AUTOMOTIVE DOOR TRIM PANEL

PROJECT REPORT

Prepared by :

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DEVELOPMENT OF AUTOMOTIVE DOOR TRIM PANEL

- Mukesh Kanna T

Objective:

Our goal is to develop a production-ready CAD model for the Door Trim panel using CATIA V5 software. This model will include a defined thickness, mounting features and attachment methods (including push pins with doghouses and heat stakes). Material selection, draft analysis, tooling analysis, and parting lines will all be considered to optimize the manufacturing process. This comprehensive model will serve as a valuable reference for both production and future maintenance of the door trim panel.

Introduction:

Automotive Plastic Trims:

Automotive trims are the finishing touches, both inside and outside a car, that play a dual role: enhancing appearance and offering functionality and the material used for automotive trims are majorly plastics.

Interior Trims:

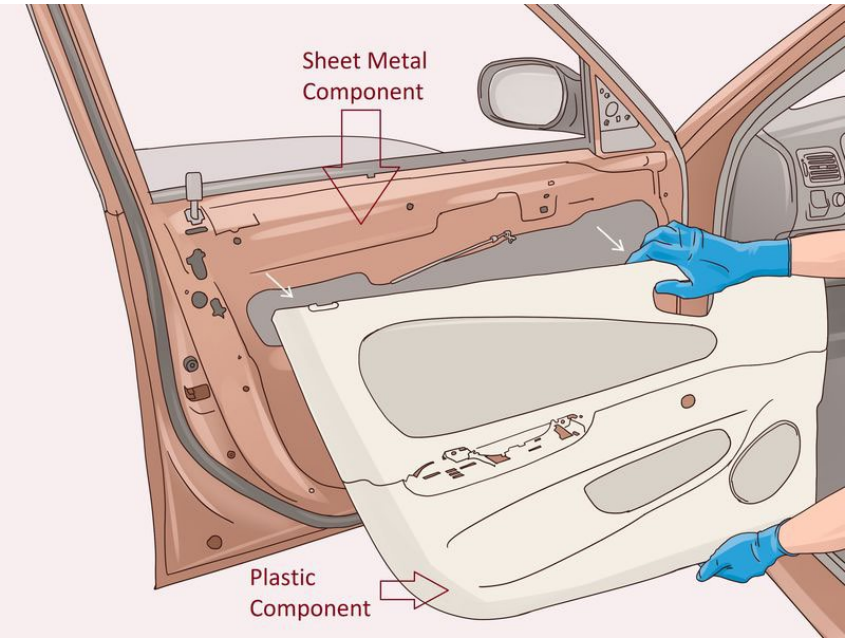
- **Aesthetics:** Door panels, dashboards, and consoles are adorned with trims that elevate the car's interior feel. Materials like leather, wood accents, or varying types of plastics create a luxurious, sporty, or budget-friendly ambiance.
- **Functionality:** Trims can house essential controls like window switches, armrests, storage compartments, and even infotainment system elements.
- **Protection:** Strategically placed trims can shield vulnerable areas from scratches and wear, especially on high-traffic zones like door handles and entry points.

Exterior Trims:

- **Style Statement:** From chrome finishes to painted accents, exterior trims personalize a car's look. They can also add a touch of ruggedness or sporty flair.
- **Defense Mechanism:** Bumpers, mud flaps, and rocker panel trims safeguard the car's body from minor scrapes, dents, and road debris, preserving its value and appearance.
- **Aerodynamics:** Some exterior trims, like spoilers or side skirts, can subtly influence a car's aerodynamics, improving handling and fuel efficiency.

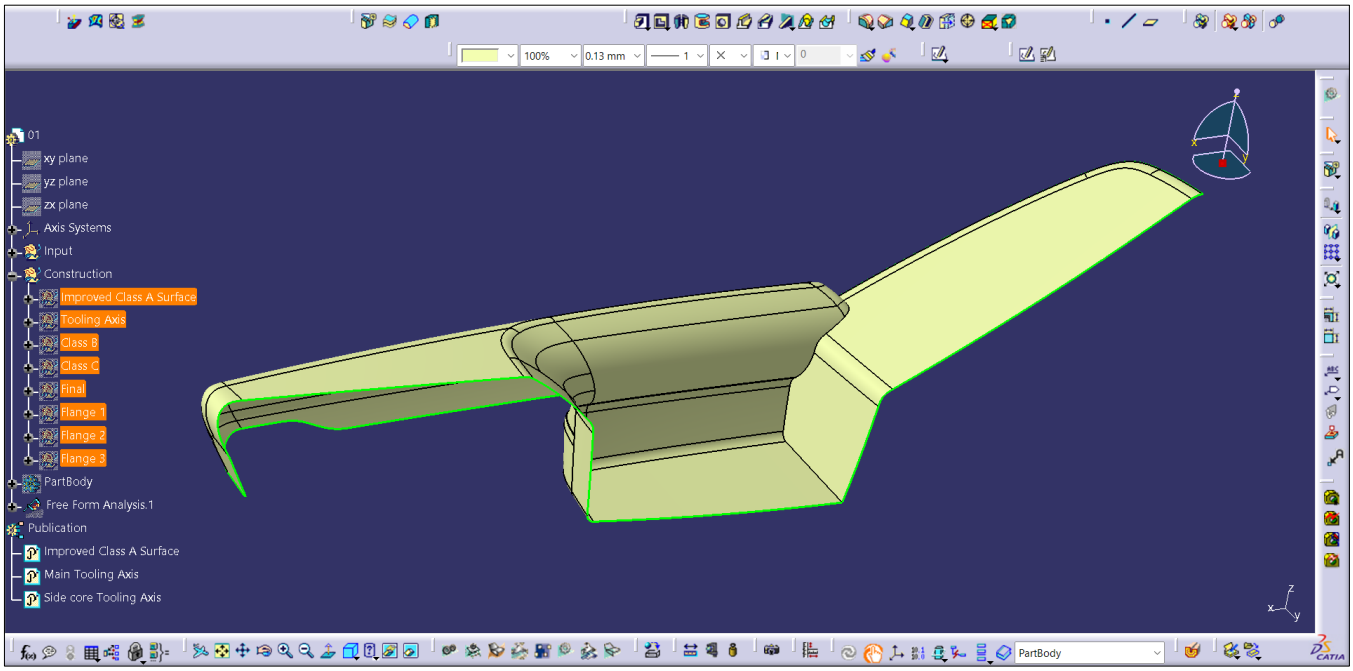
In essence, automotive trims are the unsung heroes, silently enhancing a car's aesthetics, functionality, and even performance.

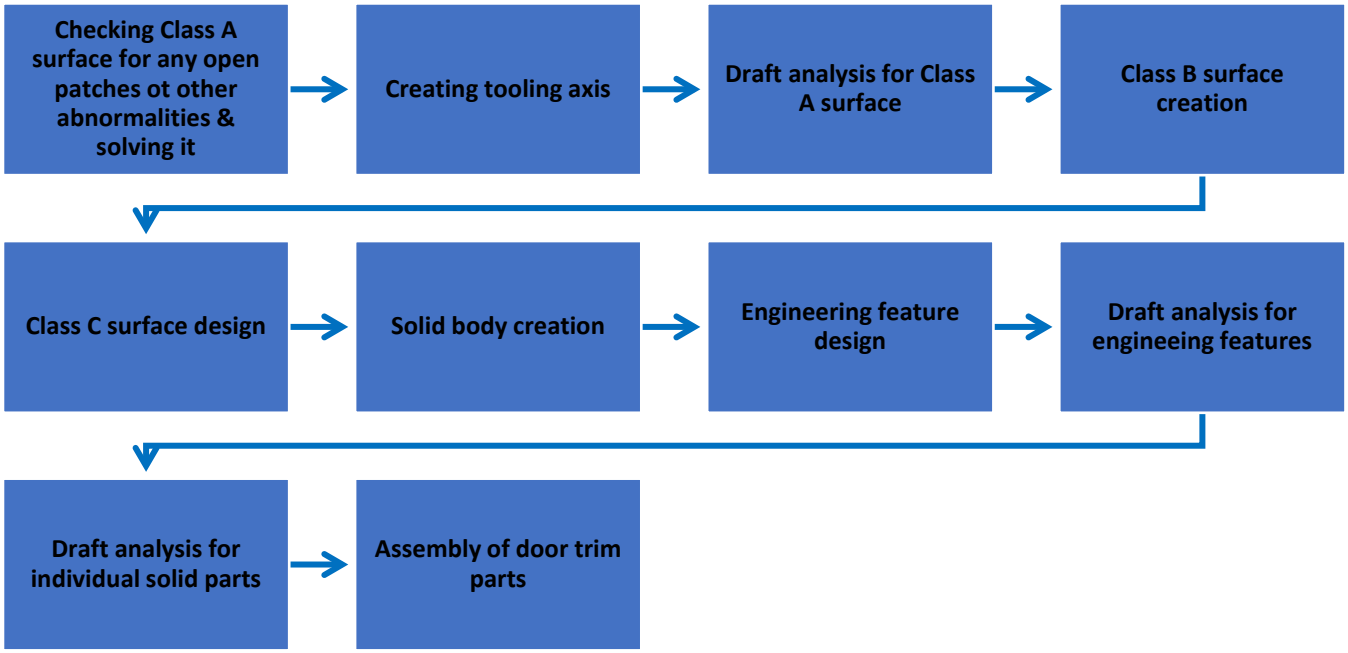
Door Trim Panel:



Door Arm Rest:

Design Workflow methodology:





The first step involves in creating all the essential Geometrical sets itself under a geometrical set named Construction for the given model which includes:

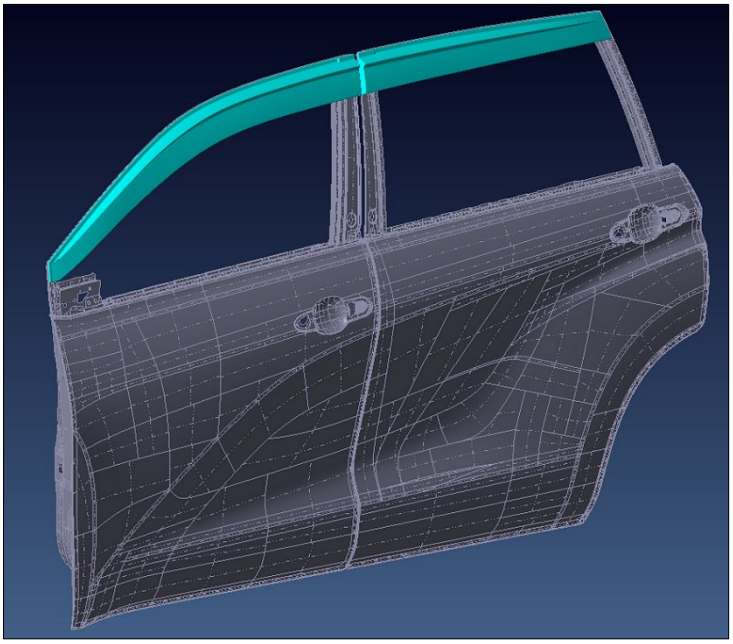
- Class A surface (Input)
- Tooling Axis
- Class B surface
- Class C surface
- Final A+C

Class A surface (Input):

In automotive design, a Class A surface refers to the highest quality visible surface on a car, such as the exterior body panels or the interior door trim panel. Here's a breakdown of its key characteristics:

- **Visual Perfection:** Class A surfaces are meticulously designed to be smooth, free of imperfections, and visually appealing. They set the overall aesthetic tone for the car's design.
- **Highest Tolerance:** These surfaces are manufactured to extremely tight tolerances, ensuring a consistent and flawless finish. Any bumps, ripples, or inconsistencies would be unacceptable in a Class A surface.
- **Focus on Appearance:** The primary concern for Class A surfaces is their visual quality. Unlike Class B or C surfaces, they are not typically subjected to structural analysis or other engineering considerations.
- **Impact on Manufacturing:** Achieving Class A surface quality often requires specialized tooling and manufacturing processes to ensure the desired smoothness and precision. This can make them more expensive to produce compared to lower-class surfaces.

In essence, Class A surfaces are the "show stoppers" of car design, defining the car's visual appeal and setting the bar for overall quality.



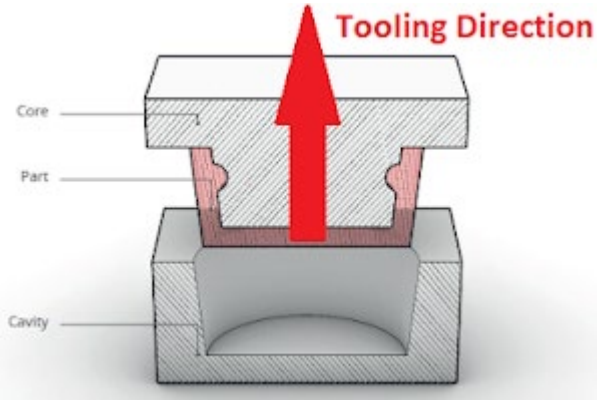
Tooling axis:

A tooling axis refers to the imaginary direction along which the mold that shapes the part will open and close. It's a crucial element for designing manufacturable parts, especially those created using injection molding. The significance of the tooling axis is:

- **Mold Design:** The tooling axis dictates how the mold splits into two halves to allow for the removal of the finished part after the plastic has cooled. A well-defined tooling axis ensures the mold can open and close smoothly without encountering any undercuts or features that would trap the plastic.
- **Draft Angle:** The tooling axis is directly linked to the concept of draft angle. Draft angles are slight inclines on the walls of the part that facilitate the removal of the part from the mold. By aligning the draft angles with the tooling axis, designers ensure smooth ejection and prevent the part from getting stuck.

- **Manufacturability:** A well-defined tooling axis promotes manufacturability by enabling efficient mold design and minimizing the risk of production issues. It helps avoid the need for complex mold configurations or additional processes to remove the part.
- **Parting Line:** The tooling axis also plays a role in determining the parting line, which is the imaginary line where the two halves of the mold meet. Ideally, the parting line should be positioned strategically based on the tooling axis to minimize draft angles and optimize mold design.

In essence, the tooling axis is a fundamental concept in car part design, especially for injection molded components like door trim panels. It guides the mold design process, ensures smooth part ejection, and ultimately contributes to efficient and cost-effective production.



Draft Analysis:

Draft analysis is a crucial process that ensures a smooth and efficient manufacturing experience, particularly for parts created using injection molding. Here's a breakdown of its importance:

- A draft analysis is a virtual inspection technique used in CAD software to assess the angle of a part's walls relative to the tooling axis (the imaginary direction the mold splits open).
- During injection molding, molten plastic is injected into a closed mold. Once cooled, the mold needs to open to release the finished part. However, if the part has walls that are completely perpendicular (90 degrees) to the tooling axis, it can get stuck in the mold. This is because the plastic has no angle to "slide" out as the mold opens.
- A draft analysis helps identify areas on the part where the draft angle might be insufficient. The software typically displays the draft angle in a color gradient, with areas closest to perpendicular highlighted in red or another warning color.

Class B Surface:

In automotive design, a Class B surface refers to a hidden surface that lies beneath the visually appealing Class A surface. It plays a crucial role in the car's structure and functionality, but is typically not seen by the end user. Some of the characteristics of Class B surface are:

- **Supporting Structure:** Class B surfaces provide structural support and mounting points for the Class A surface and other vehicle components. They help ensure the overall rigidity and functionality of the car's interior or exterior panels.
- **Less Stringent Tolerances:** Compared to Class A surfaces, Class B surfaces have slightly looser tolerances. While smoothness is still important, minor imperfections are less noticeable and acceptable here.

- **Focus on Functionality:** The primary concern for Class B surfaces is their ability to fulfill their structural and attachment purposes. They may incorporate features like bosses, ribs, or channels that wouldn't be present on a purely aesthetic Class A surface.
- **Manufacturing Considerations:** While Class B surfaces require good quality, their manufacturing process is typically less demanding compared to Class A surfaces. This can allow for the use of different tooling or materials to optimize production costs.

Class C surface:

Unlike Class A and B surfaces, it's not directly concerned with aesthetics or providing core structural support. Class C surfaces often deal with internal features or hidden functionalities. They can be used to create:

- **Attachment points:** These surfaces might provide designated areas for clips, brackets, or other components that secure various parts within the car's assembly.
- **Support structures:** In some cases, Class C surfaces might offer additional internal reinforcements or ribs that enhance the rigidity of specific areas without impacting the outer aesthetics.
- **Clearance pockets:** They might be designed to create space for internal mechanisms or wiring harnesses to navigate within the car's structure.
- **Relaxed Tolerances:** Compared to Class A and B surfaces, Class C surfaces have the most relaxed tolerances. Minor imperfections or variations in their form are less critical, as they're not directly visible and don't significantly impact the car's overall function.
- **Focus on Efficiency:** The primary concern for Class C surfaces is achieving their designated purpose in the most efficient way possible. This can involve using simpler geometries or less precise manufacturing techniques compared to the higher-class surfaces.

Engineering Features:

Engineering features are the hidden functional elements that go beyond aesthetics. They play a crucial role in:

- **Attachment and Assembly:** These features ensure the trim panels securely attach to the car's frame and other components. Examples include:
- **Bosses:** Cylindrical protrusions that fit into corresponding holes on the frame.
- **Slots:** Elongated openings that allow for slight adjustments during assembly for a perfect fit.
- **Push Pins with Doghouses:** These are specialized fasteners with a spring-loaded head that inserts into a pre-drilled hole. A "doghouse" is a small recess around the push pin that creates a clean and finished look.
- **Heat stakes:** Small, pointed protrusions used for permanent bonding with a corresponding part on the car frame using a localized heat source. This eliminates the need for additional fasteners.

Engineering features integrate essential functionalities within the trim panels. Examples include:

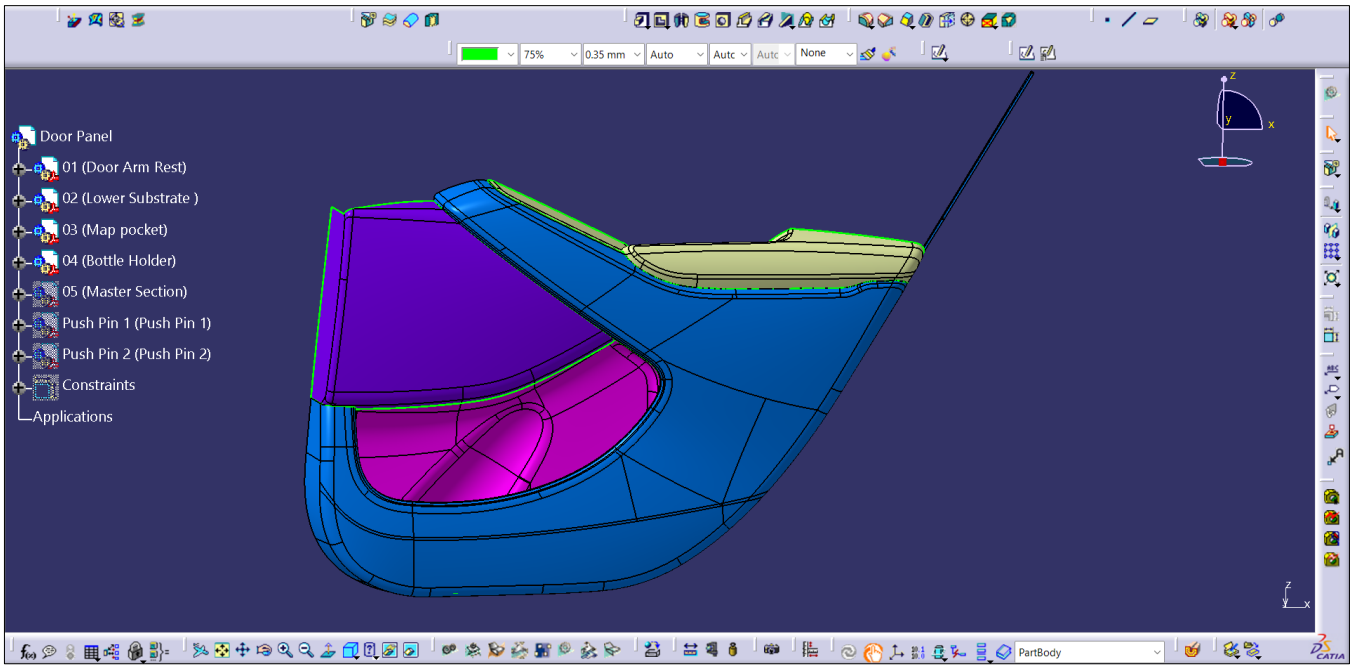
- **Mounting points for controls:** These designated areas house switches for windows, door locks, or even seat adjustments, providing easy access for the driver and passengers.
- **Storage compartments:** Pockets and integrated bins within the trim panels offer convenient storage for everyday essentials like phones or sunglasses.

- **Structural Support:** While not the primary focus, some engineering features can contribute to the overall rigidity and structural integrity of the trim panel. For example, strategically placed ribs or reinforcements can help maintain the panel's shape and prevent warping.
- **Manufacturing Efficiency:** Engineering features are often designed with efficient production in mind. They might incorporate features like:
- **Snap-on components:** These allow for quick and easy assembly during car manufacturing.

Essentially, engineering features in automotive trims are the bridge between aesthetics and functionality. They ensure a secure fit, integrate essential controls, and contribute to efficient manufacturing, all while remaining hidden from the naked eye.

