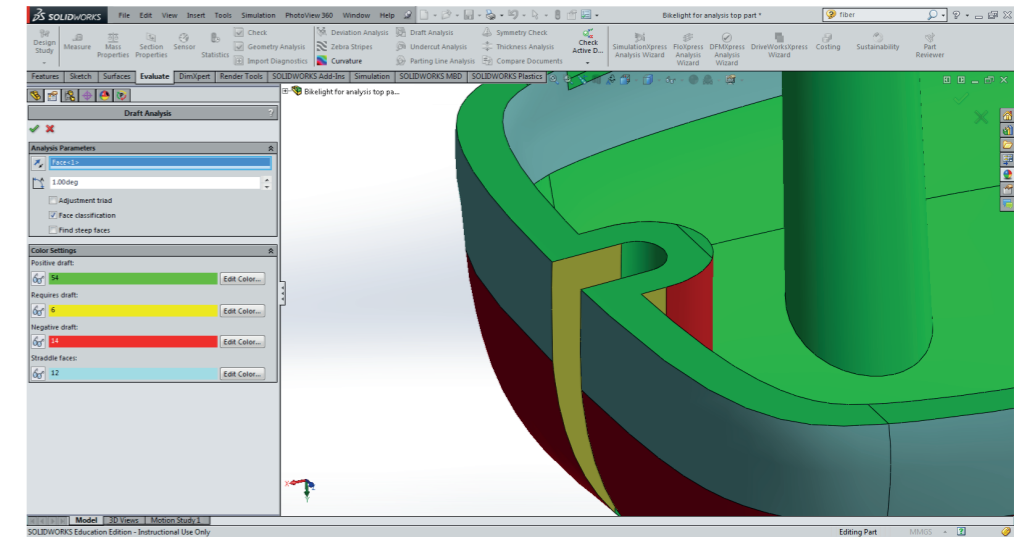
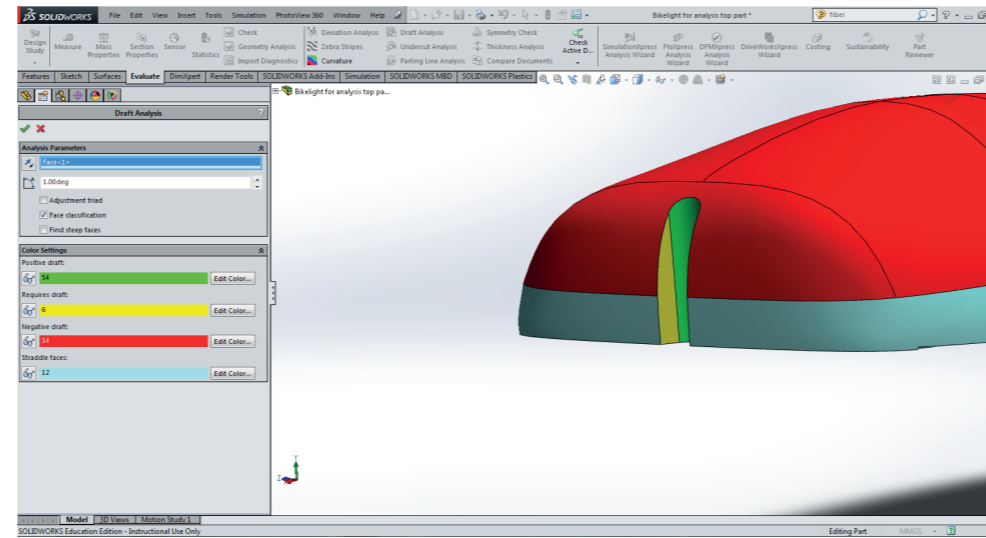
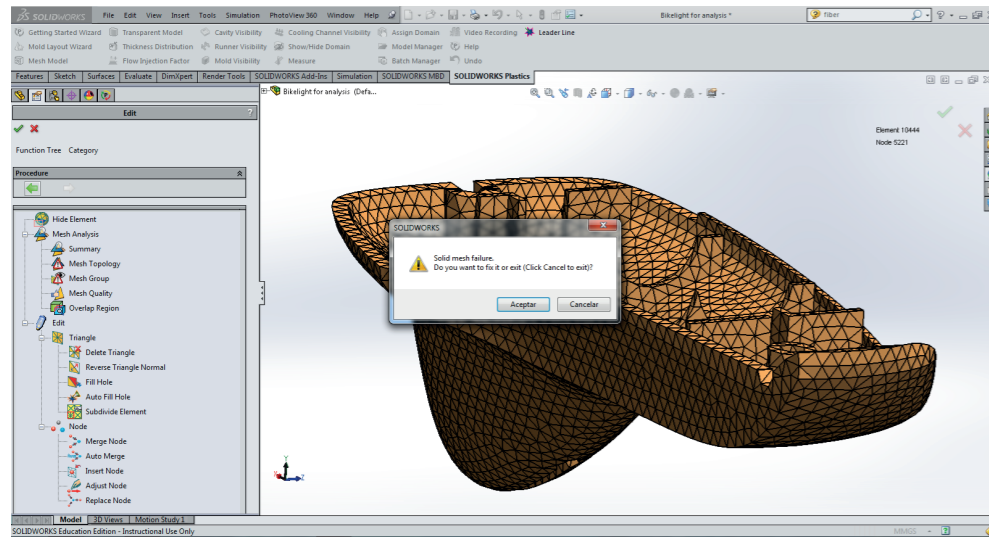
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—Draft and plastic molded analysis piece 1—



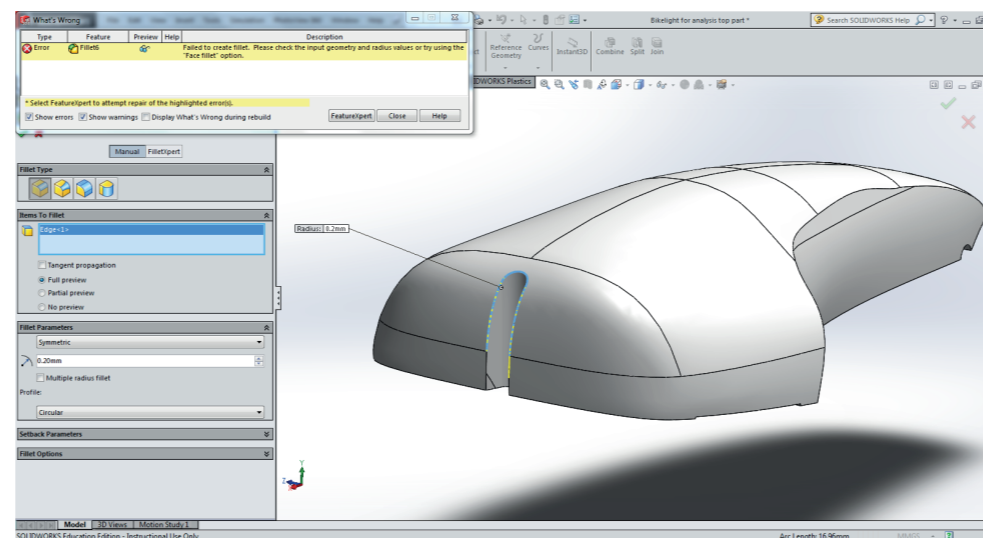
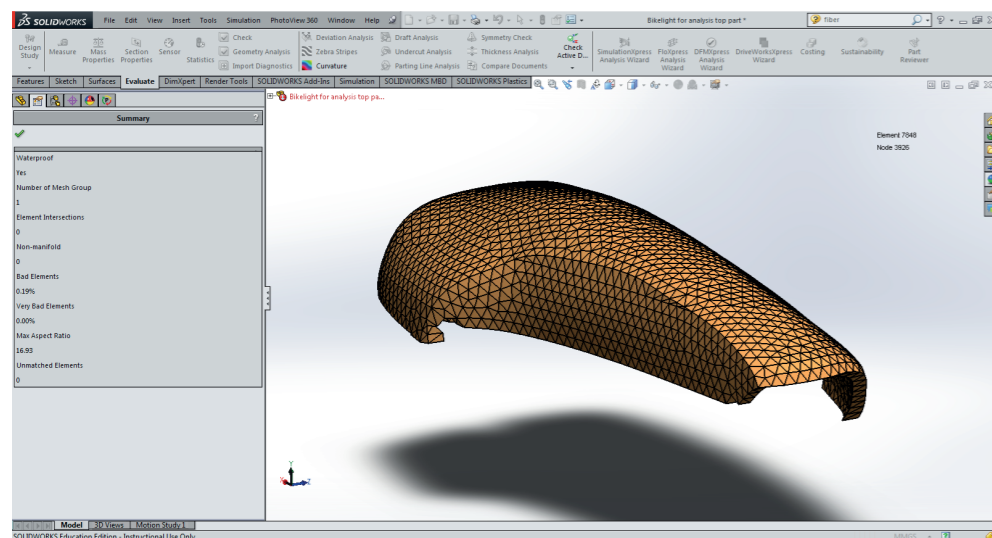
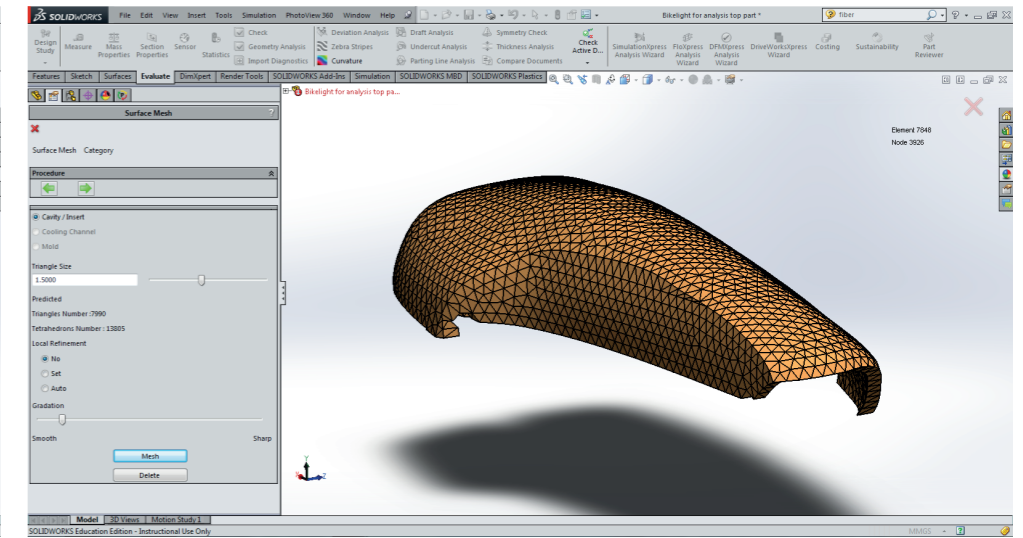