DEVELOPMENT OF DOOR TRIM PANEL:

Input:

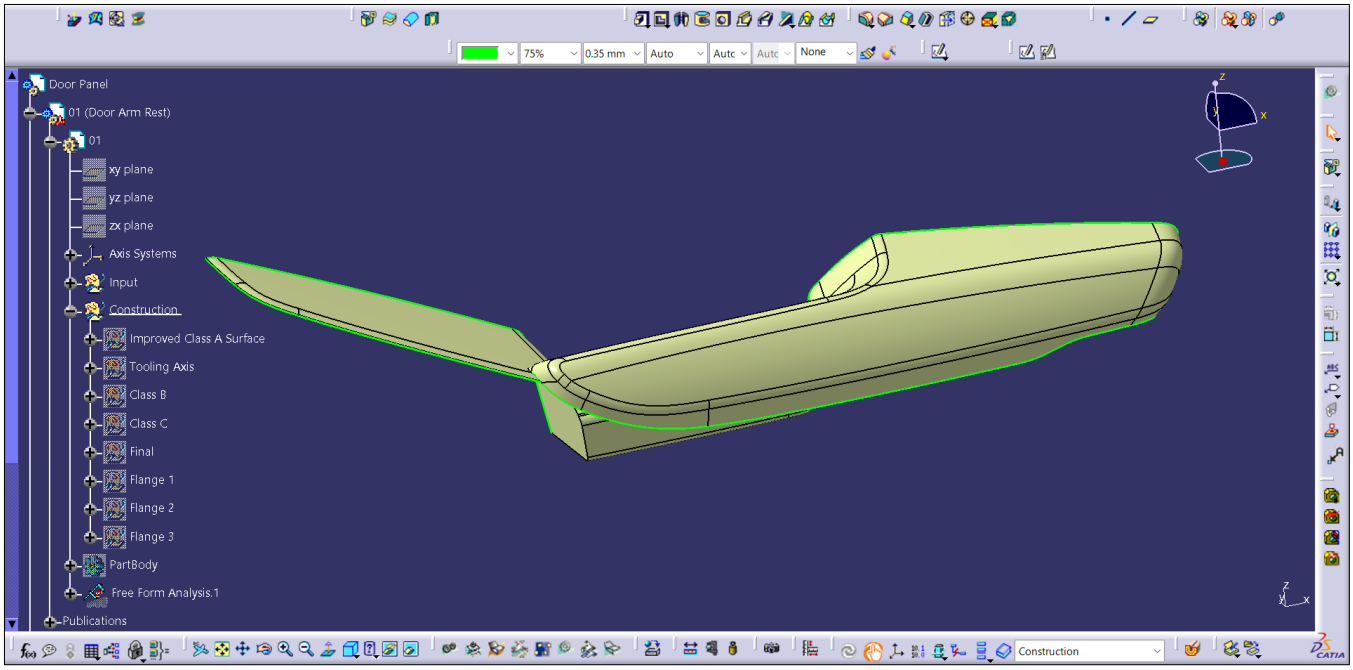


Part 1: Door Arm Rest:

Creating Essential Geometrical Sets:

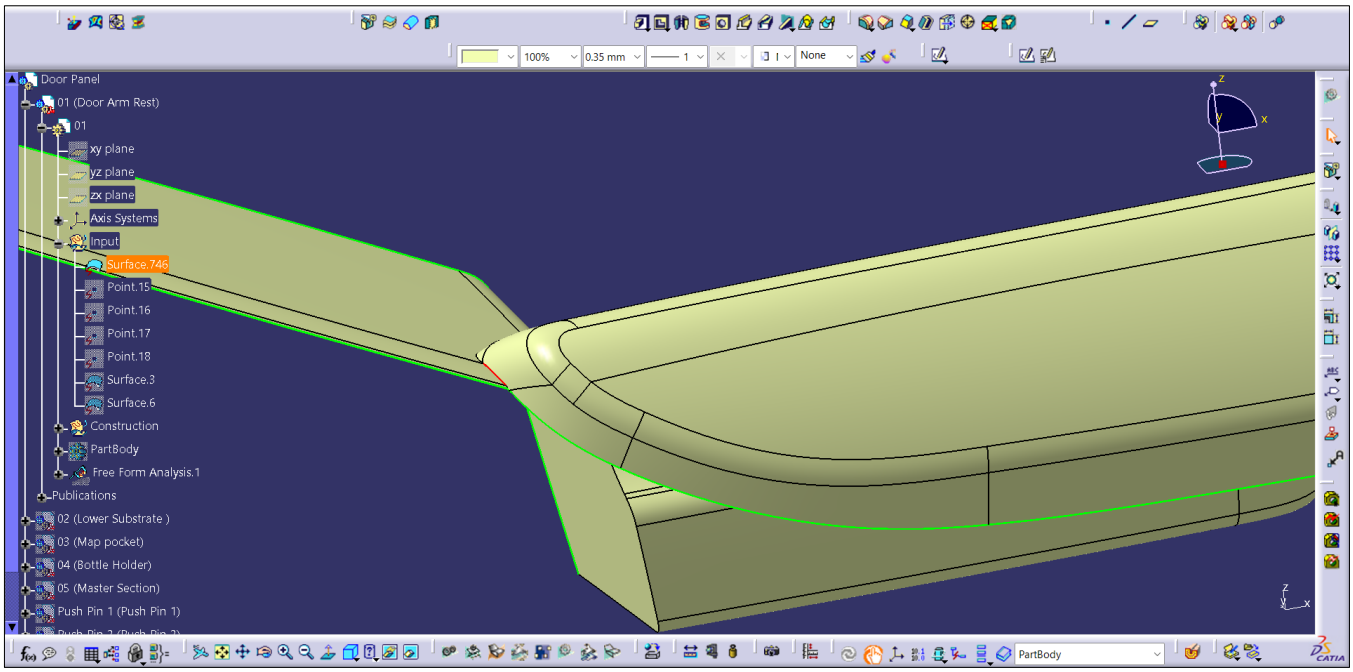
The first step involves in creating all the essential Geometrical sets itself under a geometrical set named Construction for the given model which includes:

- Class A surface (Input)
- Tooling Axis
- Class B surface
- Class C surface
- Final A+C
- Engineering Features

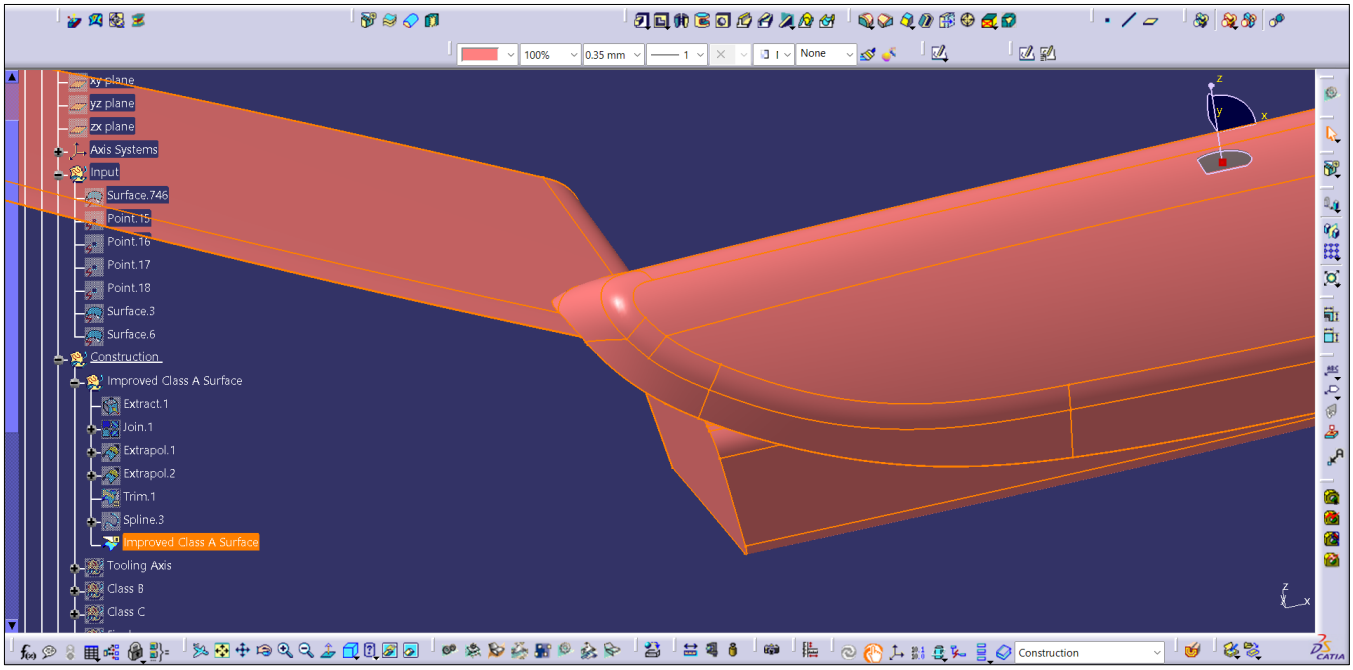


Improved Class A Surface:

- Improved class A surface is created only if the given input class A surface is not proper and there are some open ends or patches. So, it has to be solved and a proper surface will be created under improved Class A surface geometrical set.
- Here there is an open end on the give class A surface of the door arm rest (highlighted in red). So, it has to be fixed.

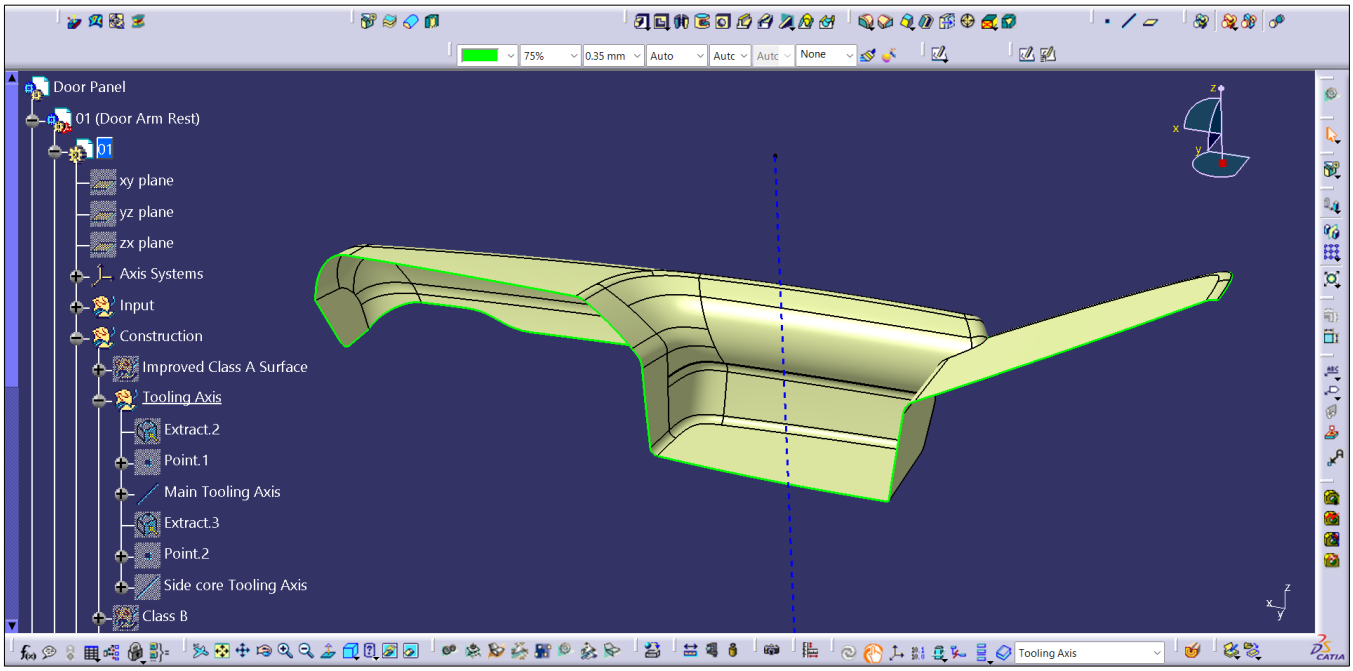


- The surface nearer to the open end is extracted & extrapolated using extract & extrapolate command and using trim command the extrapolated surface is trimmed with the class A surface.
- The final Improved class A surface will be as below & the improved Class A surface has to be published.



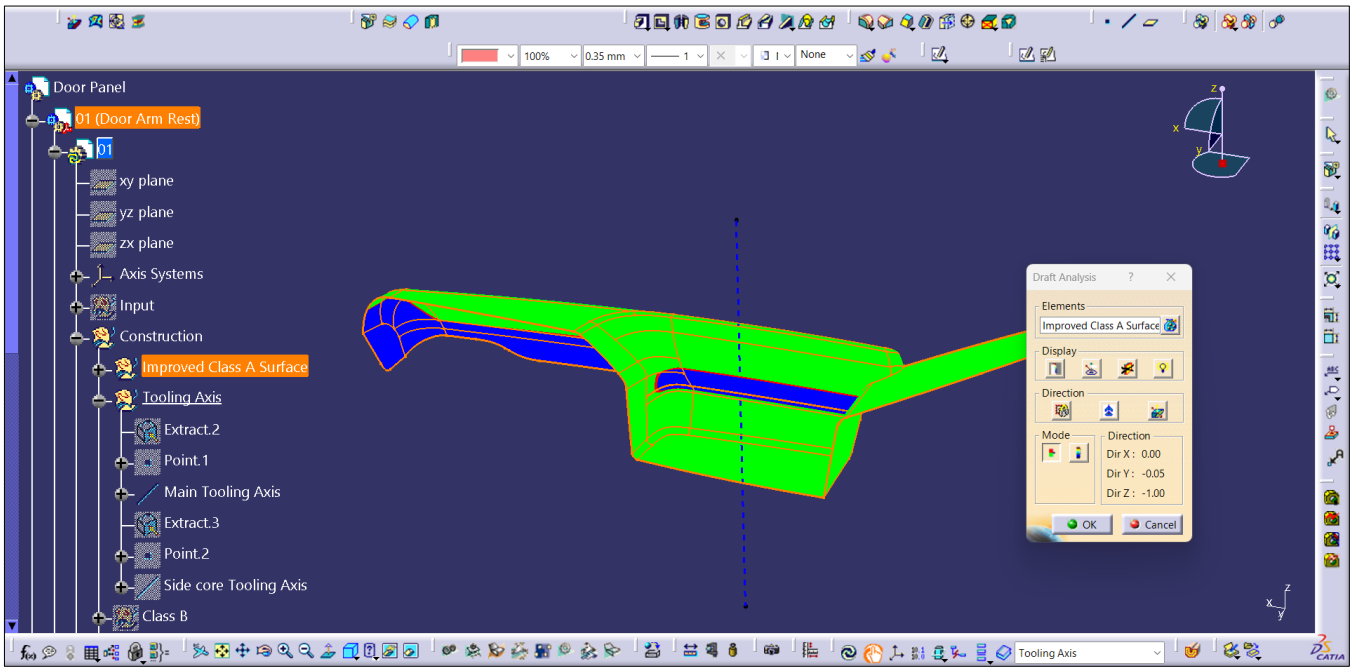
Creating Tooling Axis:

- Extract the flat surface from the Class A Surface using extract command
- Create a point on the surface and create a line on Z axis with the point as reference.

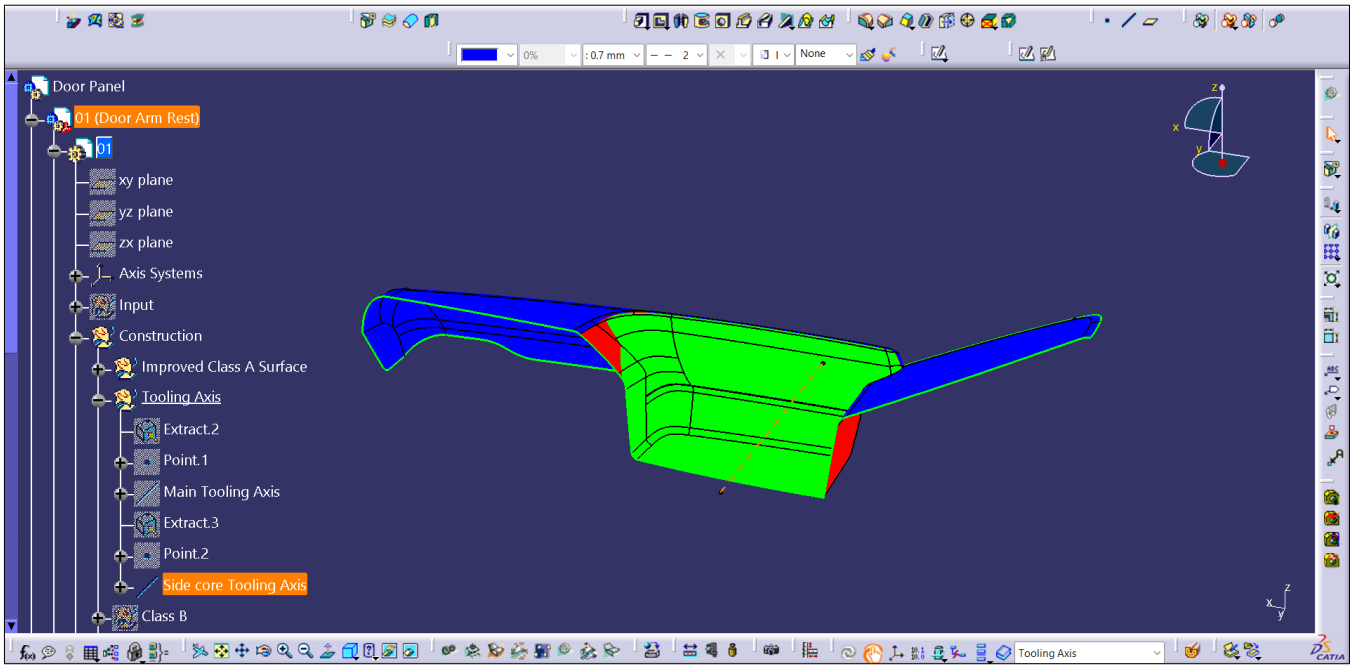


Draft Analysis:

- Check draft analysis from Feature draft analysis tool to check whether the given Class A surface is clearing the draft angle of 3°.



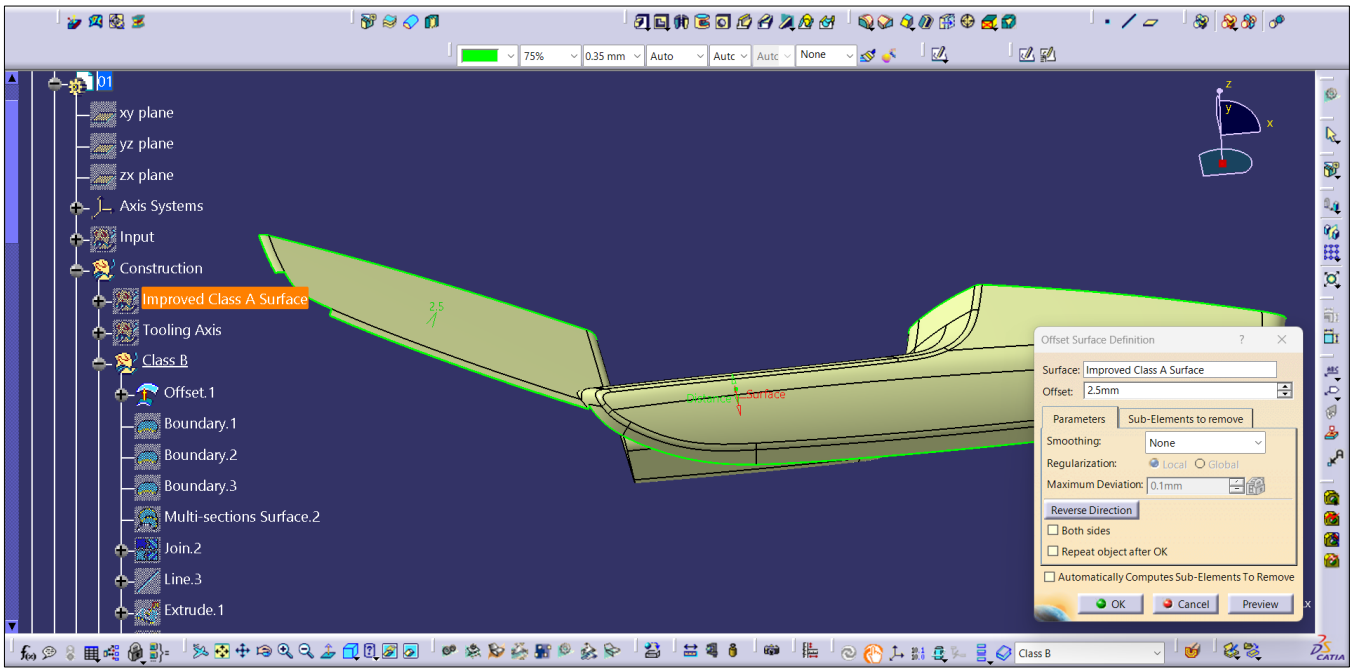
- Here not all surfaces are clearing the draft analysis, since the surface is slightly protruded away from the tooling axis. So, a separate side core has to be designed for that portion.
- So, a side core tooling axis must be created on the y axis direction and draft analysis to be checked.



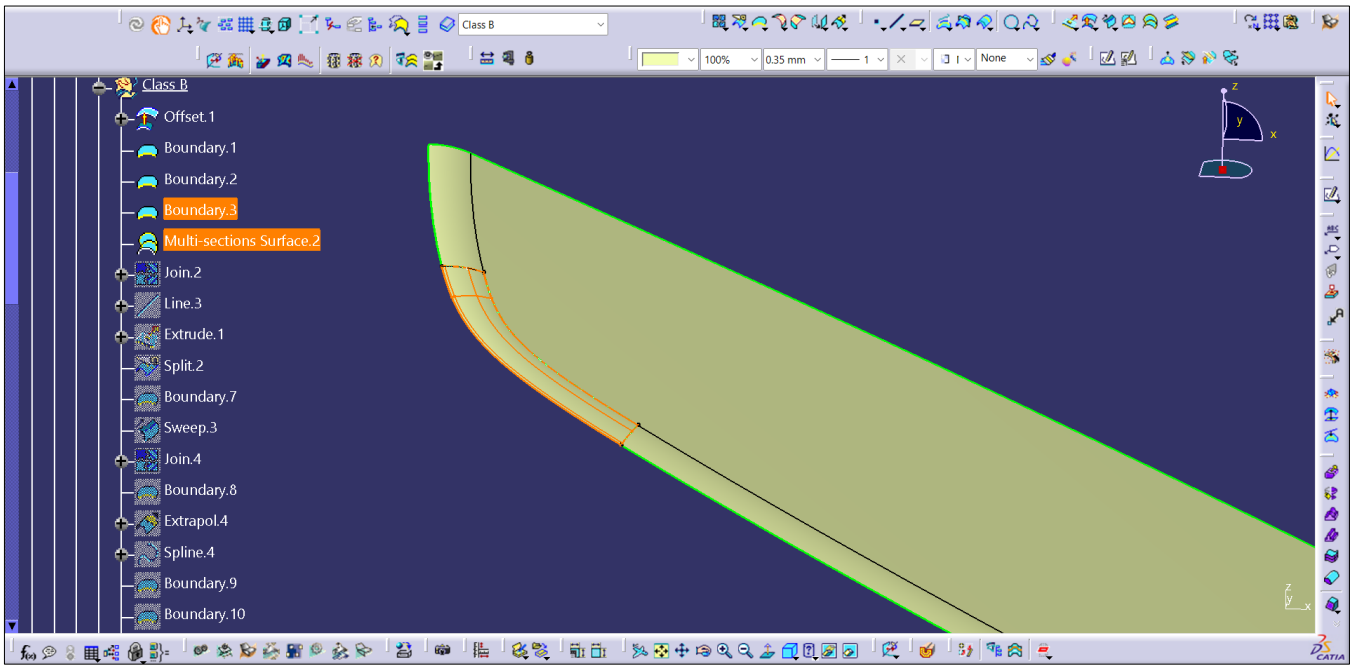
- Now the class A surface is clearing the draft analysis on the side core tooling axis.

Creating Class B Surface:

- First, the given Class A surface should be offset of 2.5mm using the offset command and the offsetted surface should be checked whether it contains any open patches.

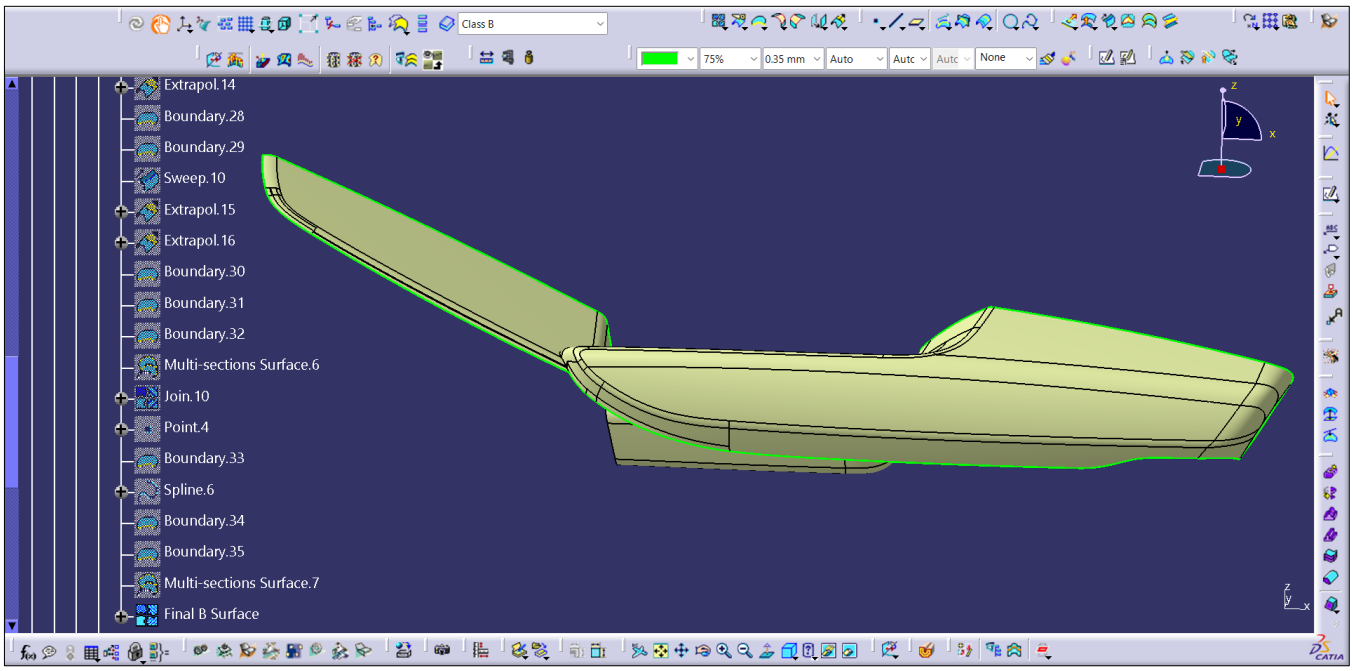


- Create the boundaries using boundary command and create the surfaces on the open patch areas using sweep & multi-sections surface command and heal up the open patch areas using join & trim commands.



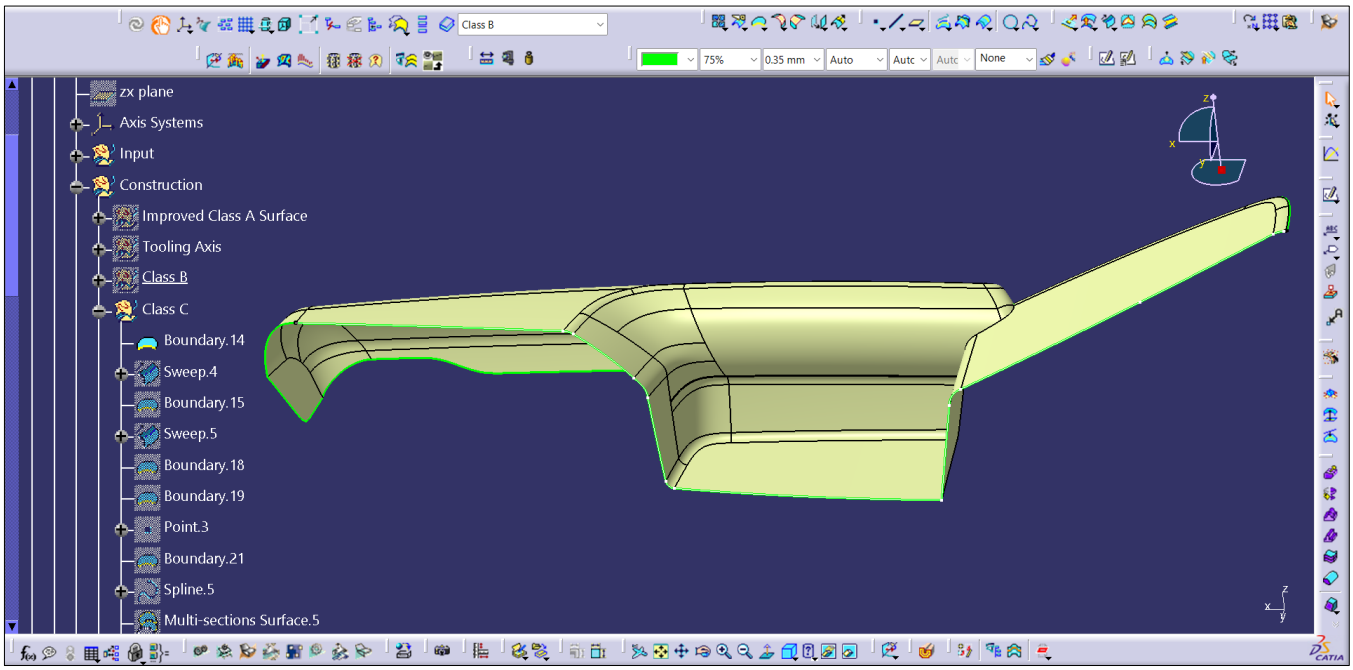
- Using extrapolate command, extrapolate every edge of the class A surface so that the Class B surface will be properly intersected to the Class C surface.

- Publish the final B surface for future reference. The Final B surface will be as below:

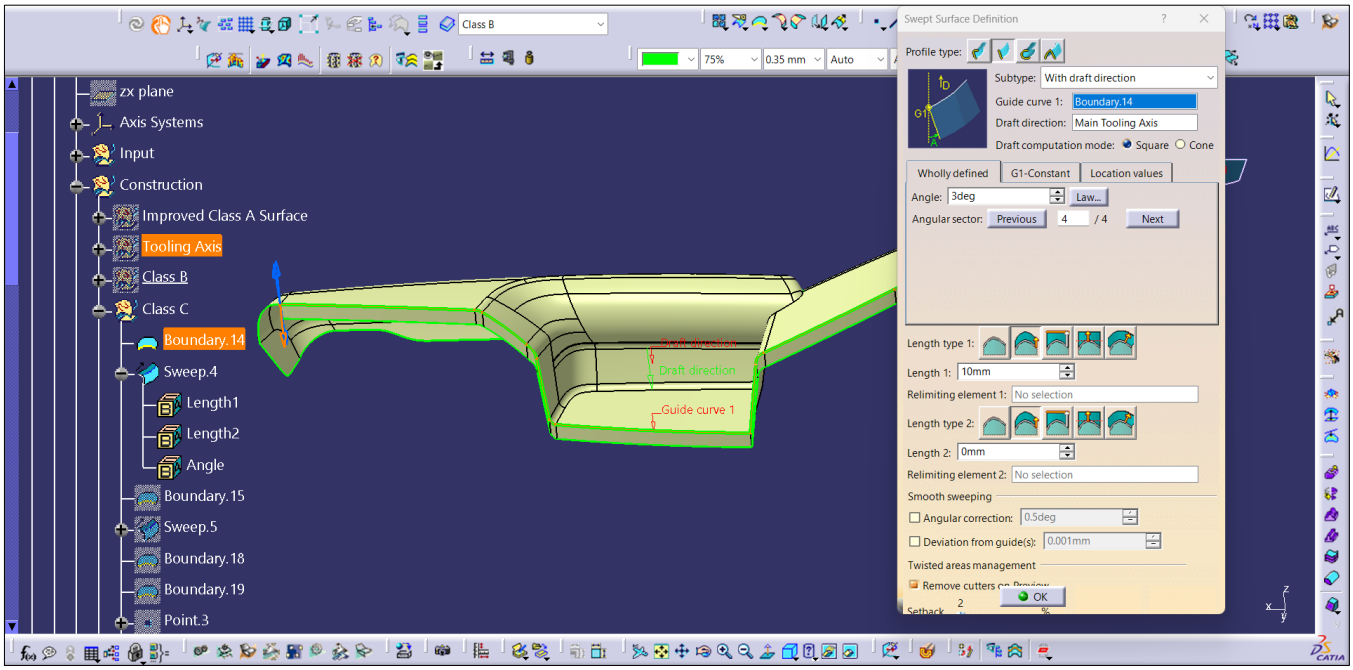


Creating Class C Surface:

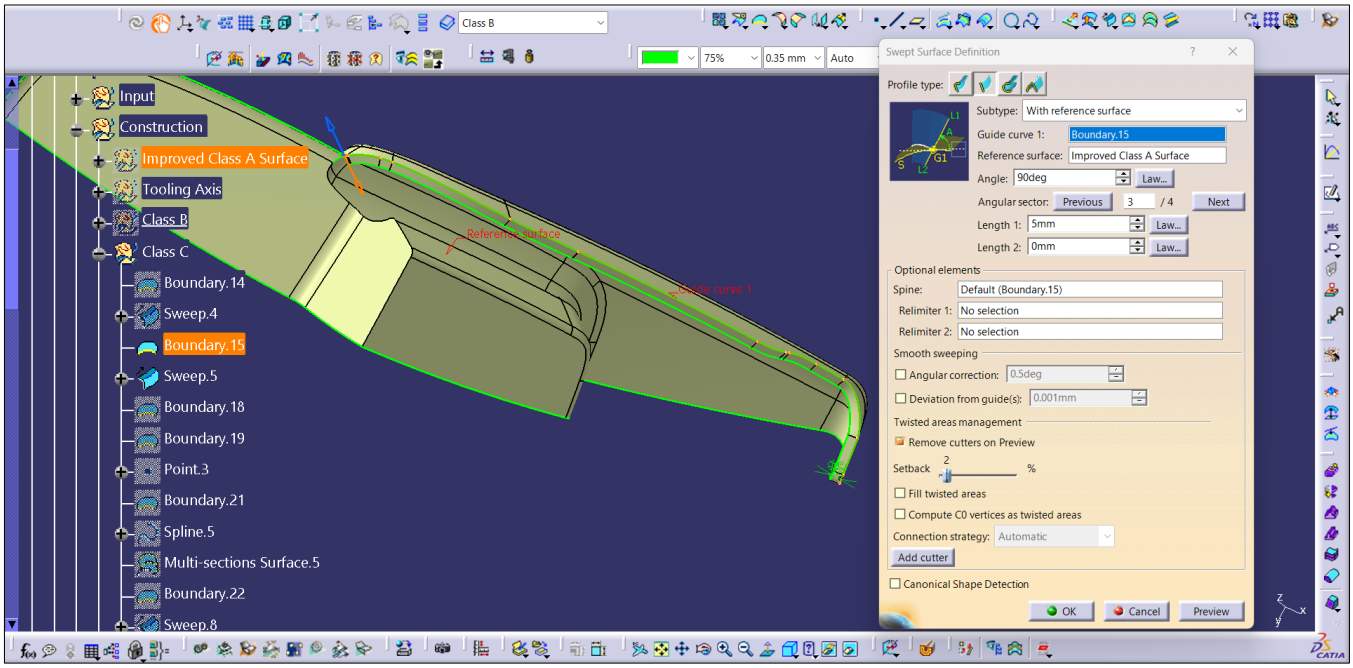
- Enable the Class A surface & create a boundary on all the edges using boundary command.



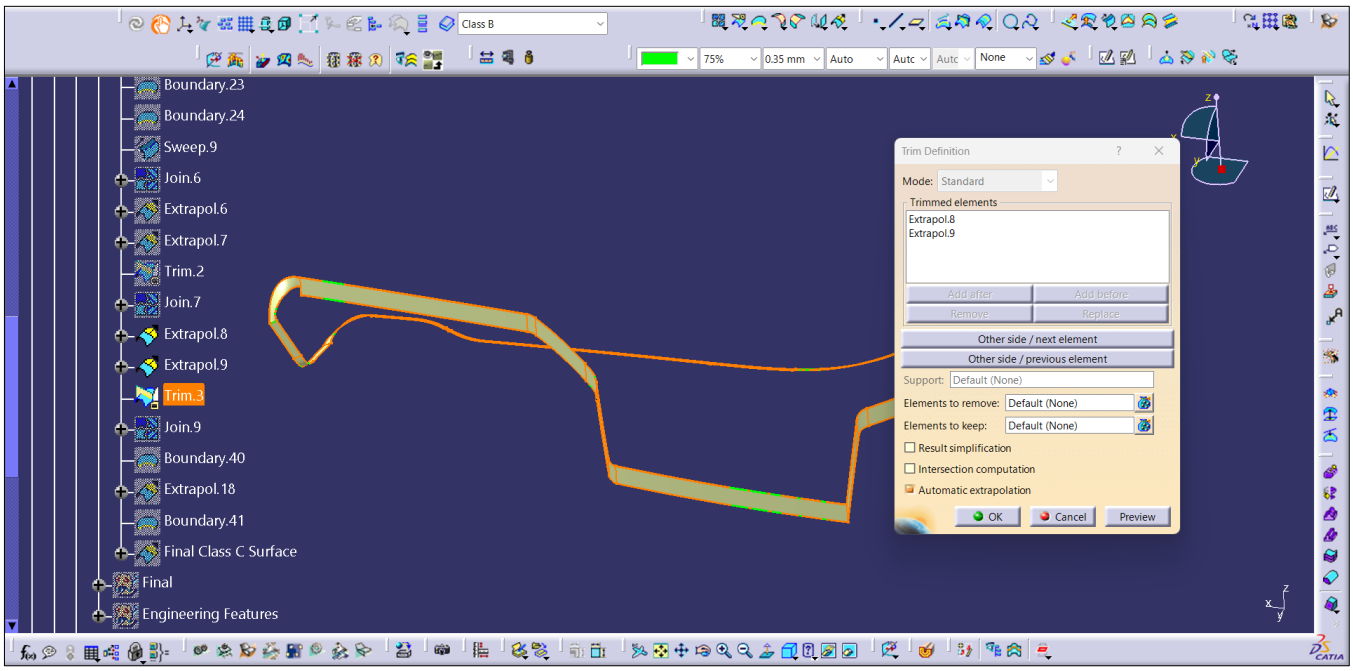
- Using sweep command - with draft direction command create the surface on the boundary with the draft angle of 3° & this should be repeated for all the edged which are parallel to the tooling axis.



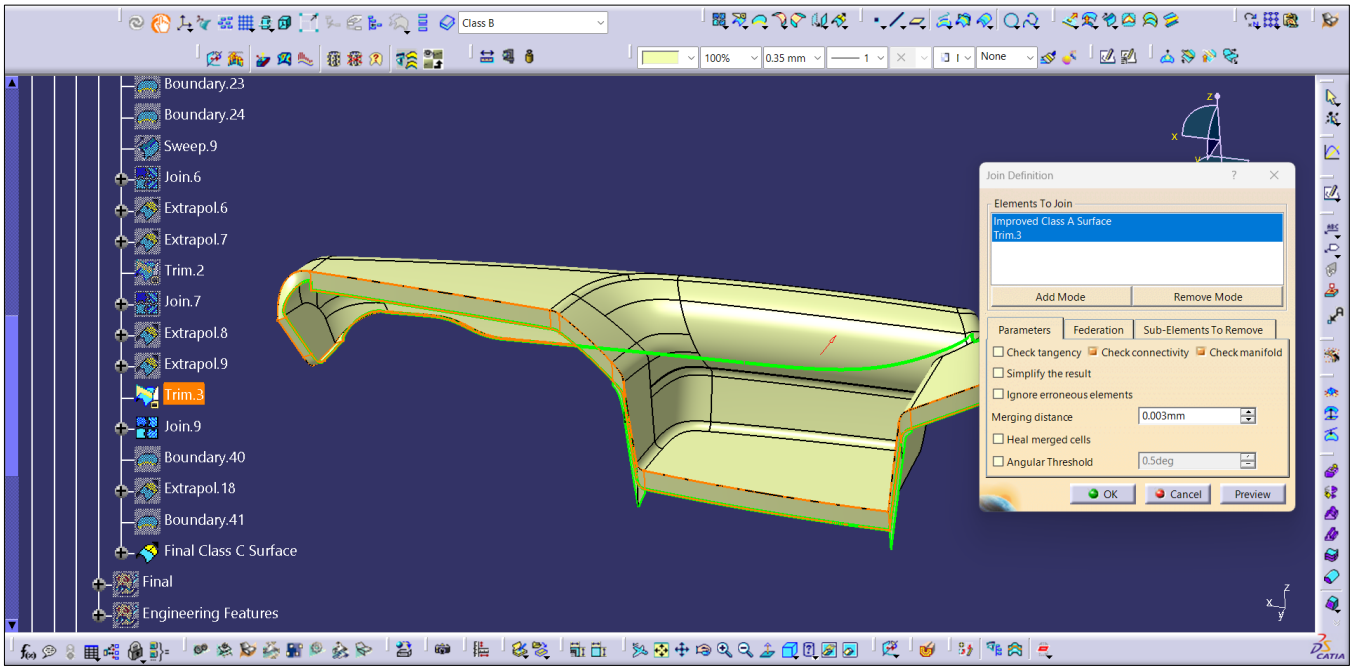
- Using sweep command - with reference surface command create the surface on the boundary with the angle of 90° & this should be repeated for all the edged which are not parallel to the tooling axis.



- Using trim command, join all the sweep surfaces.

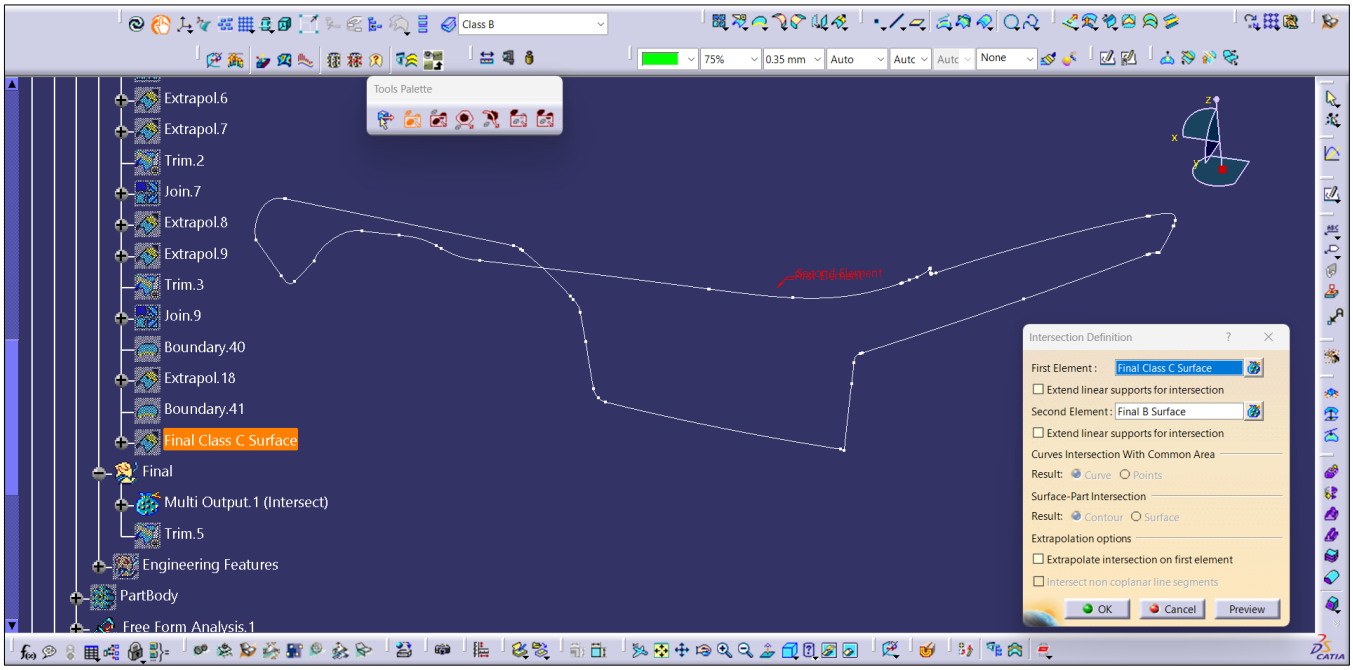


- Using Join command, join trim 3 surface & the class A surface. The final class C surface will be as below.

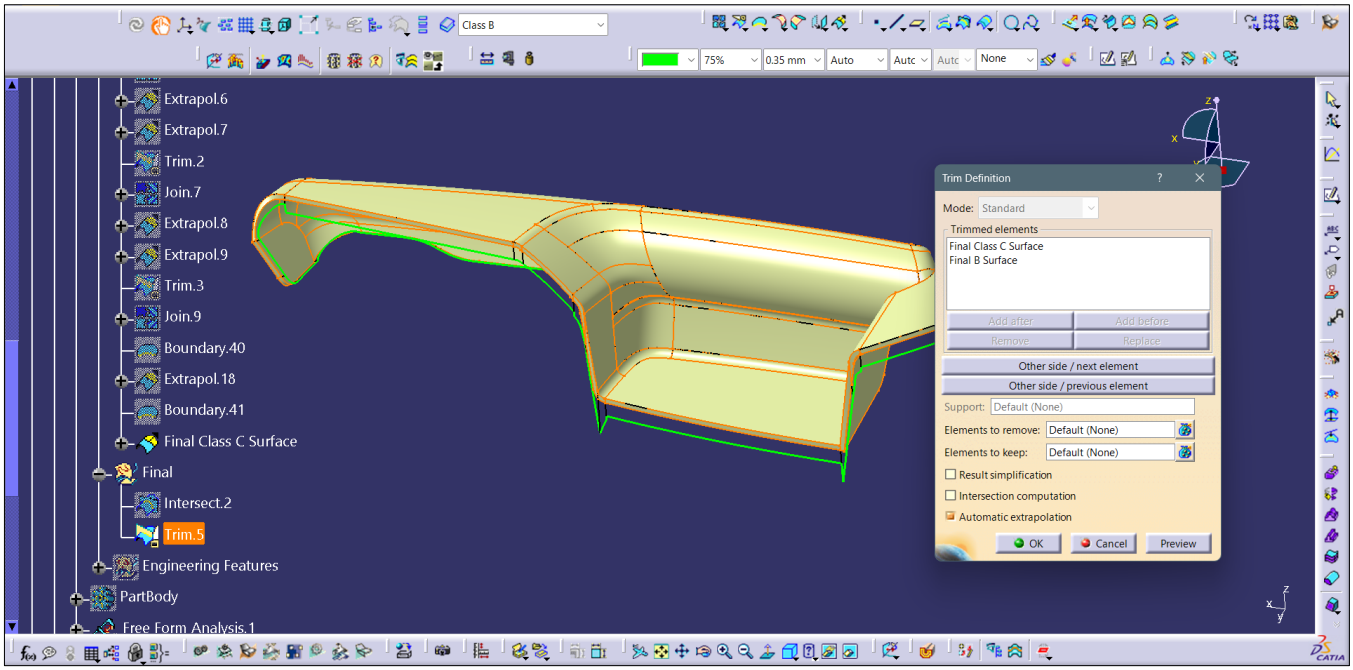


Creating Final closed Surface:

- Using the intersect command, check whether both the Class-B surface & class-C surface are properly intersecting. If there is no black point in the intersection result, then the two surface are properly intersecting.

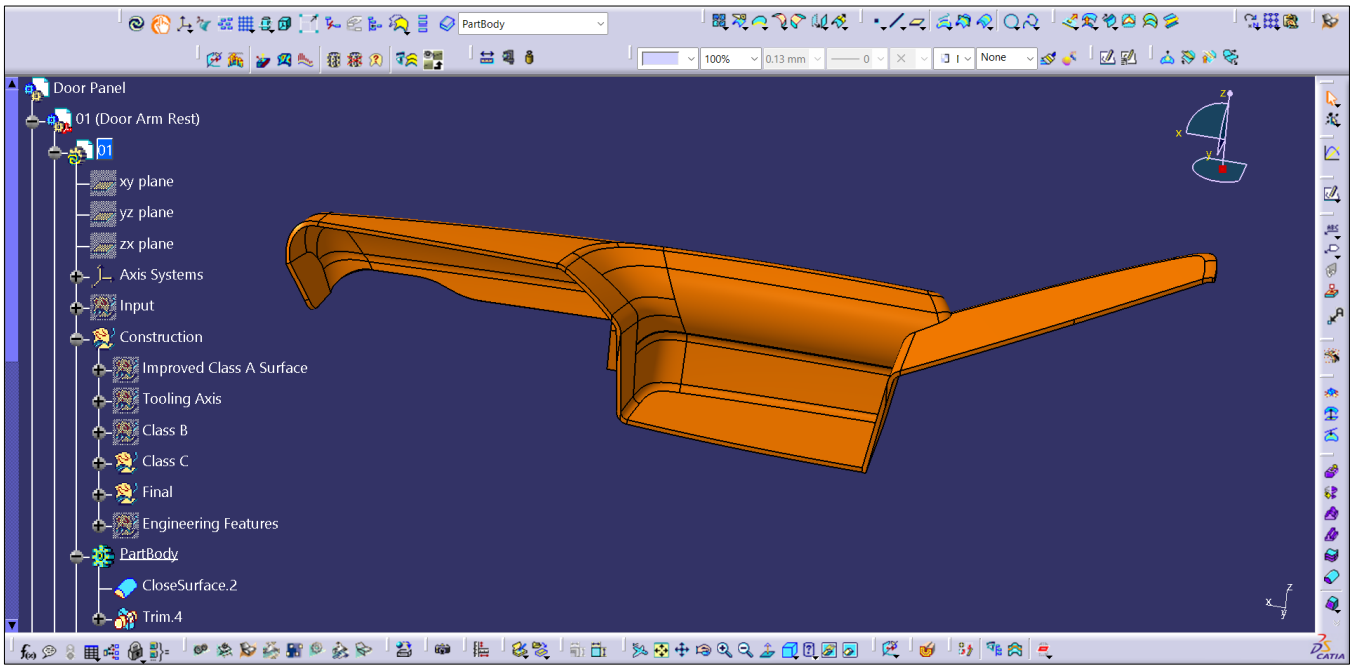


- After ensuring both the Class B & Class C surfaces are properly intersecting, using the trim command, trim both the surface to form a closed surface.