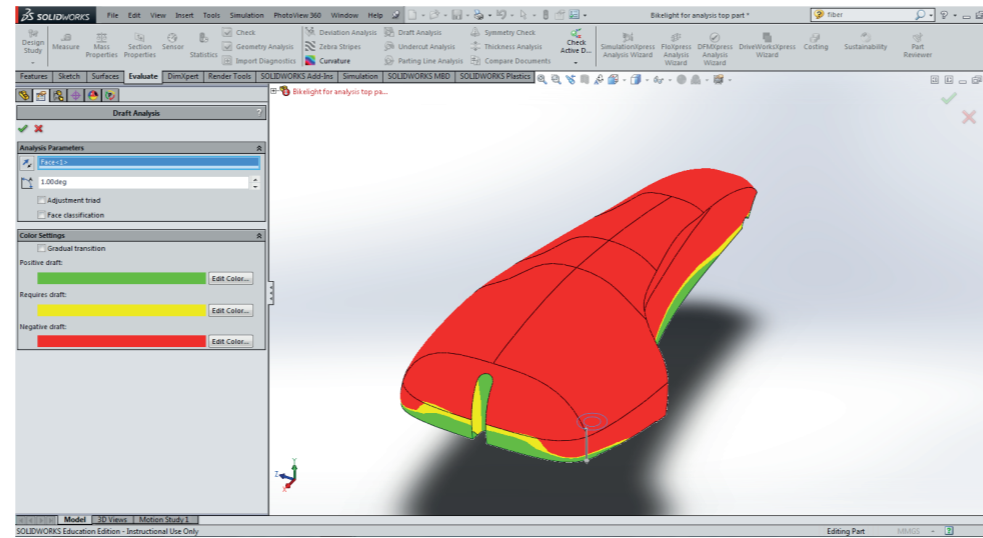
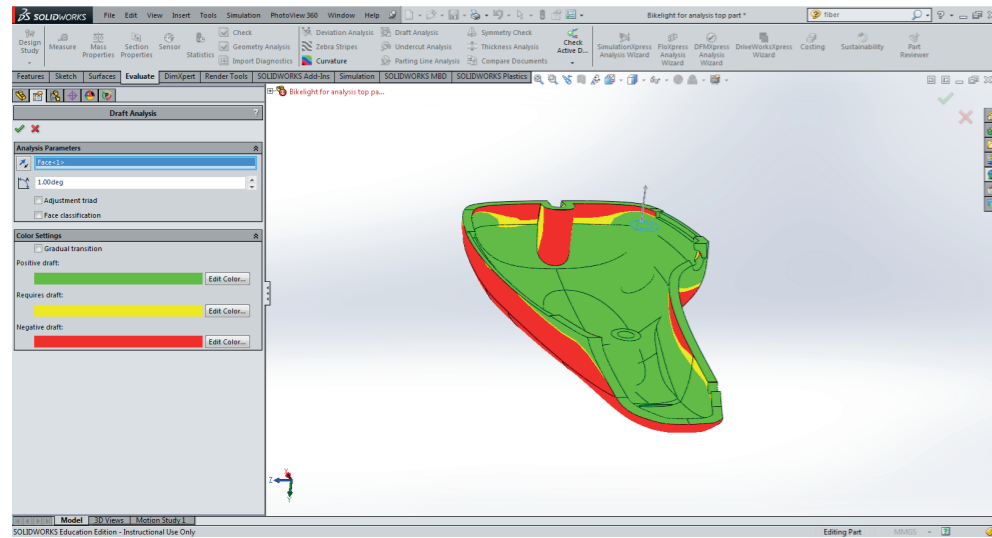
Bike Light for Manufacture

— Draft and plastic molded analysis failed trial in piece 1 —
Draft analysis in piece 2



Bike Light for Manufacture

—Draft and plastic molded analysis piece 2—



The first was to check if any draft was required in the bottom shell for doing after the plastic molding analysis, so I made some drafts in the walls, reducing from 7 to 2 faces. This 2 faces were just visible ticking in the face option when draft analysis. Other ways there were just some areas in some faces with a little bit of yellow on it. This last faces didn't allow me to make a draft.

After that I tried to do the plastic molded analysis but it was not possible due to a "Solid mesh failure", once the mesh was done.

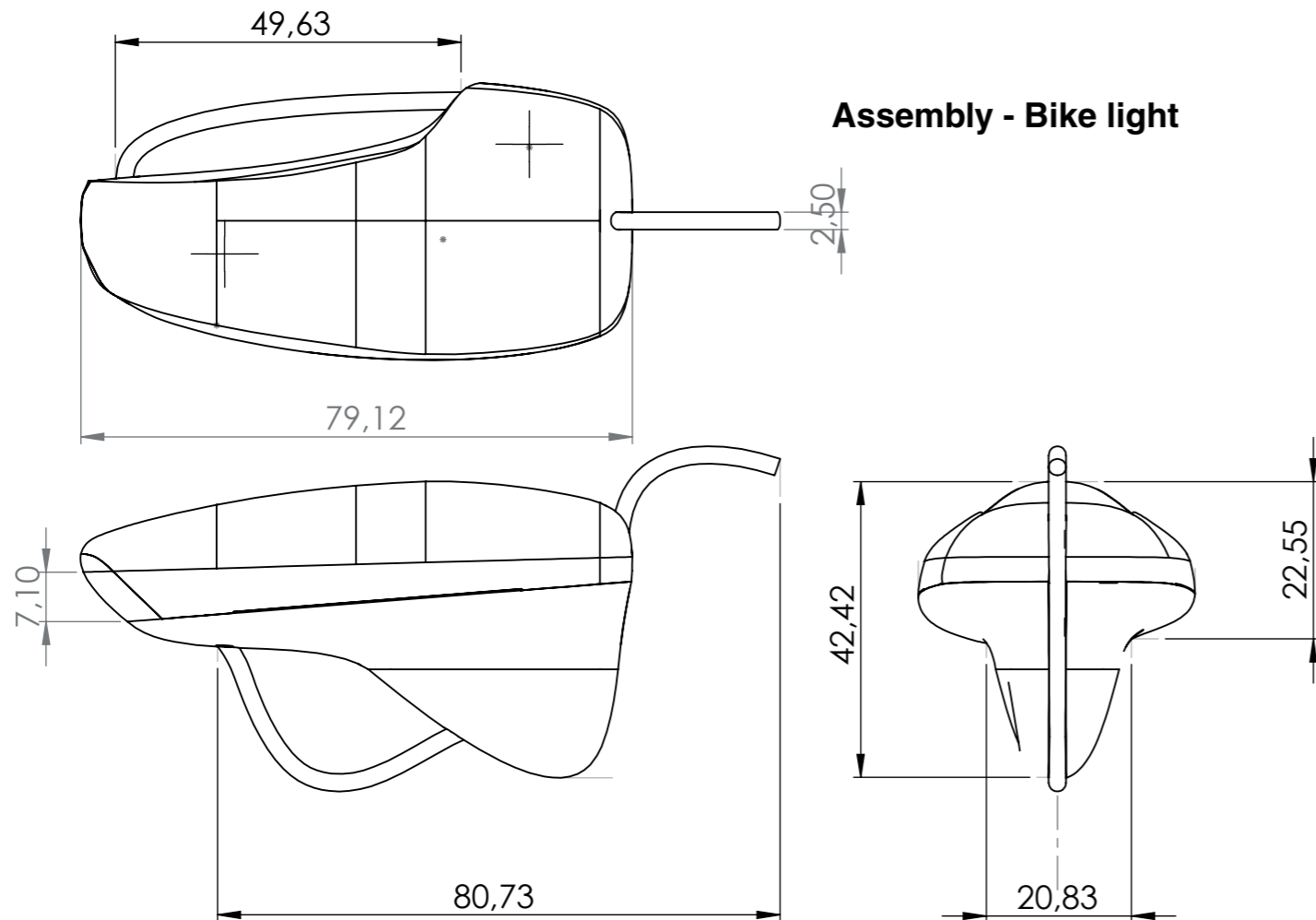
So I came up with the top shell of the bike light, and I reduced from 6 to 2 faces the faces that needed a draft, and in this two ones, as in the other shell, the draft areas were not visible with the face classification, they were just visible as small areas in the faces.