Creating Solid Part:

- Change the workbench to Part design and using closed surface command create the solid part model.
- The final solid part for Door Arm Rest is as below.

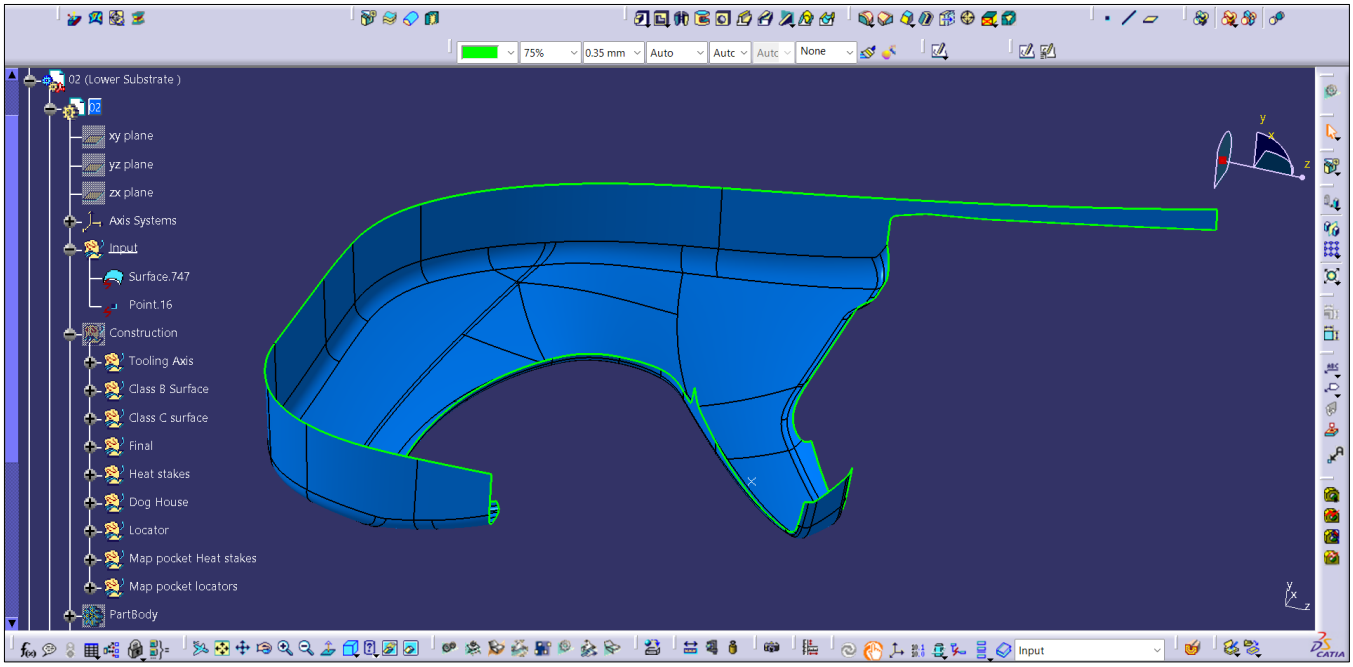


Part 2: Lower Substrate:

Creating Essential Geometrical Sets:

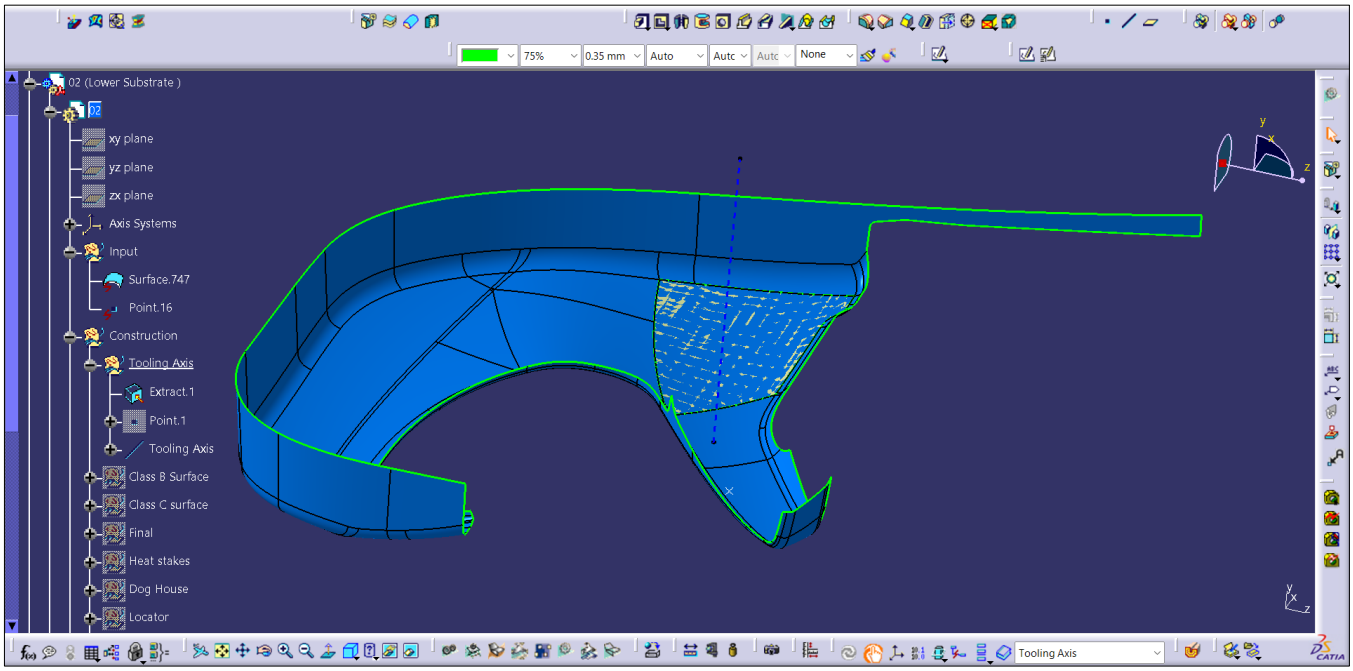
The first step involves in creating all the essential Geometrical sets itself under a geometrical set named Construction for the given model which includes:

- Class A surface (Input)
- Tooling Axis
- Class B surface
- Class C surface
- Final A+C
- Engineering Features



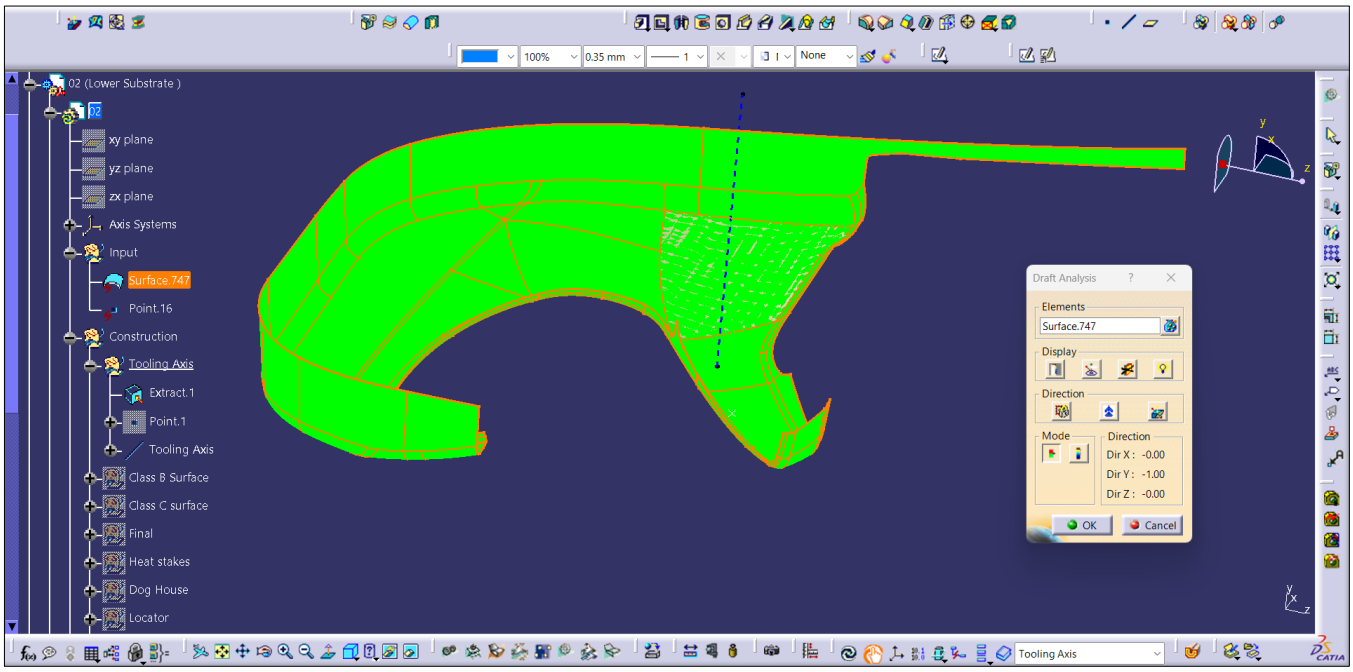
Creating Tooling Axis:

- Extract the flat surface from the Class A Surface using extract command
- Create a point on the surface and create a line on Z axis with the point as reference.



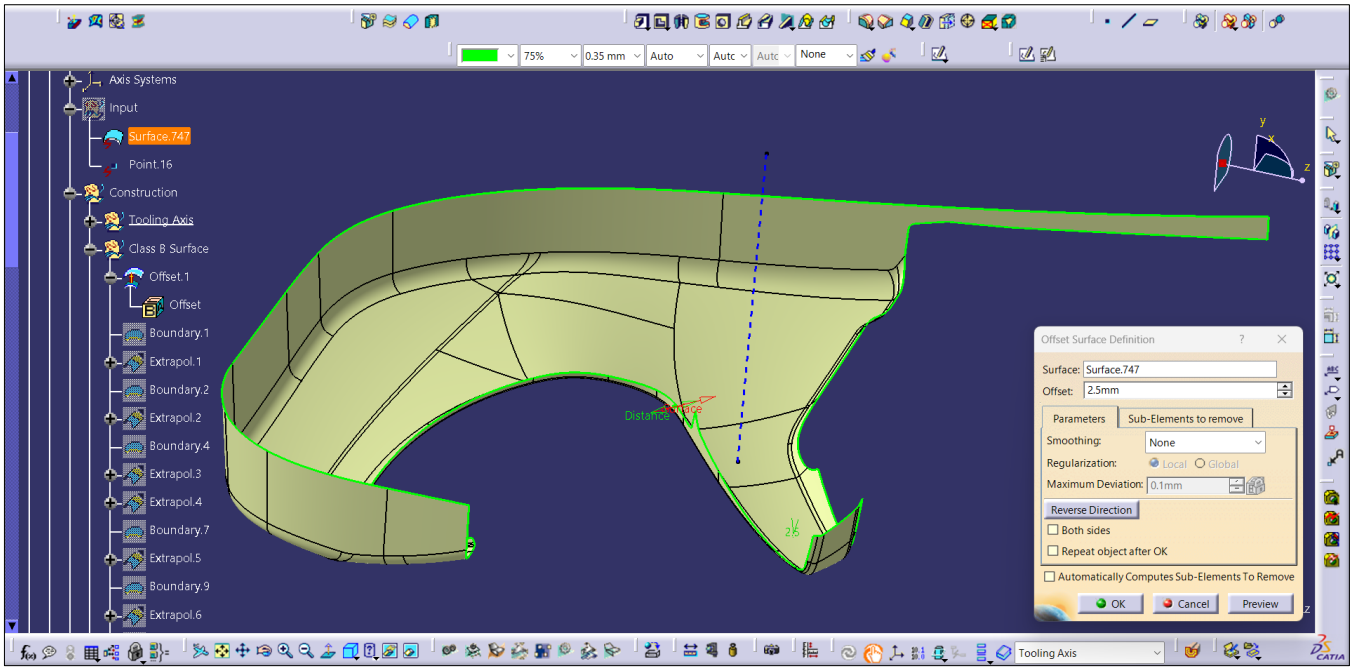
Draft Analysis:

- Check draft analysis from Feature draft analysis tool to check whether the given Class A surface is clearing the draft angle of 3°.

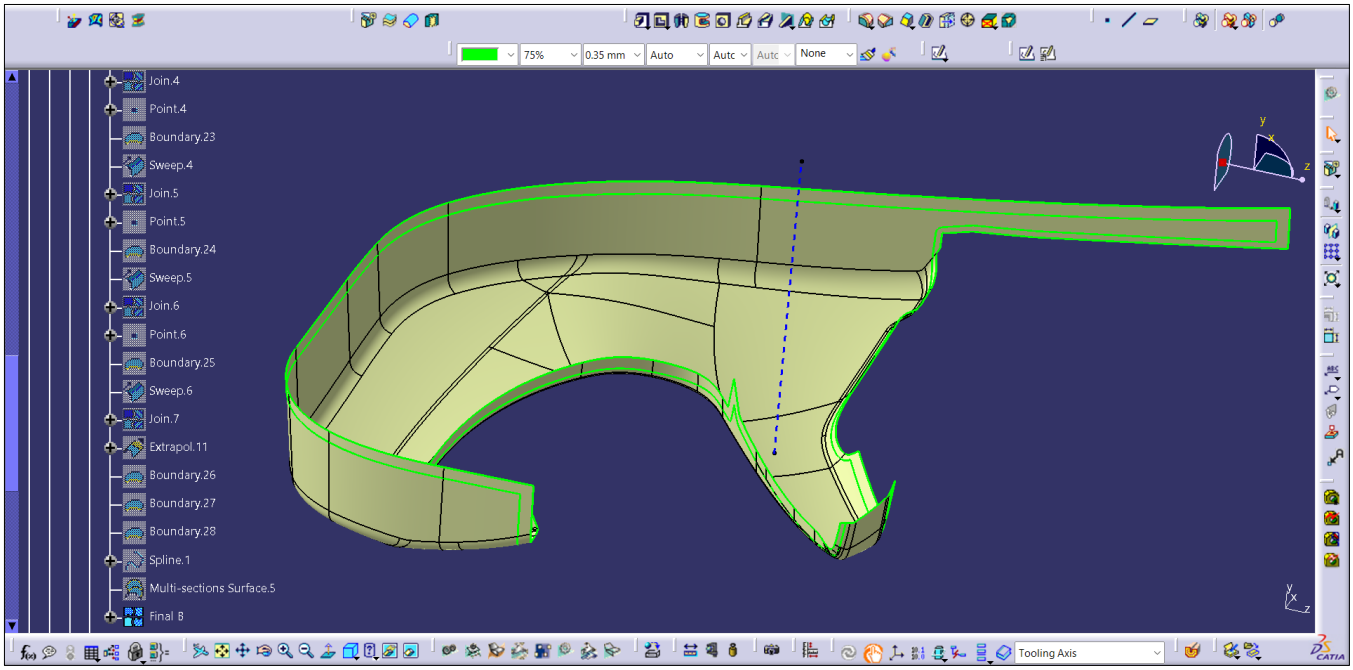


Creating Class B Surface:

- First, the given Class A surface should be offset of 2.5mm using the offset command and the offsetted surface should be checked whether it contains any open patches.

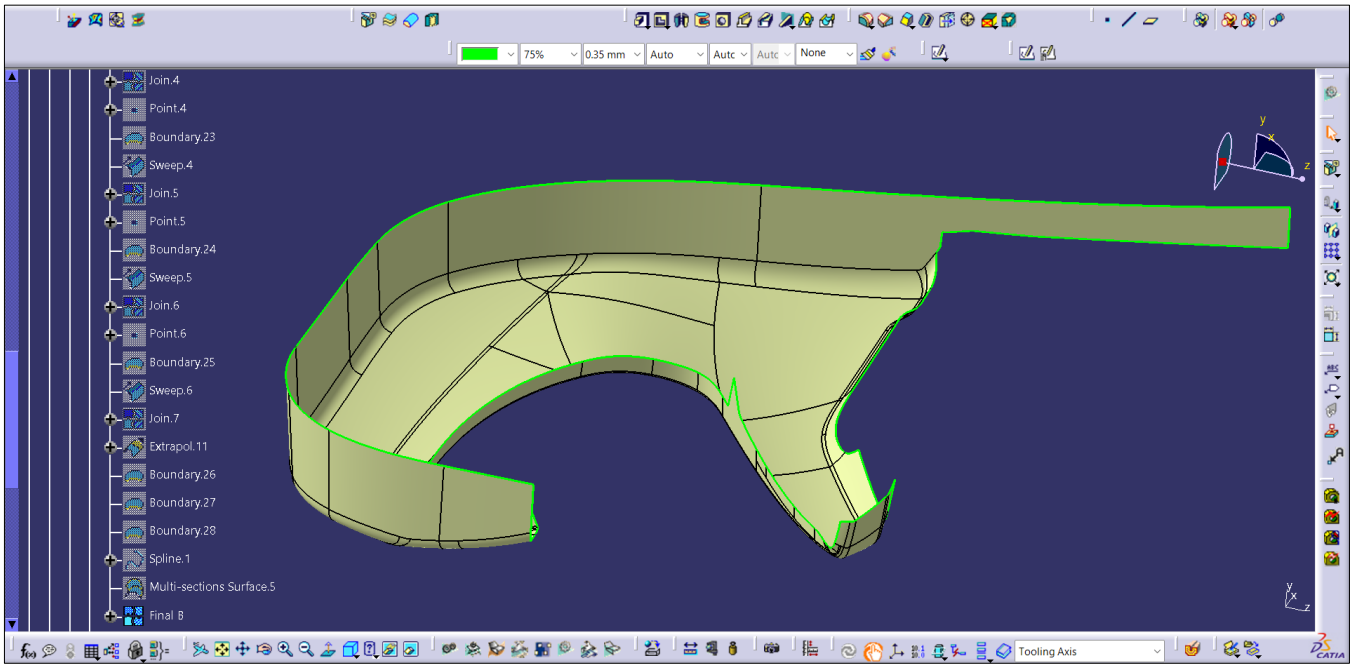


- Create the boundaries using boundary command and create the surfaces on the open patch areas using sweep & multi-sections surface command and heal up the open patch areas using join & trim commands.



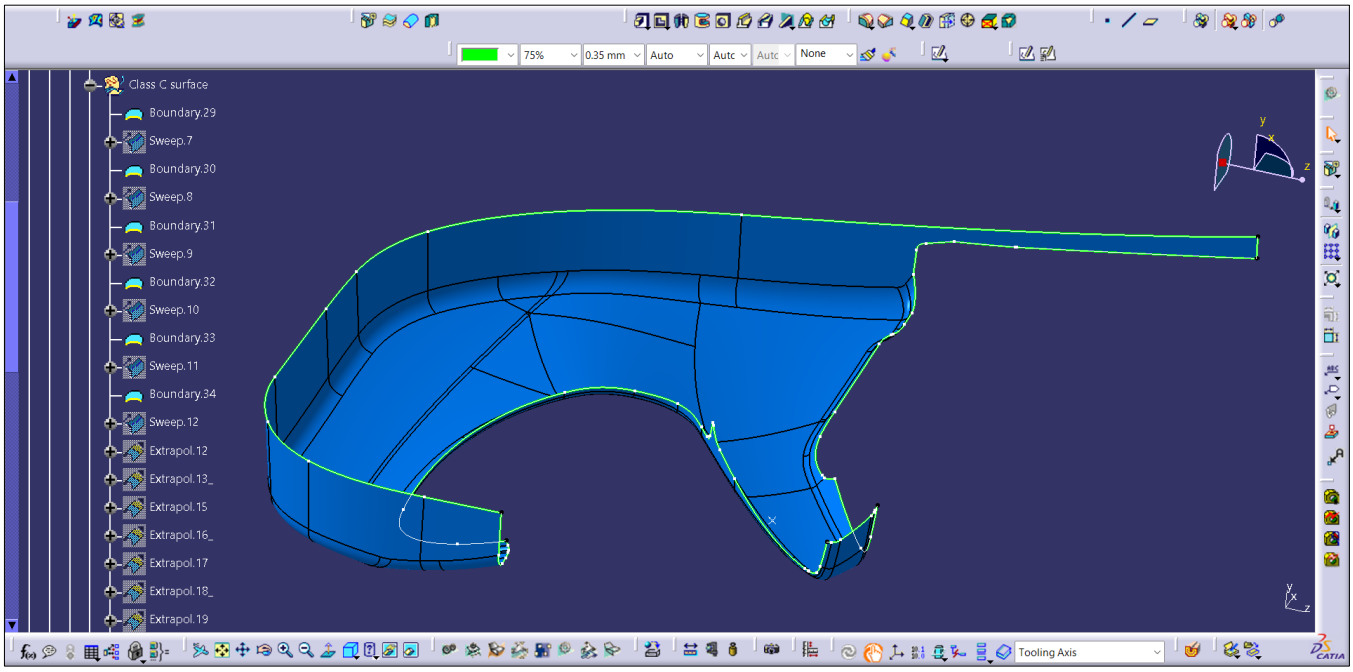
- Using extrapolate command, extrapolate every edge of the class A surface so that the Class B surface will be properly intersected to the Class C surface.

- Publish the final B surface for future reference. The Final B surface will be as below:

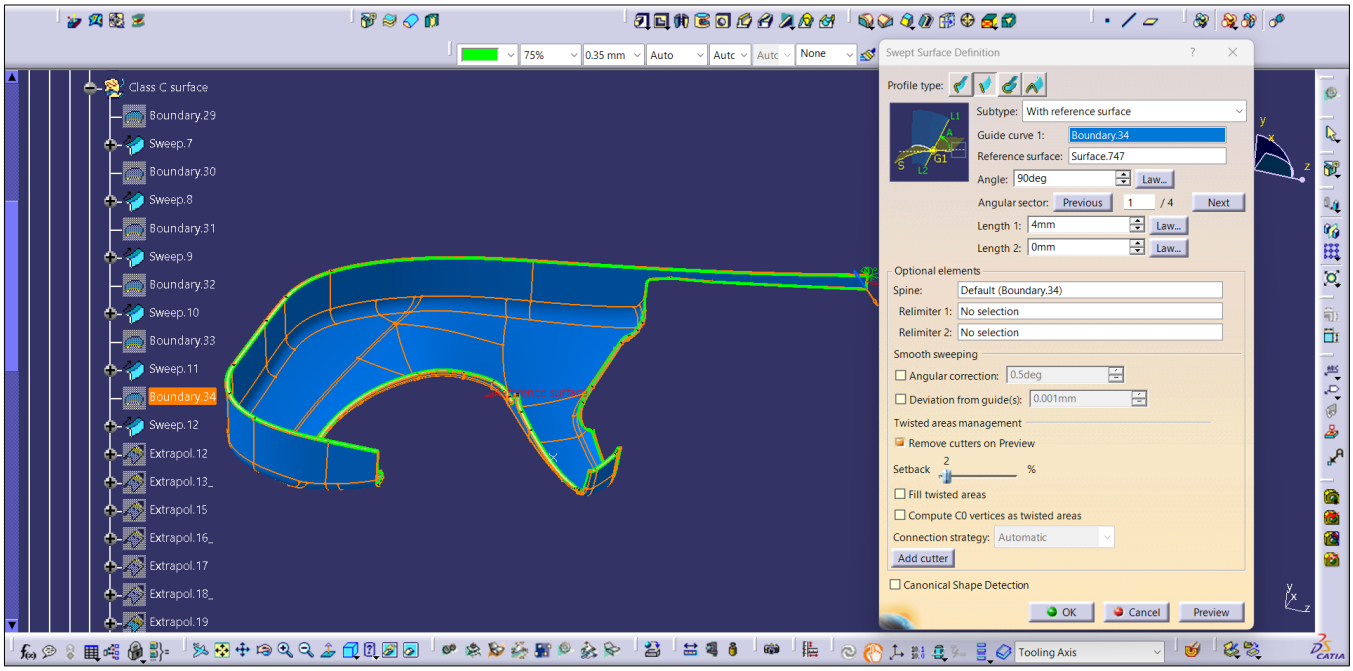


Creating Class C Surface:

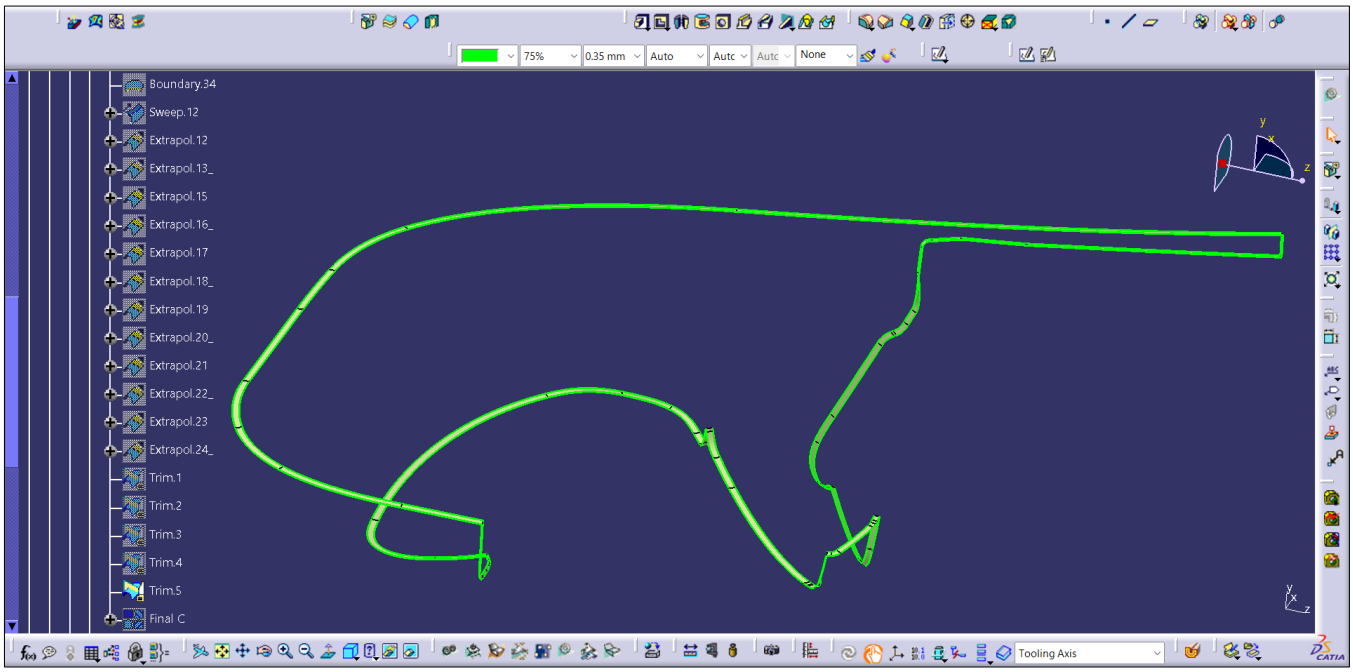
- Enable the Class A surface & create a boundary on all the edges using boundary command.



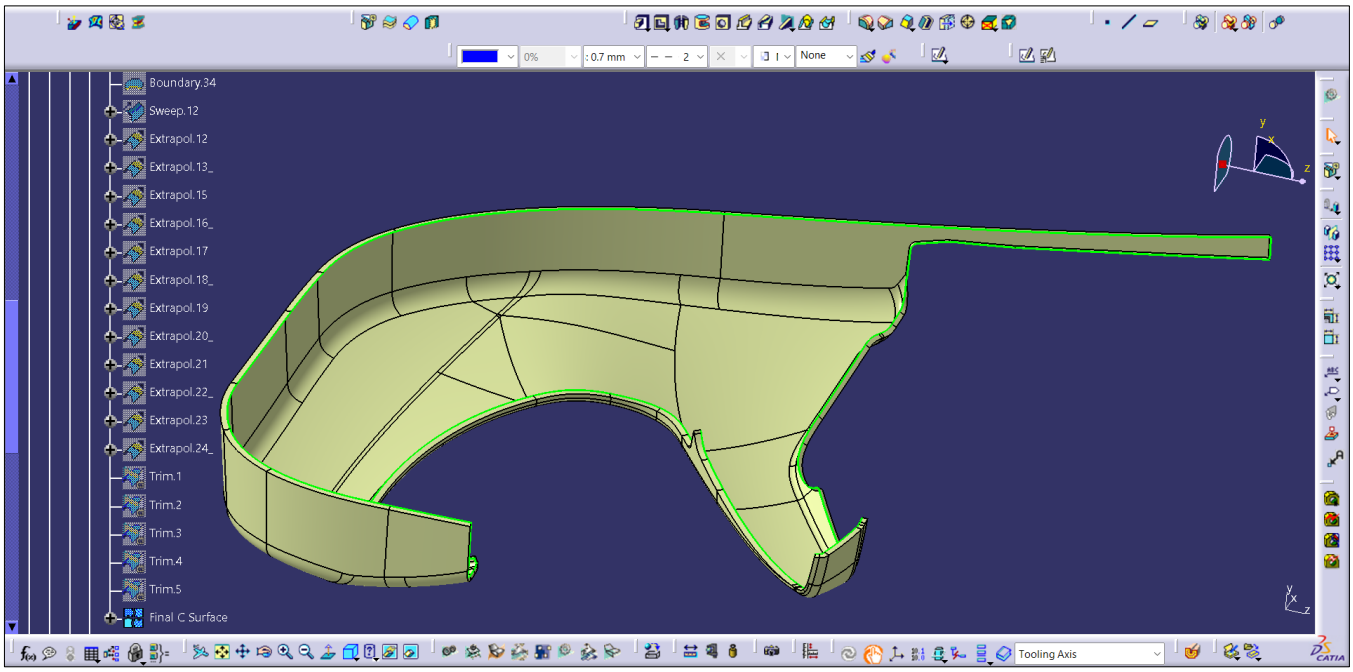
- Using sweep command - with reference surface command create the surface on the boundary with the angle of 90° & this should be repeated for all the edges which are not parallel to the tooling axis.



- Using trim command, join all the sweep surfaces.

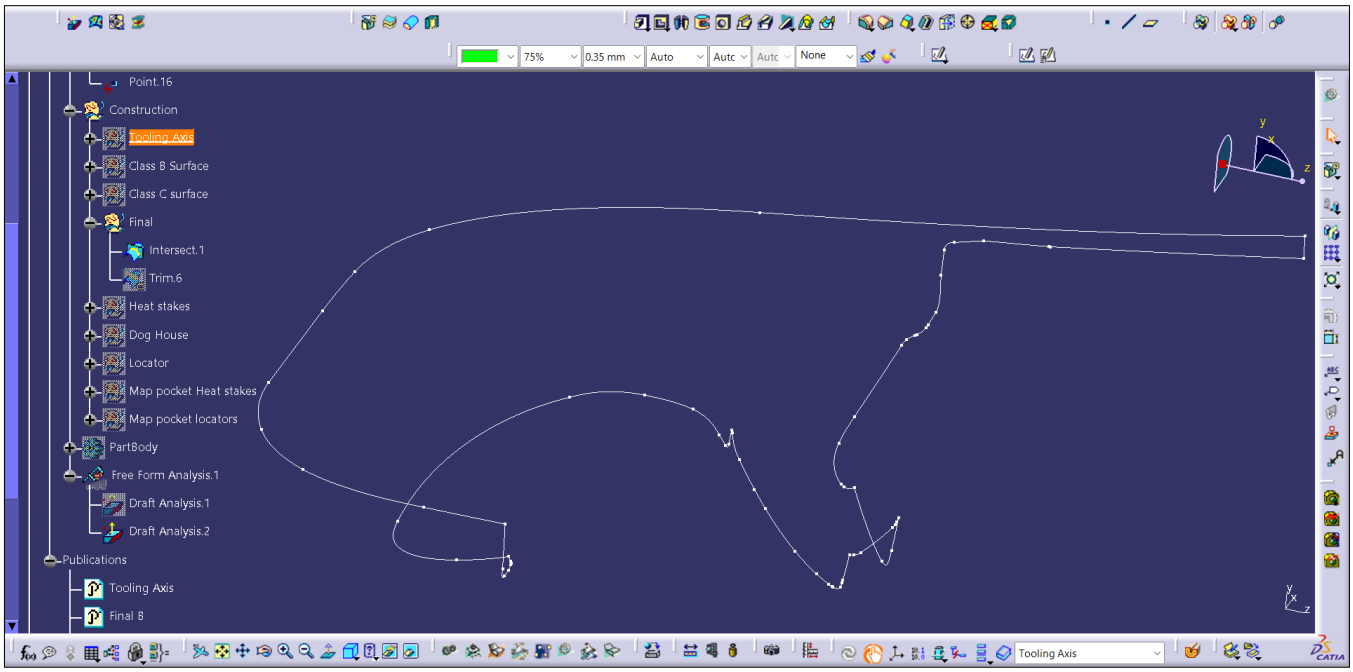


- Using Join command, join trim 3 surface & the class A surface. The final class C surface will be as below.

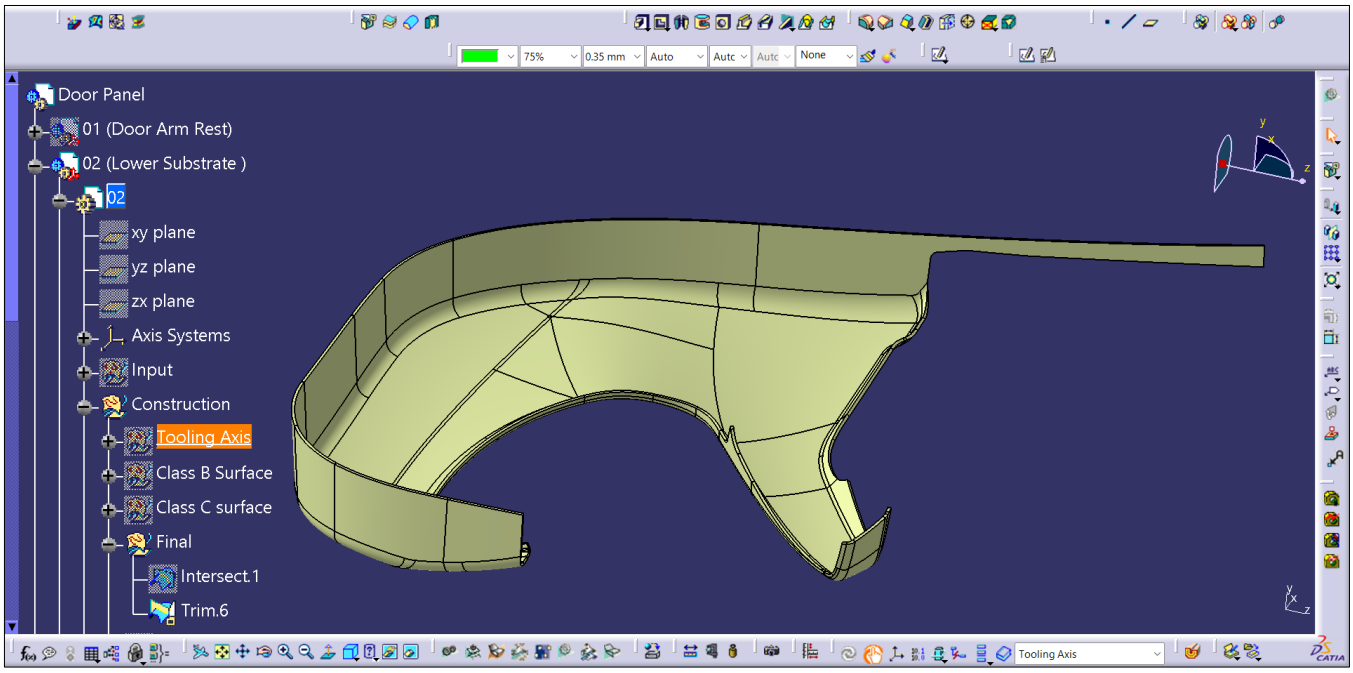


Creating Final closed Surface:

- Using the intersect command, check whether both the Class-B surface & class-C surface are properly intersecting. If there is no black point in the intersection result, then the two surface are properly intersecting.

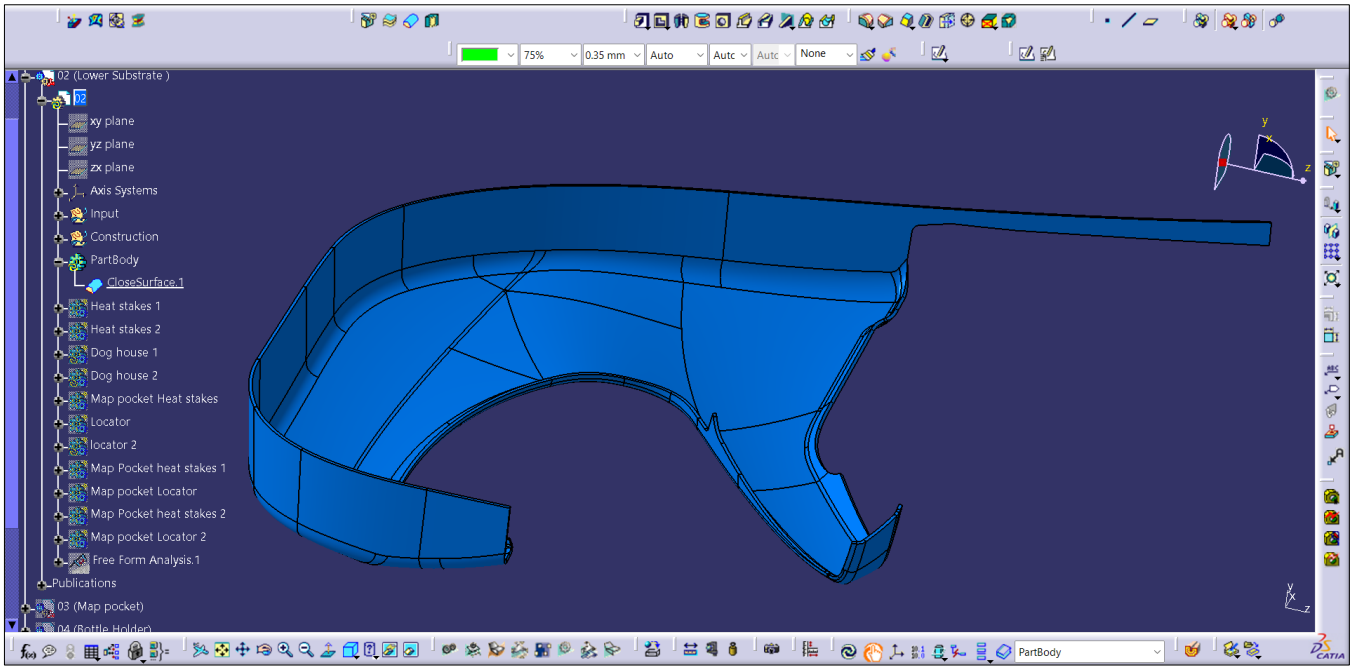


- After ensuring both the Class B & Class C surfaces are properly intersecting, using the trim command, trim both the surface to form a closed surface.



Creating Solid Part:

- Change the workbench to Part design and using closed surface command create the solid part model.
- The final solid part for lower substrate is as below.

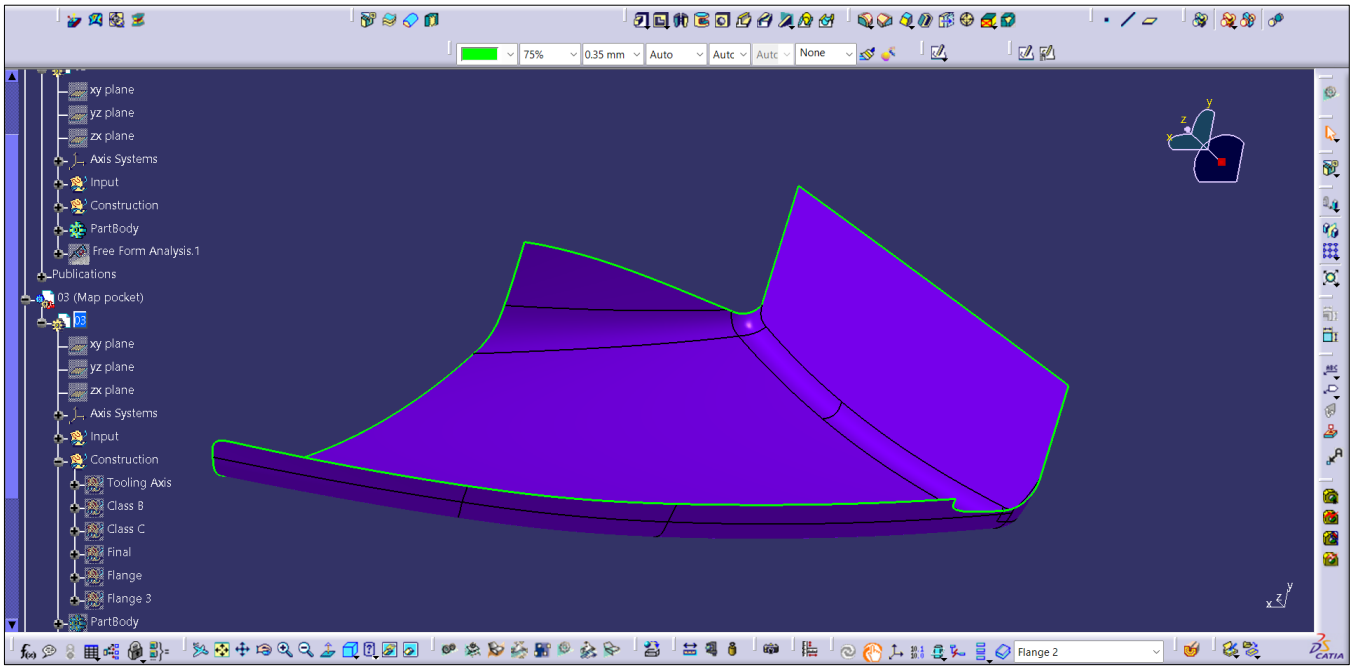


Part 3: Map Pocket:

Creating Essential Geometrical Sets:

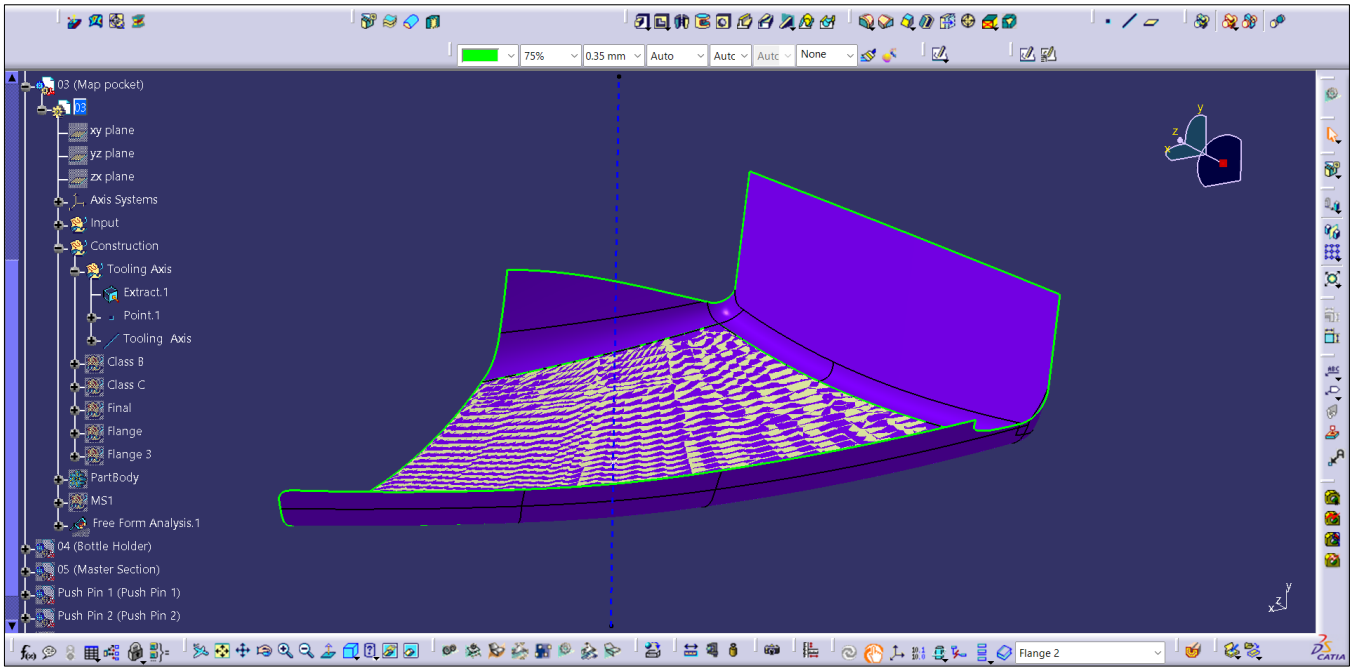
The first step involves in creating all the essential Geometrical sets itself under a geometrical set named Construction for the given model which includes:

- Class A surface (Input)
- Tooling Axis
- Class B surface
- Class C surface
- Final A+C
- Engineering Features



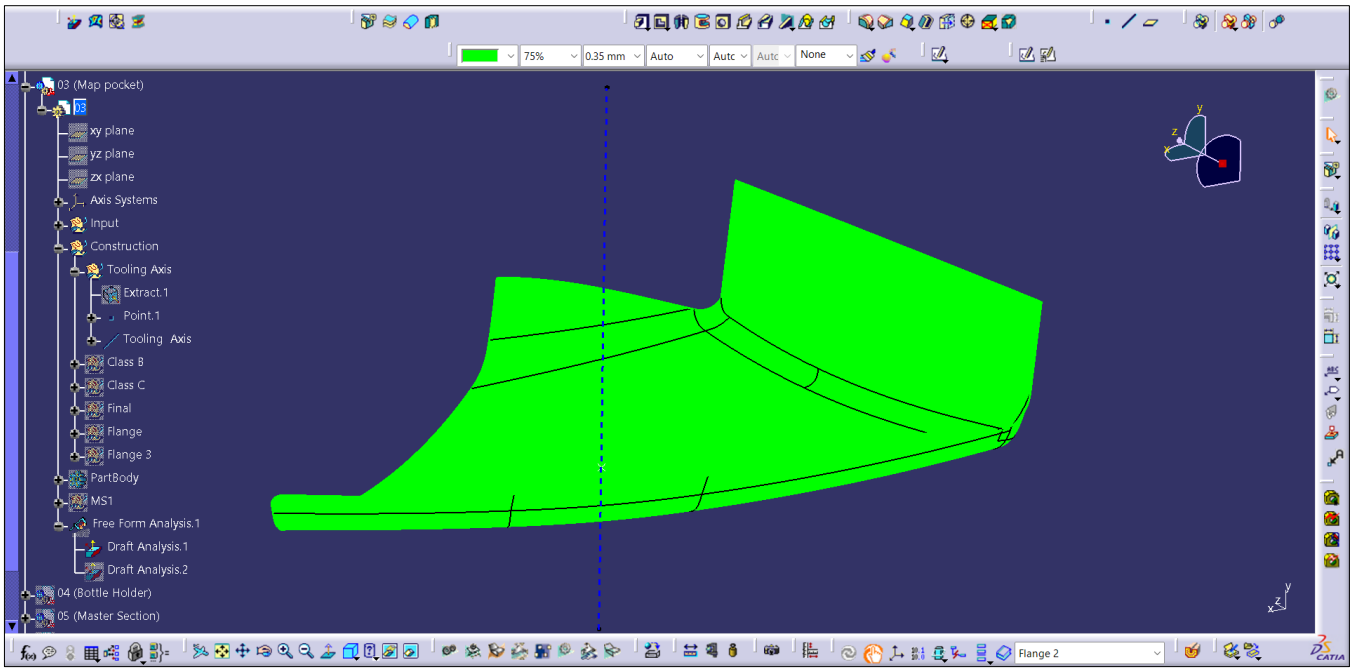
Creating Tooling Axis:

- Extract the flat surface from the Class A Surface using extract command
- Create a point on the surface and create a line on Z axis with the point as reference.