Then I did the plastic molded analysis for this part, obtaining the next results. There was just a small area on the back of the outside of sink marks. I tried to reduce it with a fillet but it was not possible as it is show just above.

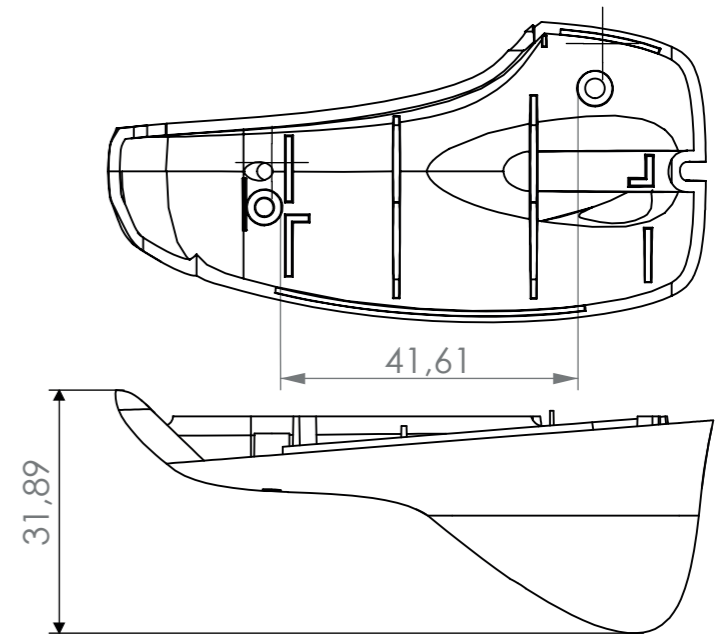
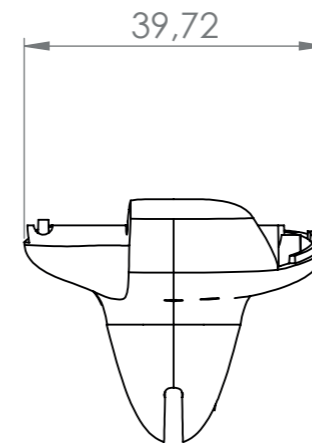
For the short shot I changed the injection point and I placed it more centered on the piece, reducing the red area on the front of the part.