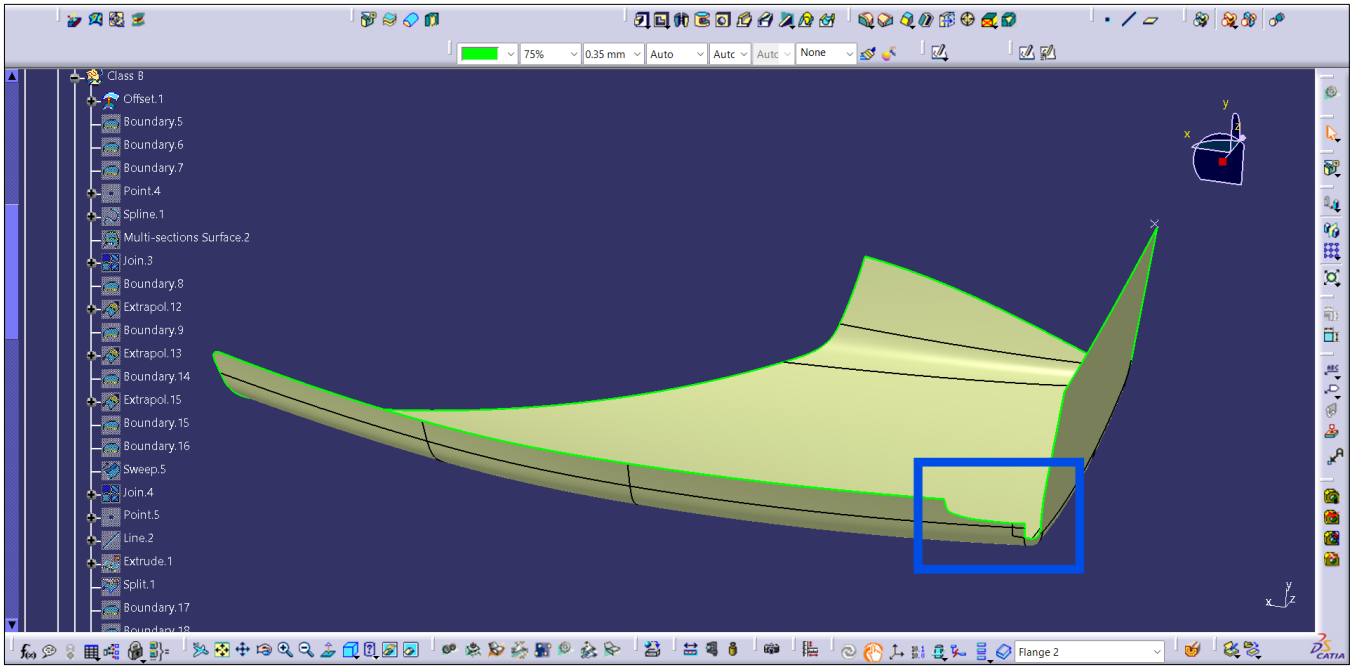
Draft Analysis:

- Check draft analysis from Feature draft analysis tool to check whether the given Class A surface is clearing the draft angle of 3°.

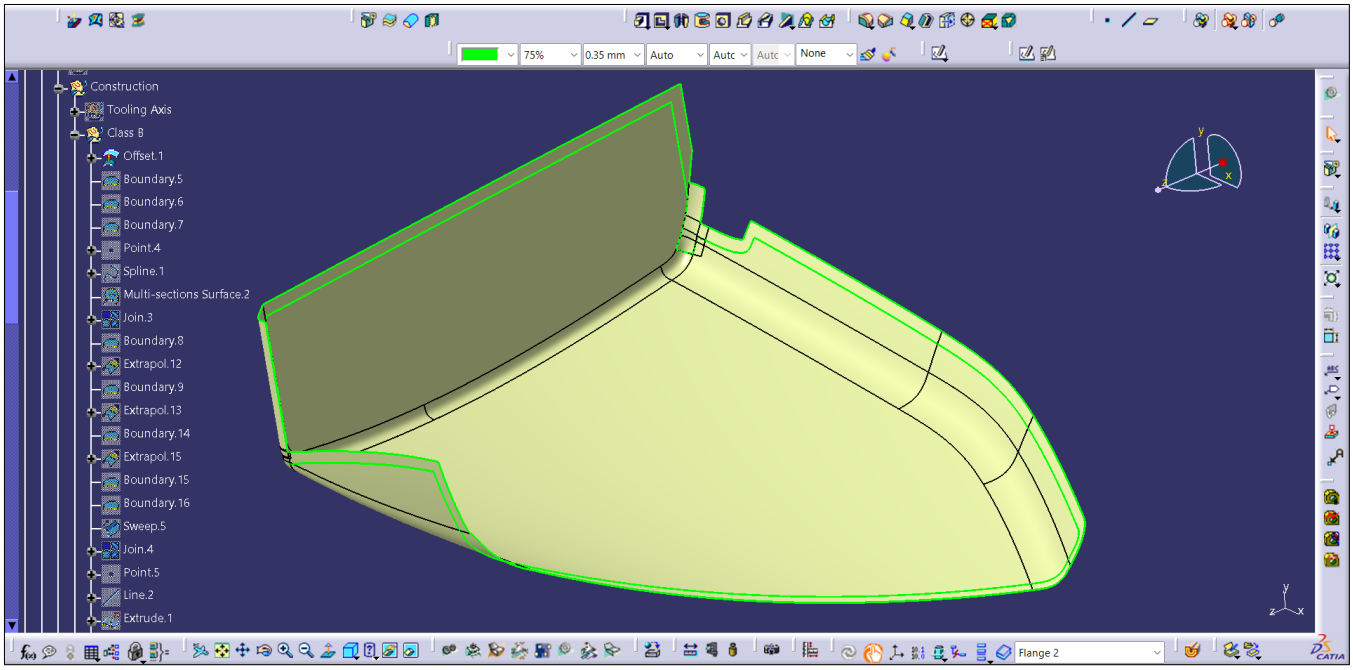


Creating Class B Surface:

- First, the given Class A surface should be offset of 2.5mm using the offset command and the offsetted surface should be checked whether it contains any open patches.

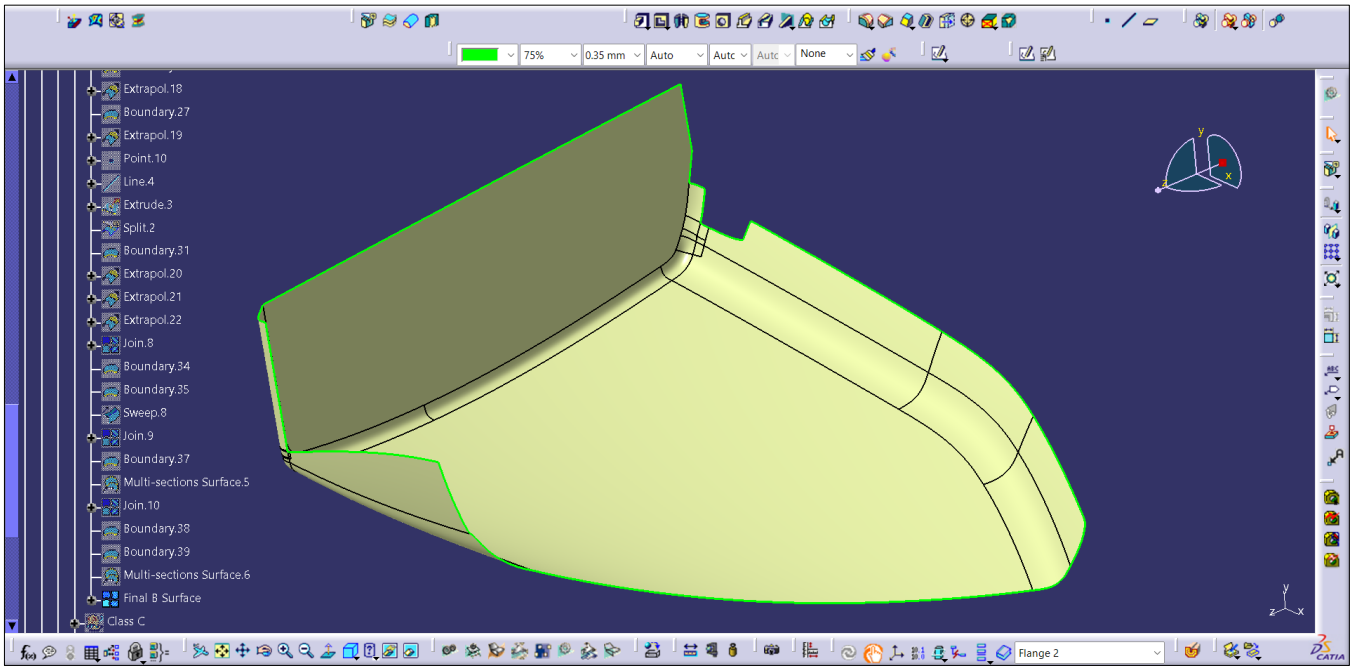


- Here there is an open patch on the offset surface & it has to be healed.
- Create the boundaries using boundary command and create the surfaces on the open patch areas using sweep & multi-sections surface command and heal up the open patch areas using join & trim commands.



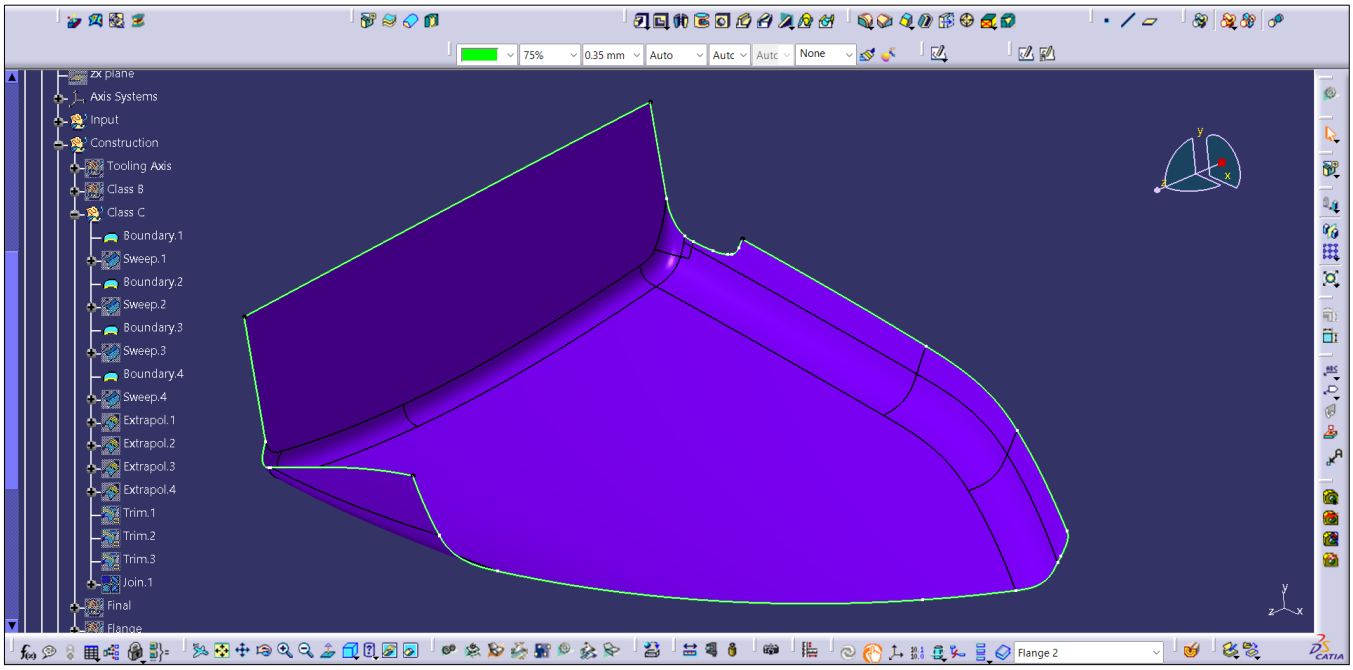
- Using extrapolate command, extrapolate every edge of the class A surface so that the Class B surface will be properly intersected to the Class C surface.

- Publish the final B surface for future reference. The Final B surface will be as below:

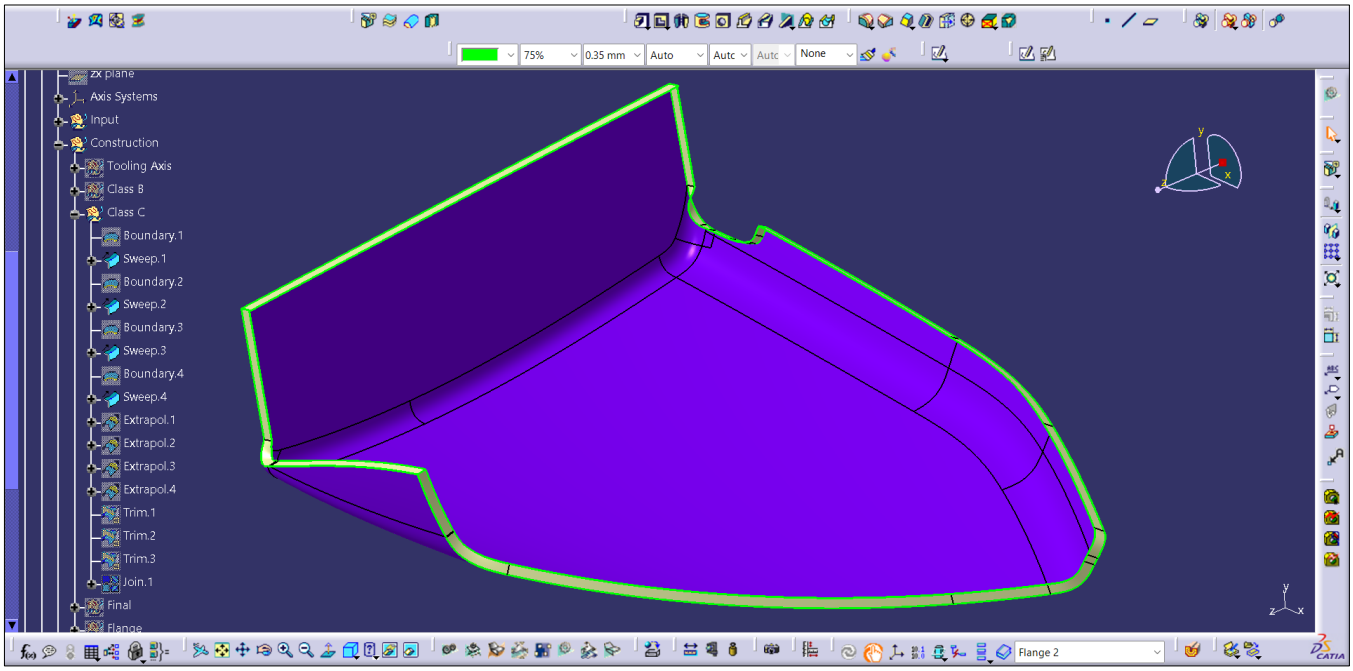


Creating Class C Surface:

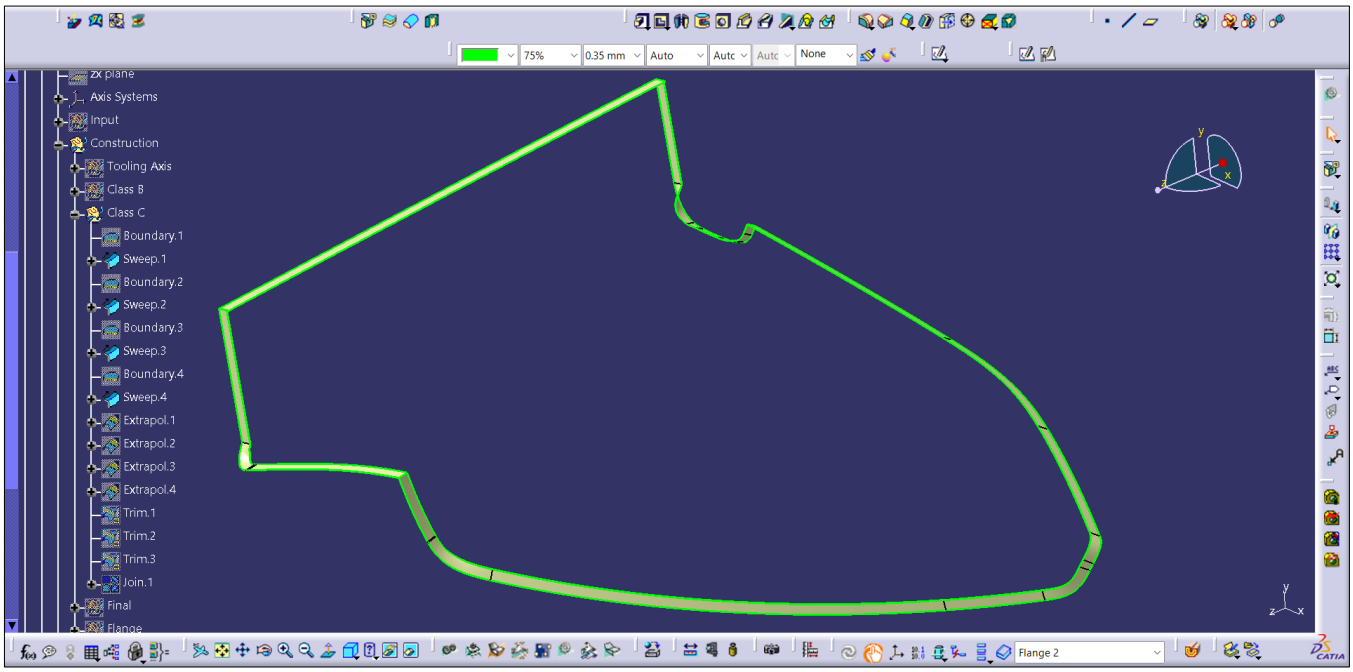
- Enable the Class A surface & create a boundary on all the edges using boundary command.



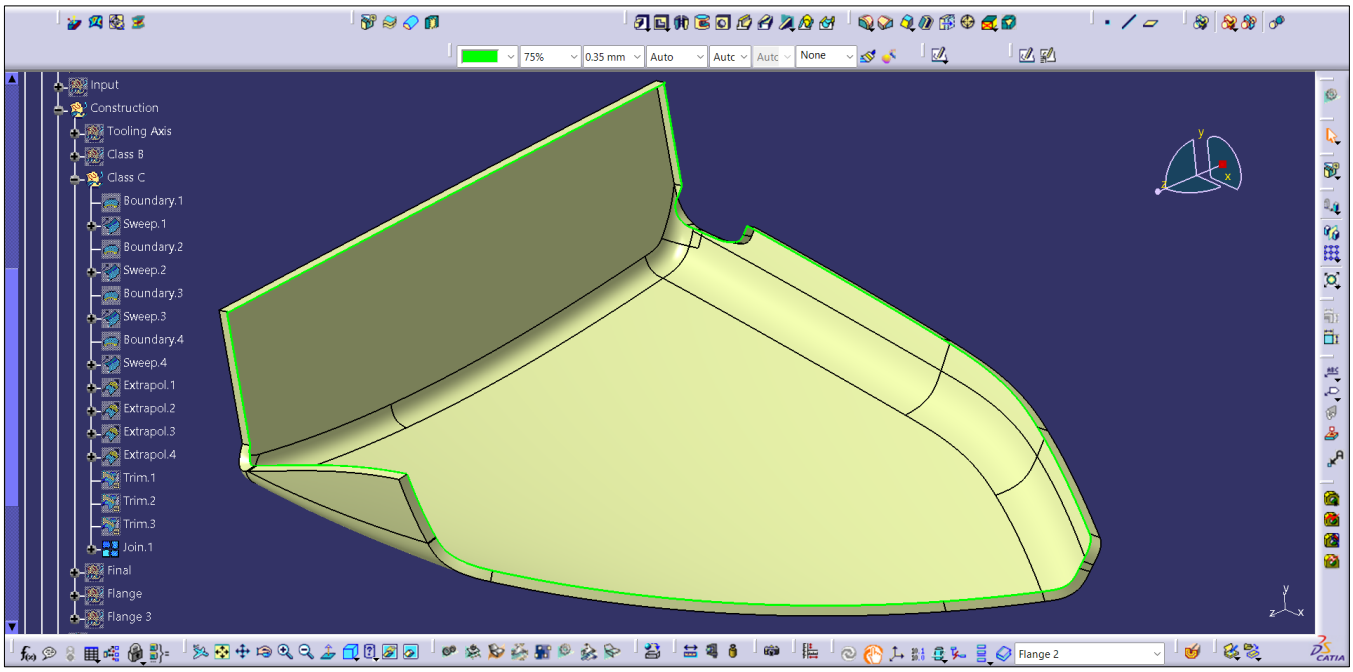
- Using sweep command - with reference surface command create the surface on the boundary with the angle of 90° & this should be repeated for all the edges which are not parallel to the tooling axis.



- Using trim command, join all the sweep surfaces.

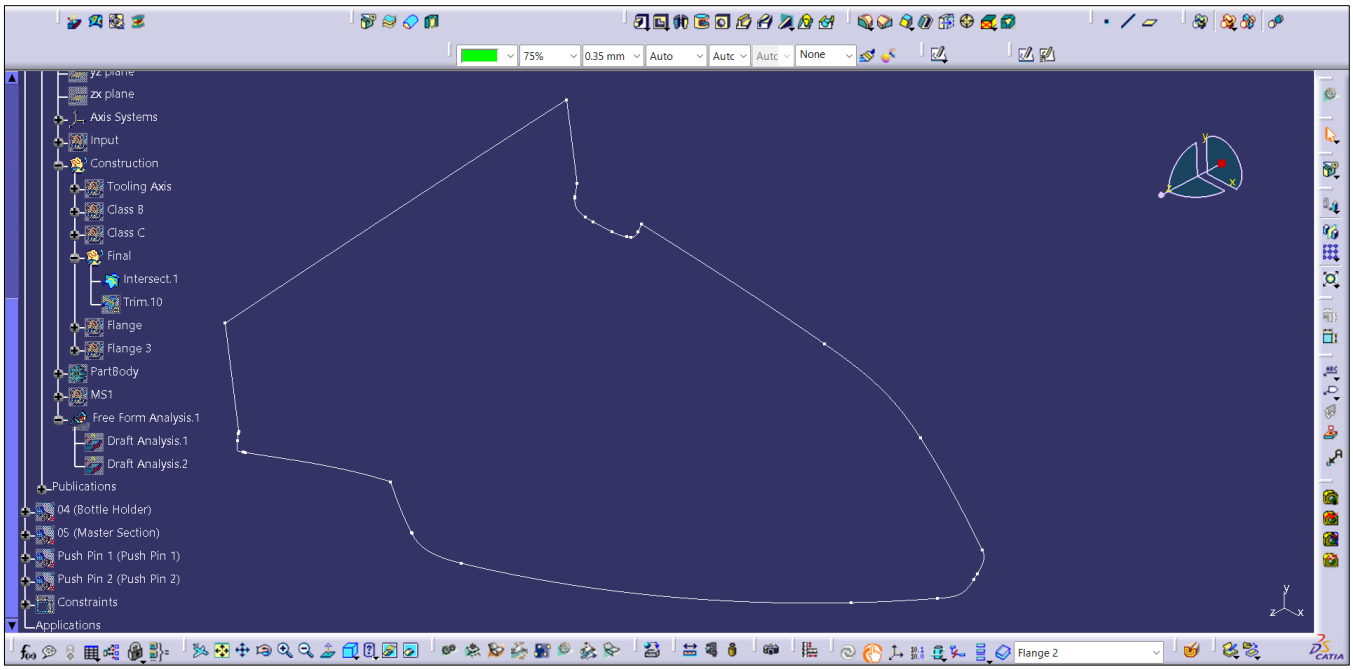


- Using Join command, join trim 3 surface & the class A surface. The final class C surface will be as below.

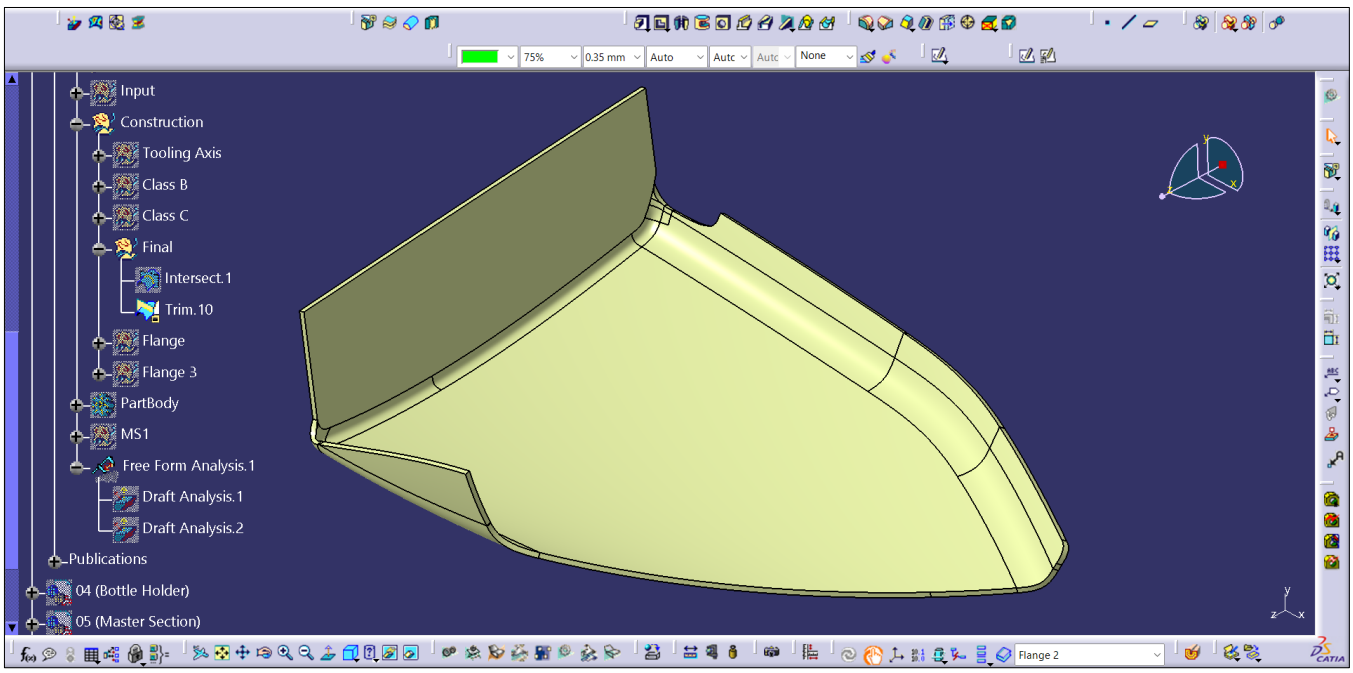


Creating Final closed Surface:

- Using the intersect command, check whether both the Class-B surface & class-C surface are properly intersecting. If there is no black point in the intersection result, then the two surface are properly intersecting.

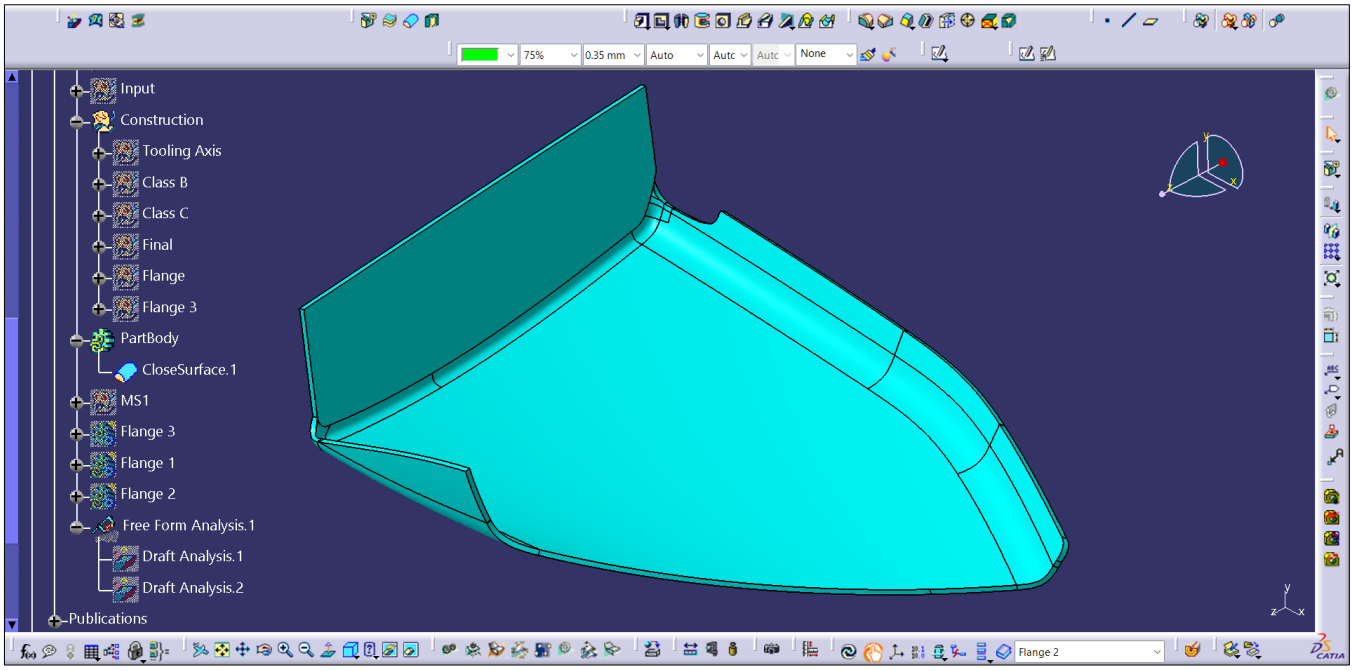


- After ensuring both the Class B & Class C surfaces are properly intersecting, using the trim command, trim both the surface to form a closed surface.



Creating Solid Part:

- Change the workbench to Part design and using closed surface command create the solid part model.
- The final solid part for lower substrate is as below.

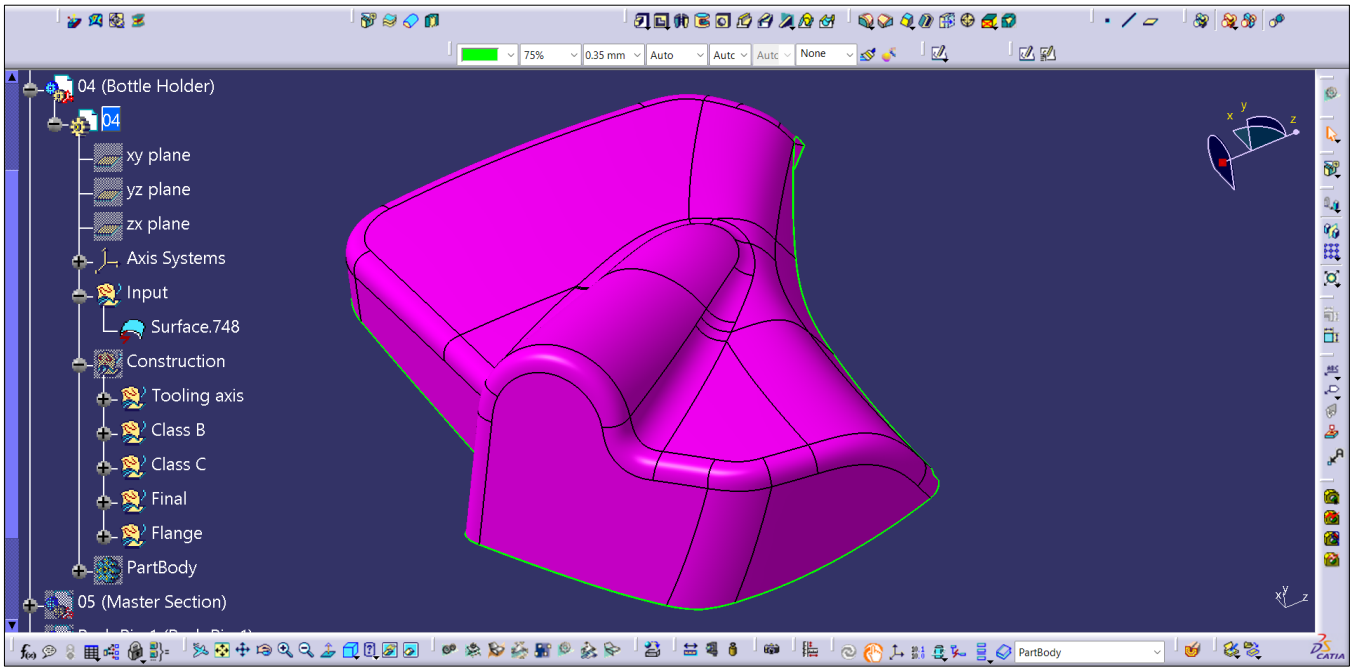


Part 3: Bottle Holder:

Creating Essential Geometrical Sets:

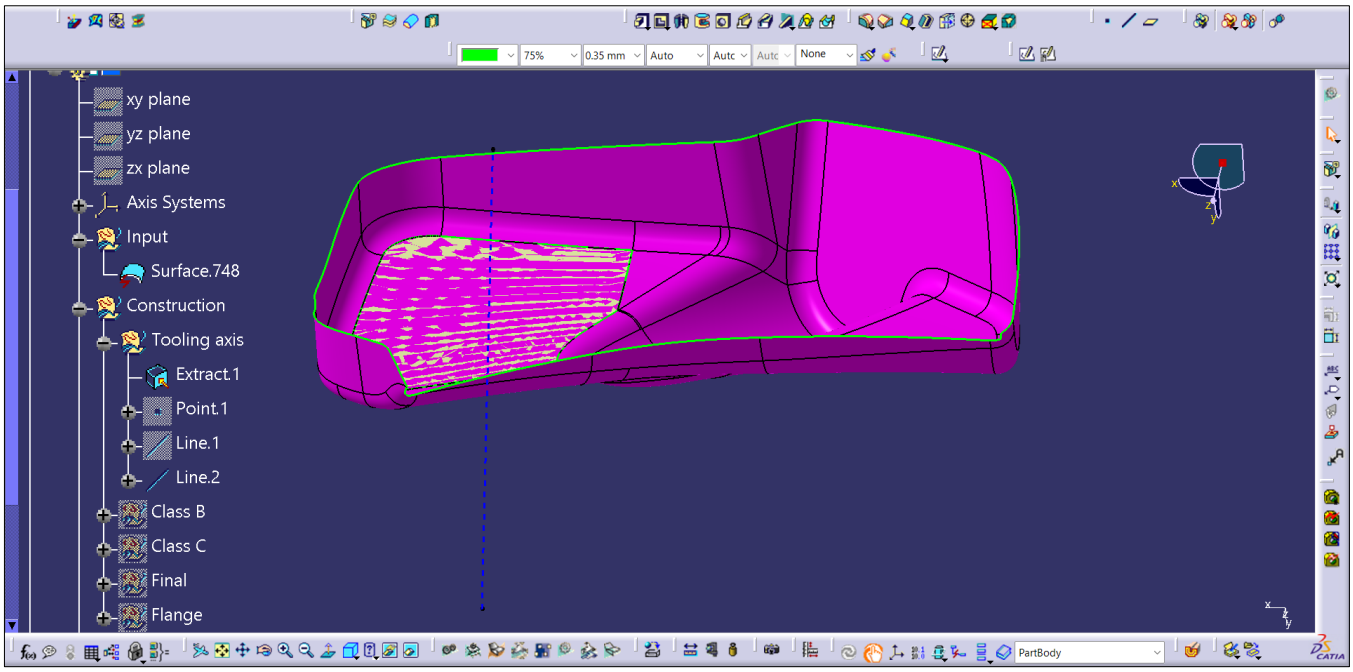
The first step involves in creating all the essential Geometrical sets itself under a geometrical set named Construction for the given model which includes:

- Class A surface (Input)
- Tooling Axis
- Class B surface
- Class C surface
- Final A+C
- Engineering Features



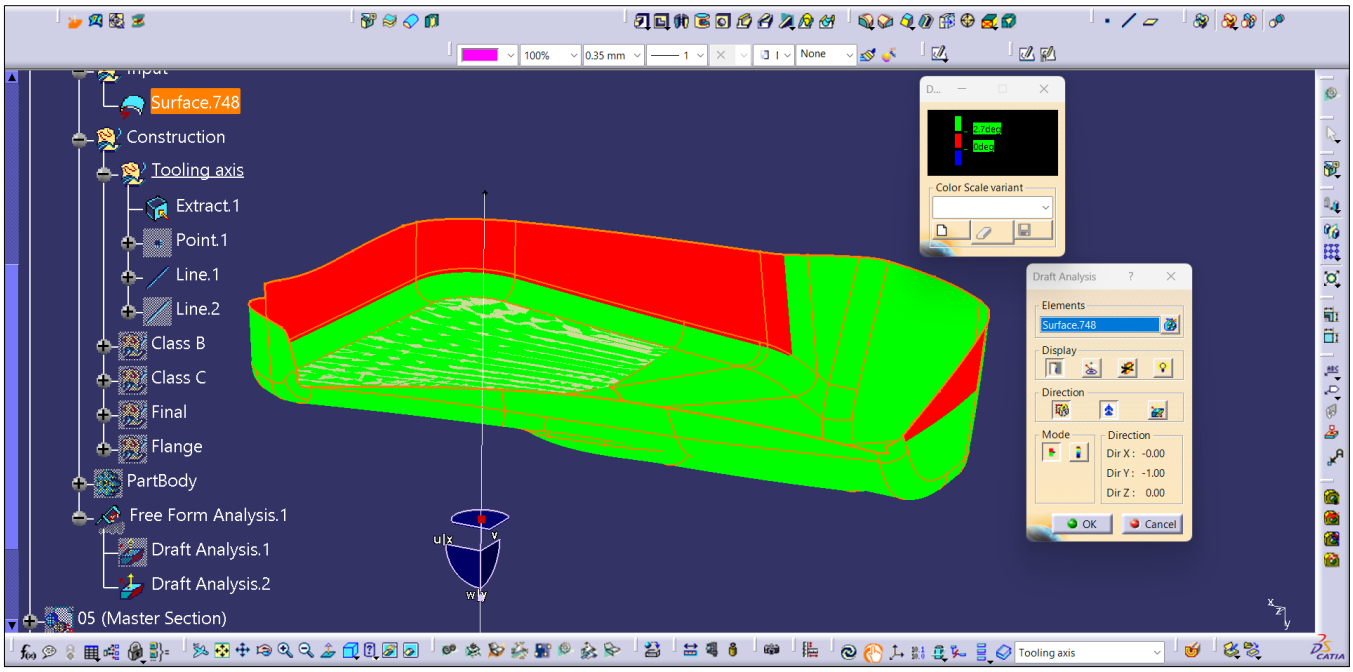
Creating Tooling Axis:

- Extract the flat surface from the Class A Surface using extract command
- Create a point on the surface and create a line on Z axis with the point as reference.



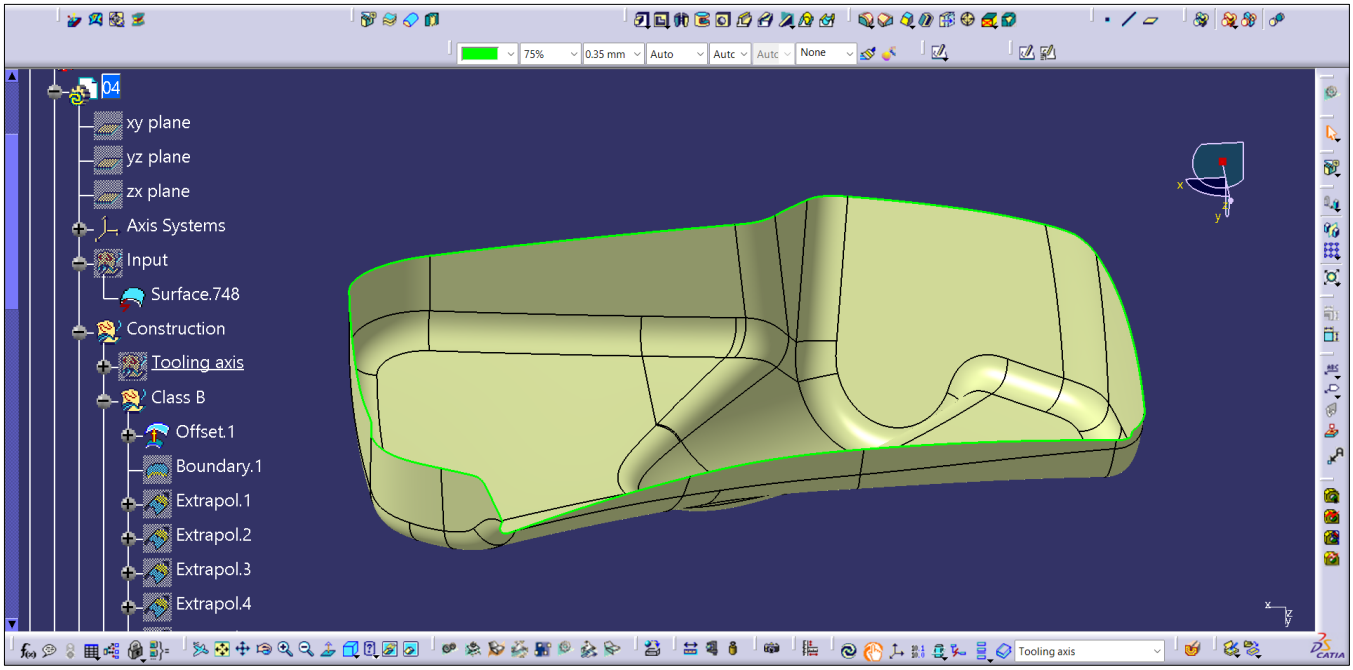
Draft Analysis:

- Check draft analysis from Feature draft analysis tool to check whether the given Class A surface is clearing the draft angle of 3°.

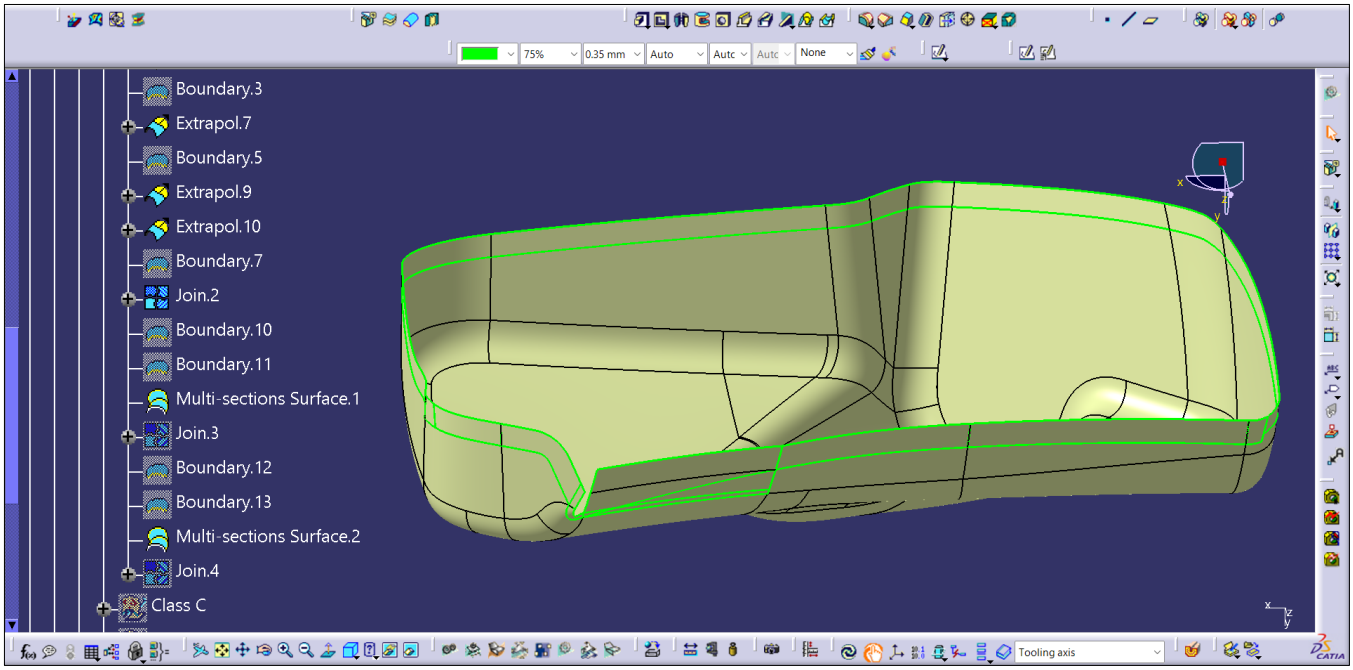


Creating Class B Surface:

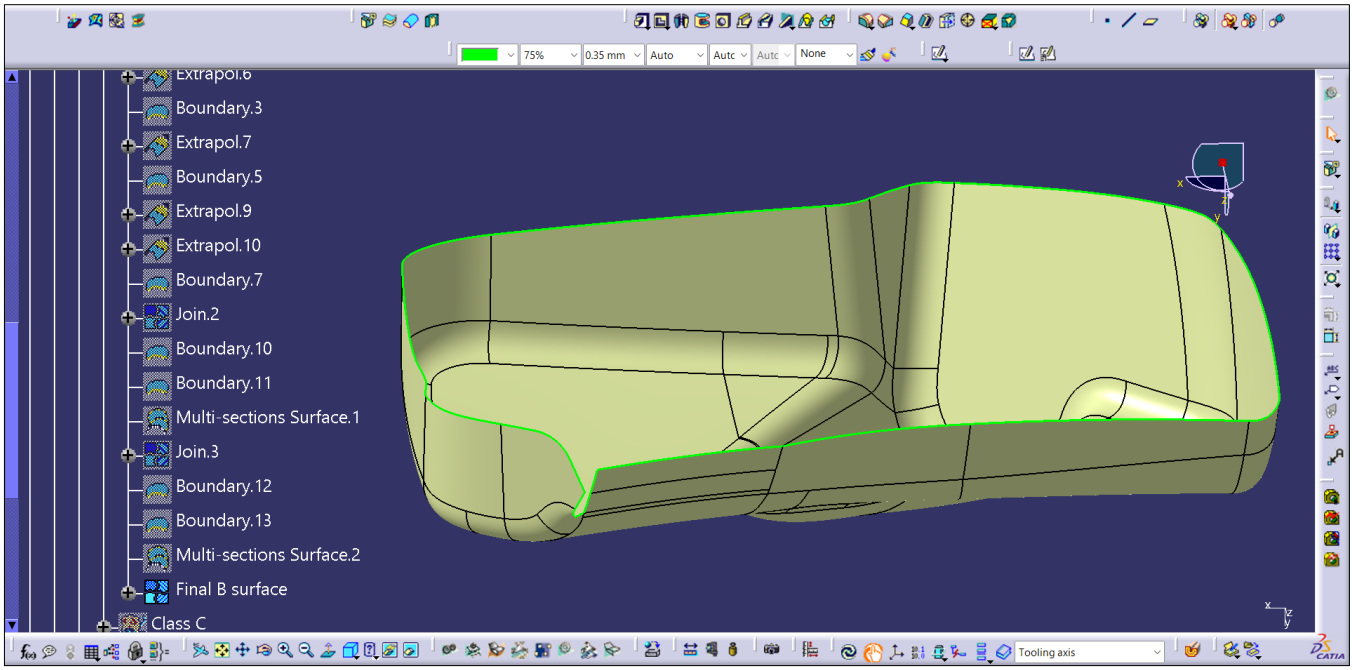
- First, the given Class A surface should be offset of 2.5mm using the offset command and the offsetted surface should be checked whether it contains any open patches.