Technical Drawings

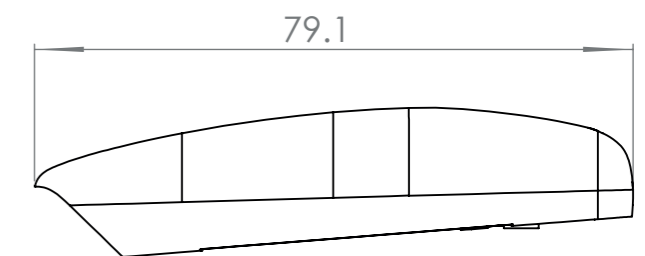
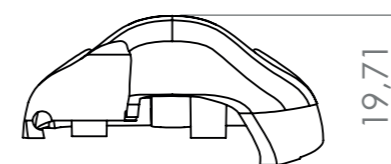
Assembly - Bike light



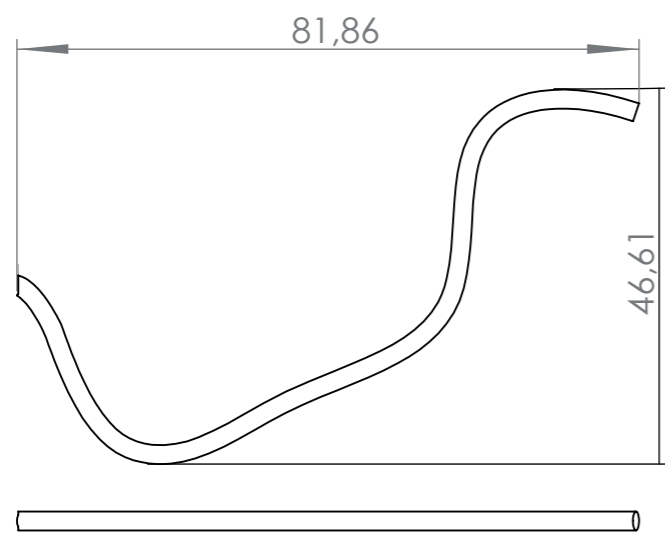
Part 1 - Bottom Shell



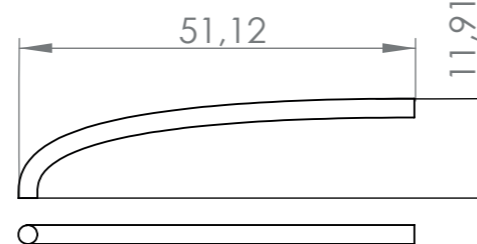
Part 2 - Top Shell



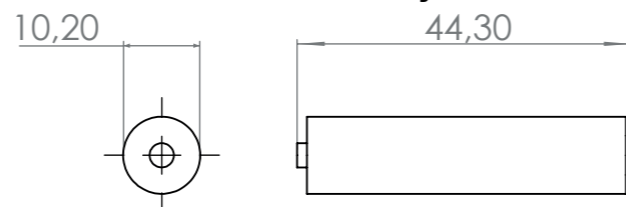
Part 3 - Anchorage wire



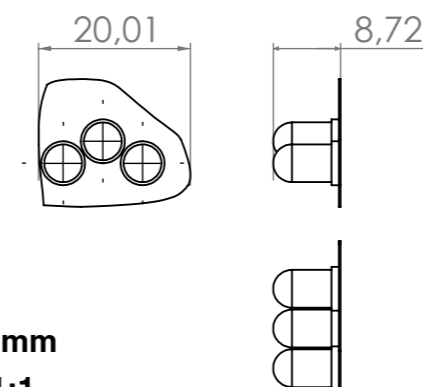
Part 4 - Handle wire



Part 6 - Battery



Part 5 - PCB + LEDs



Type of fits

- Between Part 1 - Part 2 : Lips / Groove
Mounting Boss
- Between Part 1,2 - Part 3,4 : Hole with limit
- Between Part 5 - Part 1,2 : Ribs to fix PCB
- Between Part 6 - Part 1,2 : Supports + limits

Cotas en mm
Escala 1:1

Javier Rodriguez Blasco

Bike Light for Manufacture

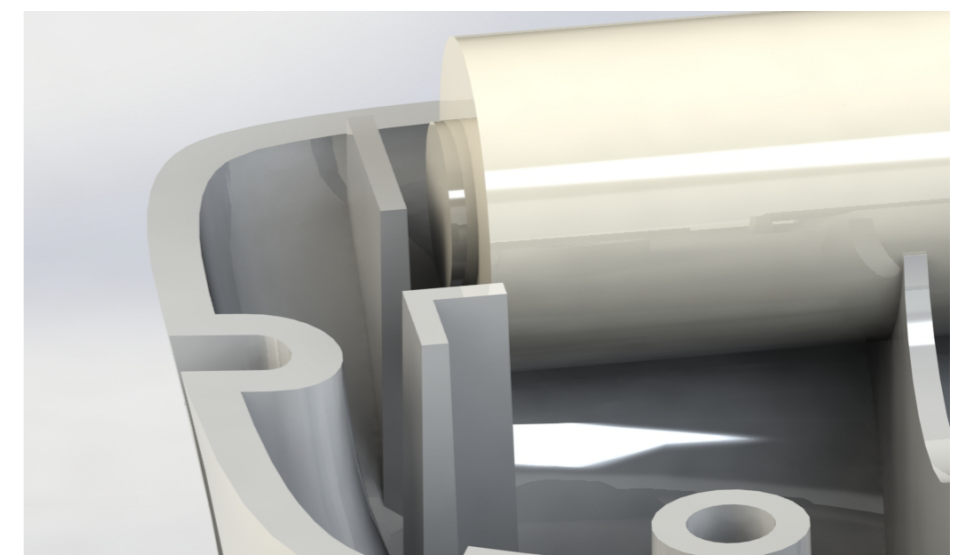
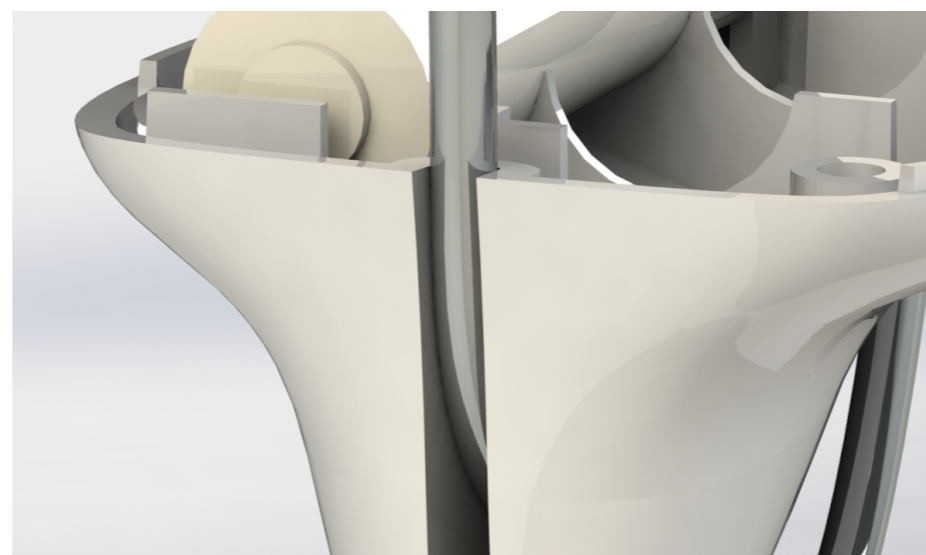
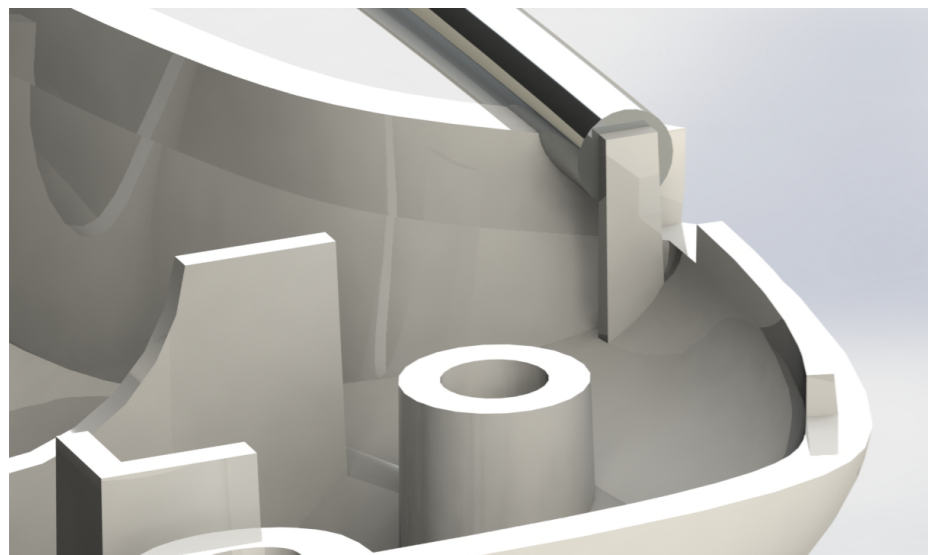
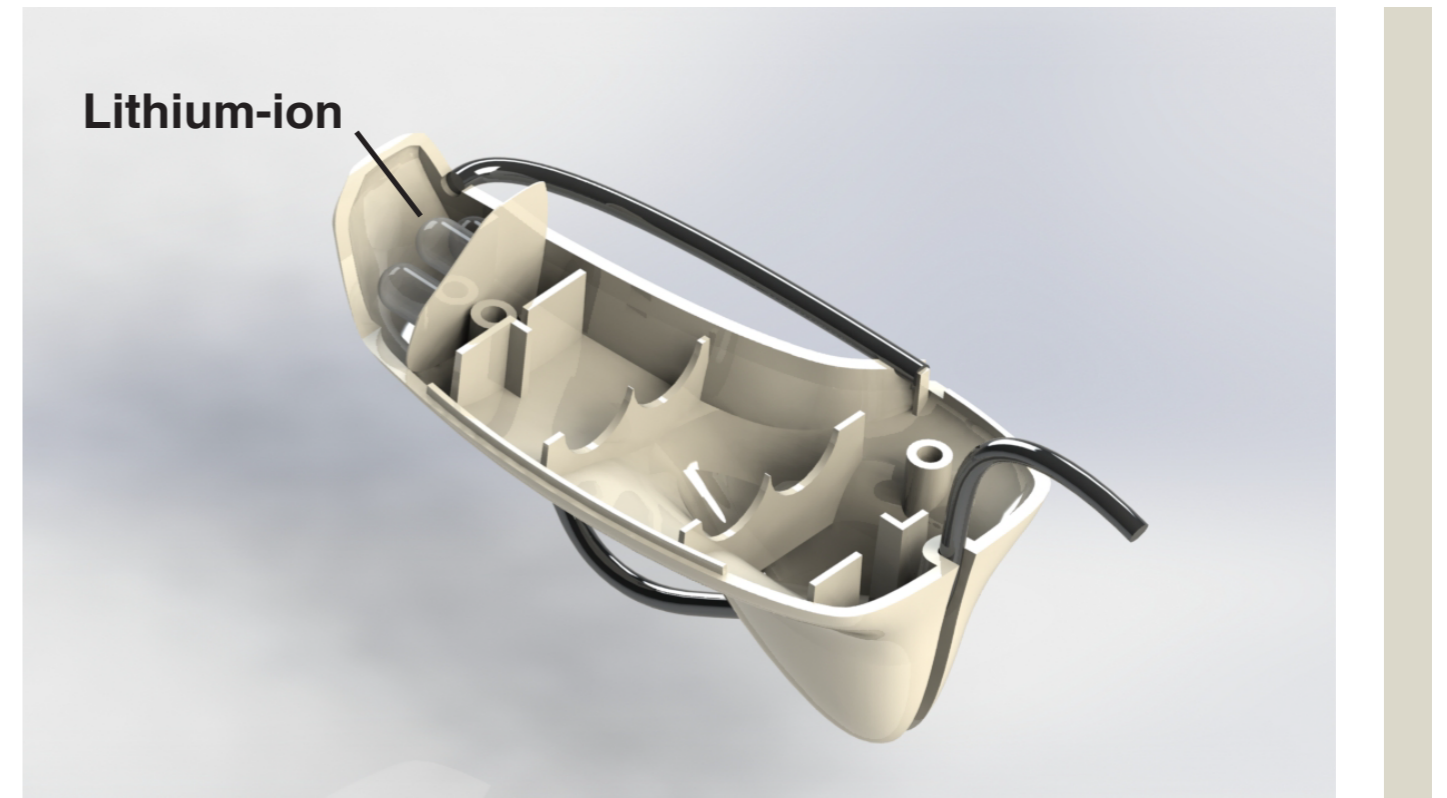
— Exploded view and Bill of materials —



- 1 - Bottom Shell : Acrylic
- 2 - Top Shell : ABS
- 3 - Anchorage wire : Coated chromium steel wire
- 4 - Handle wire : Coated chromium steel wire
- 5 - PCB + LEDs : Cooper sheets laminated onto a non-inductive substrate
- 6 - Batteries : Lithium-ion

Bike Light for Manufacture

— Renderings of the detailed concept —



In this board we can see renders showing some interior details, like the position of bateries, mountain bosses, lips and grooves for the fits and limits as for the handle, anchorage and batteries

Bike Light for Manufacture

— Renderings of the detailed concept —

Javier Rodriguez Blasco

M00550214