- Using extrapolate command, extrapolate every edge of the class A surface so that the Class B surface will be properly intersected to the Class C surface.

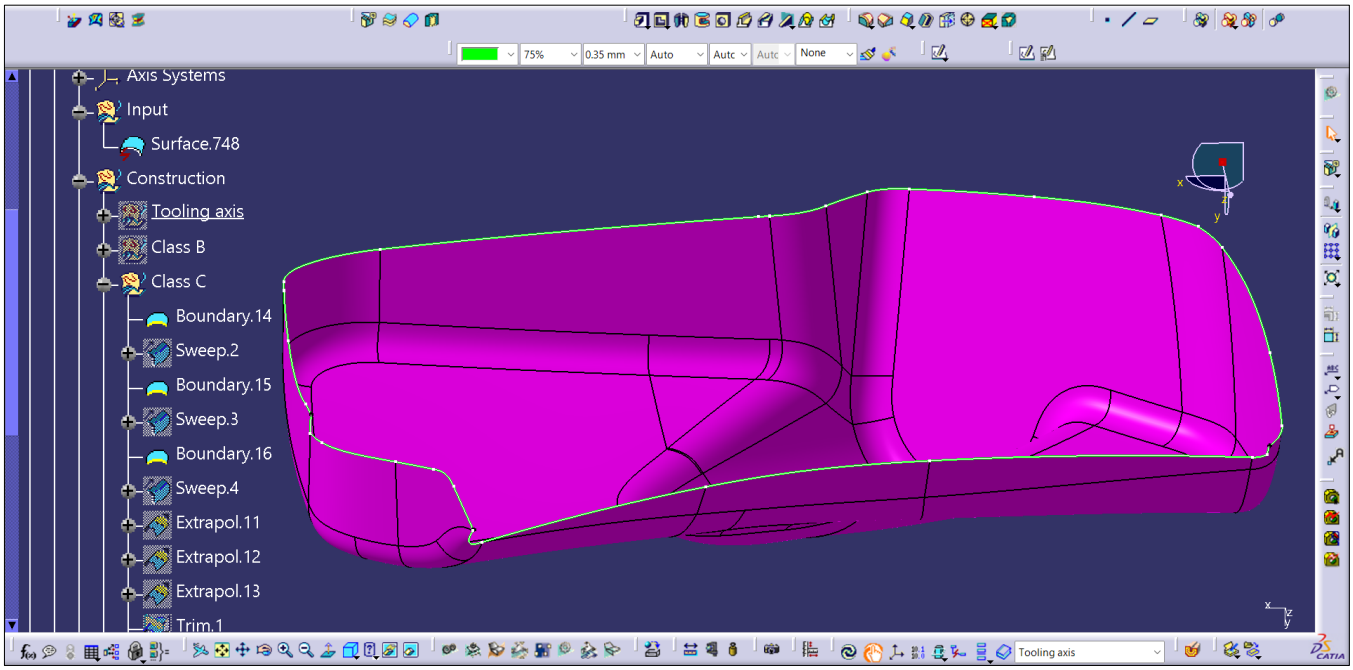


- Publish the final B surface for future reference. The Final B surface will be as below:

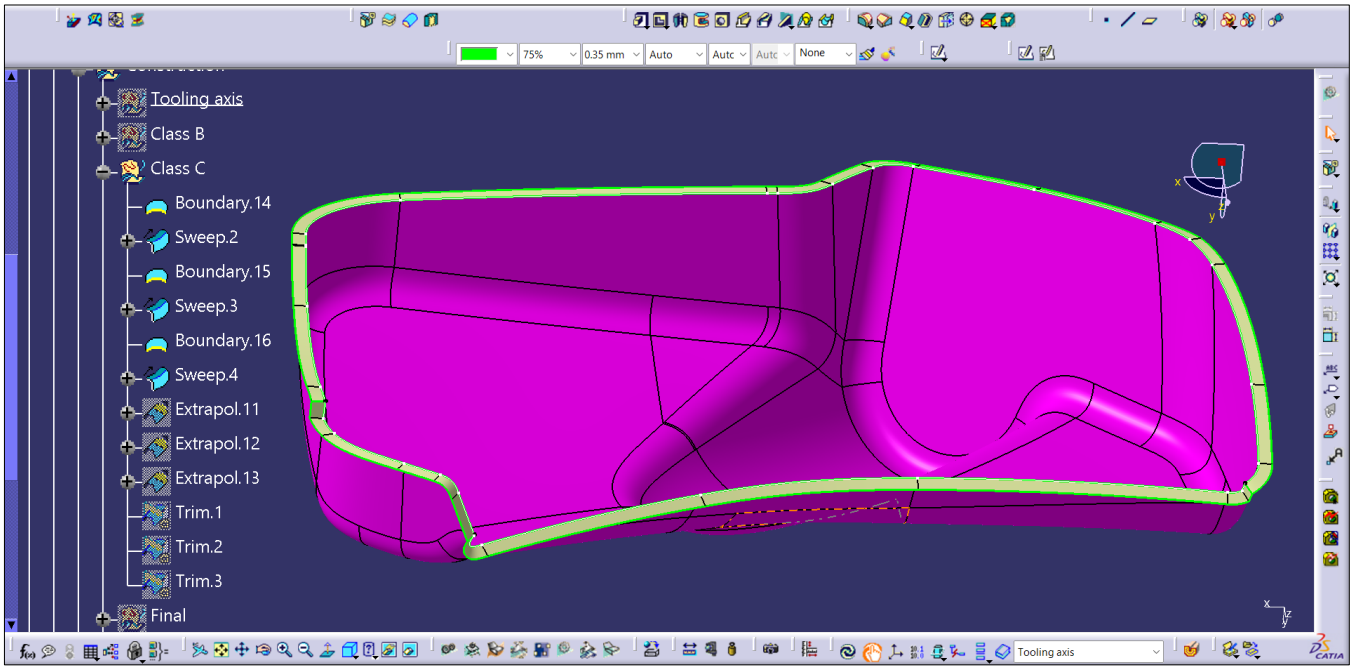


Creating Class C Surface:

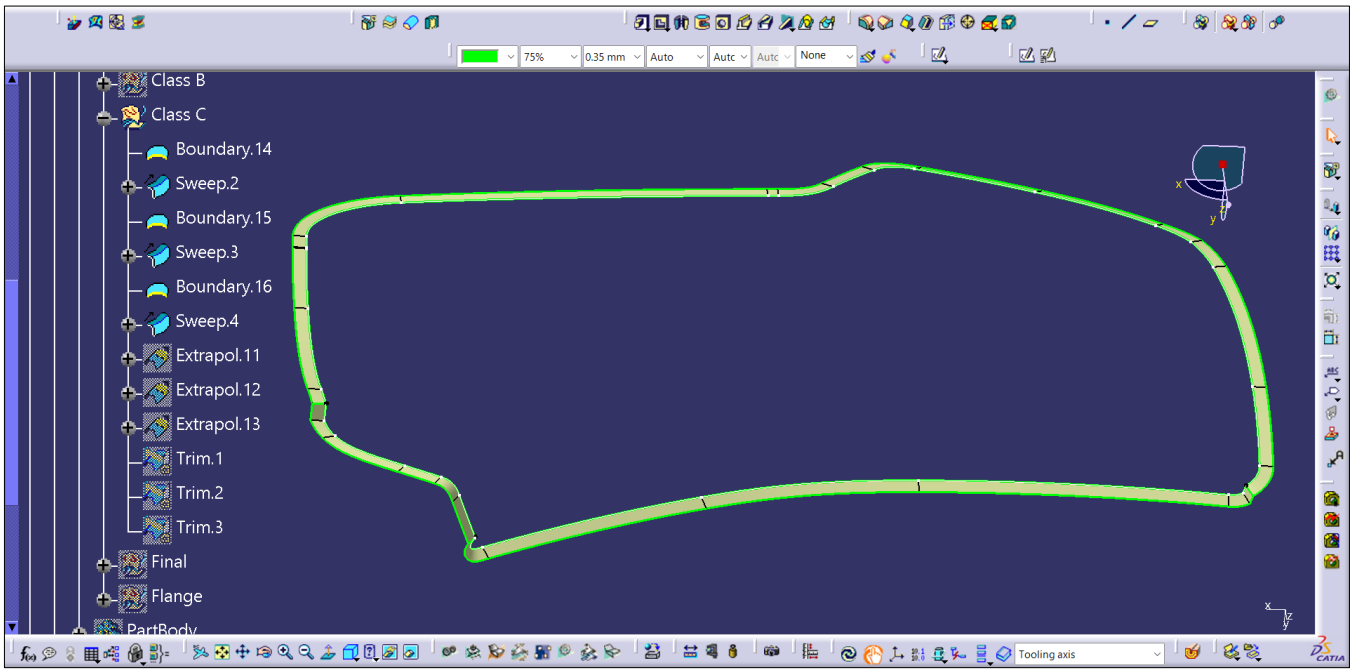
- Enable the Class A surface & create a boundary on all the edges using boundary command.



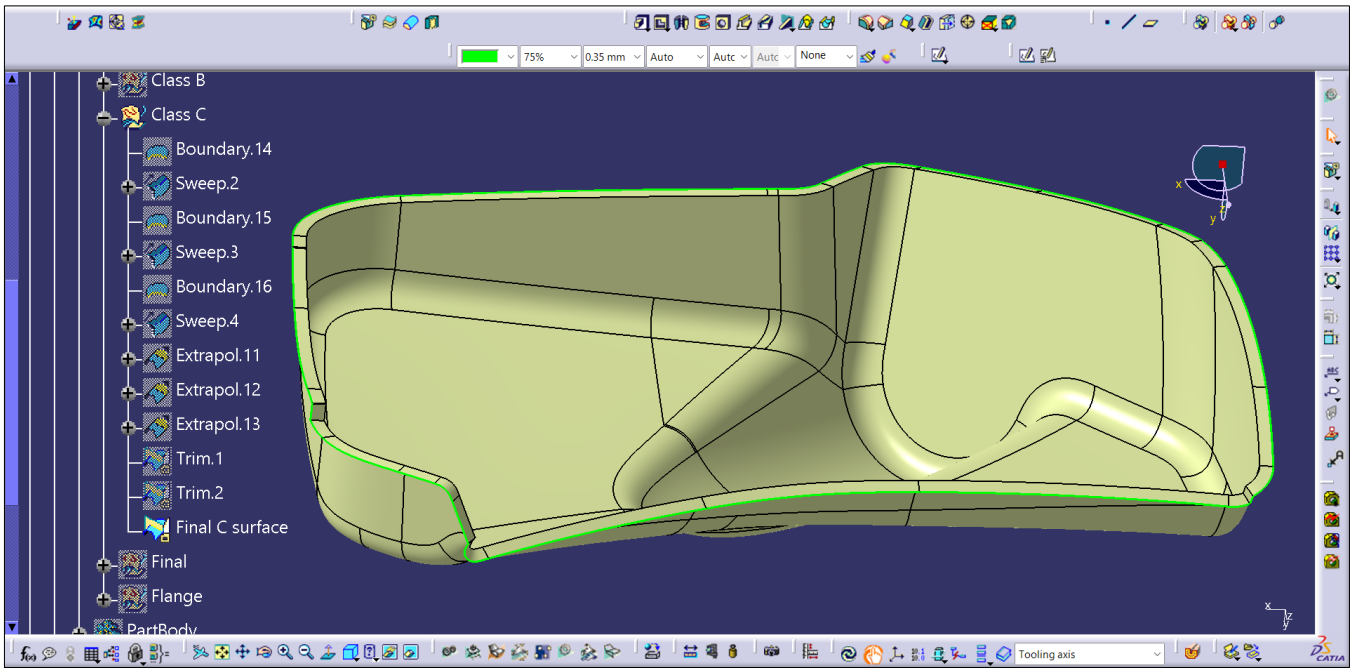
- Using sweep command - with reference surface command create the surface on the boundary with the angle of 90° & this should be repeated for all the edges which are not parallel to the tooling axis.



- Using trim command, join all the sweep surfaces.

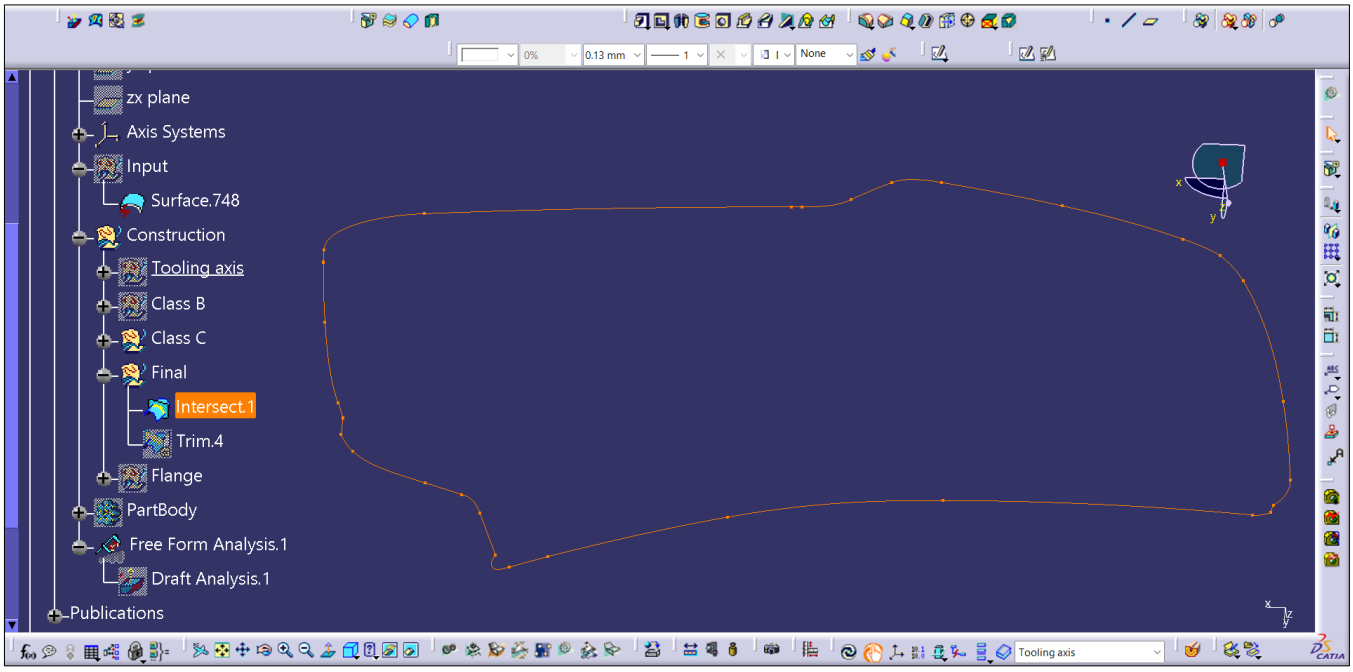


- Using Join command, join trim 3 surface & the class A surface. The final class C surface will be as below.

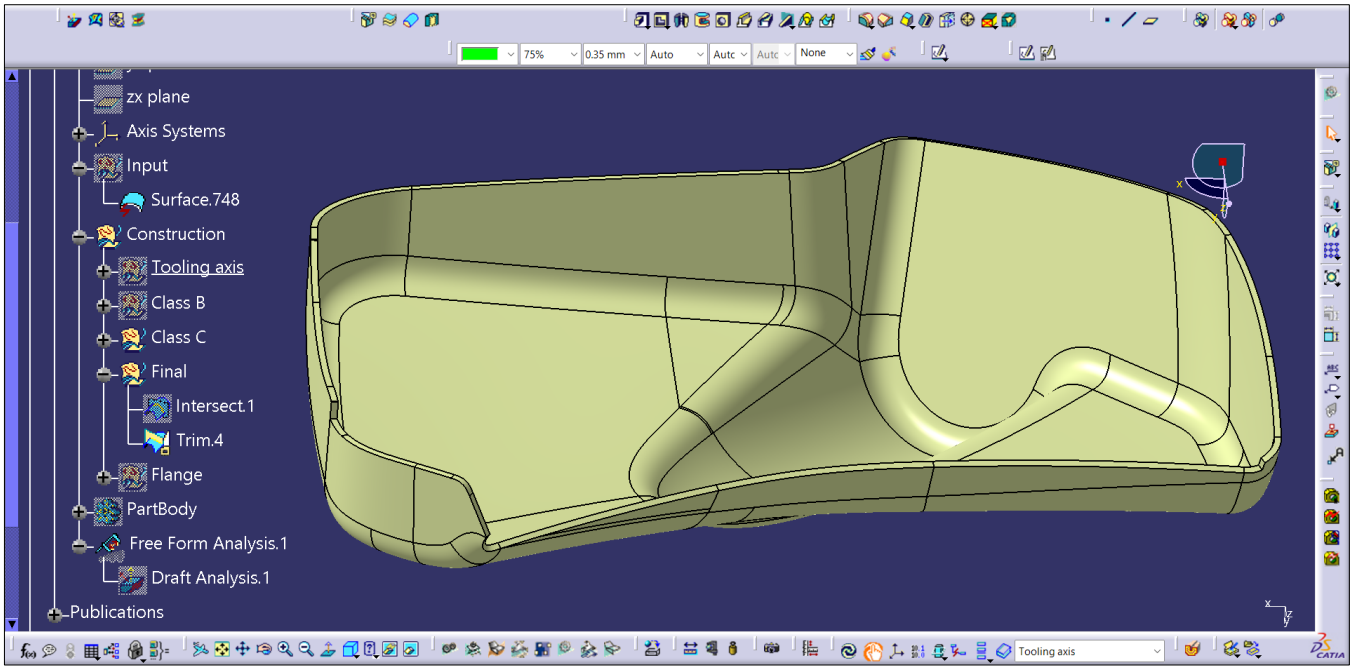


Creating Final closed Surface:

- Using the intersect command, check whether both the Class-B surface & class-C surface are properly intersecting. If there is no black point in the intersection result, then the two surface are properly intersecting.

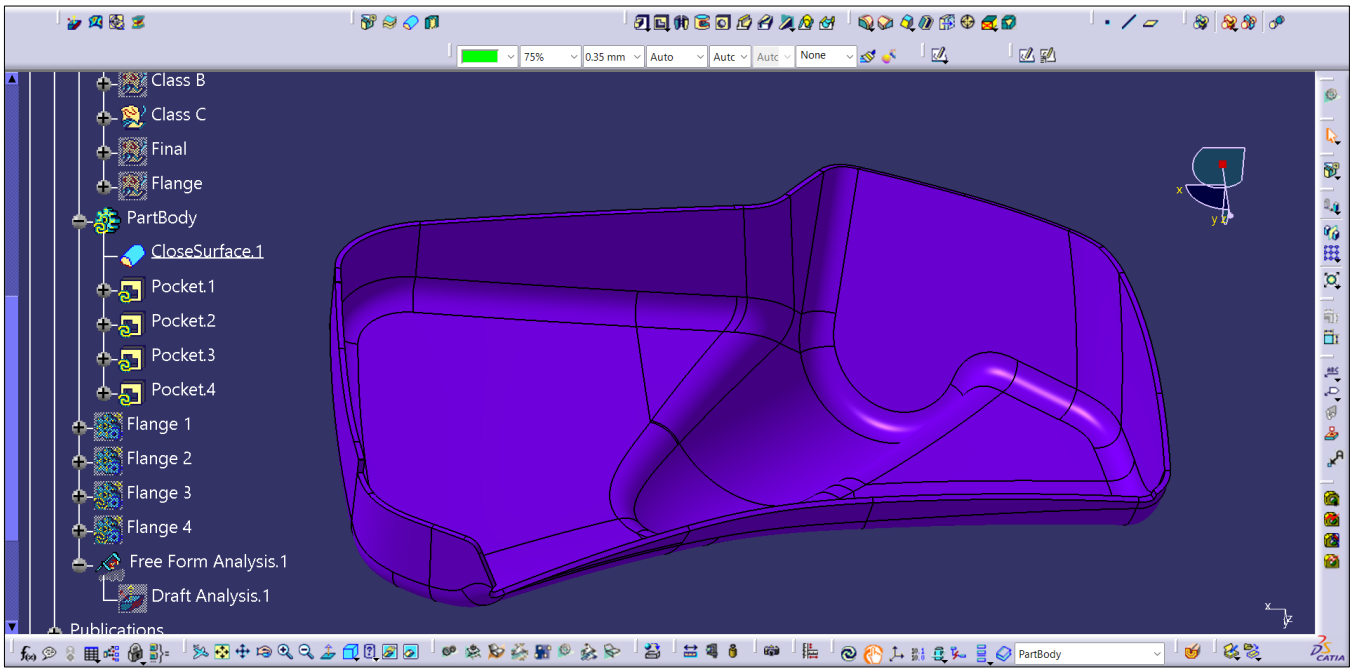


- After ensuring both the Class B & Class C surfaces are properly intersecting, using the trim command, trim both the surface to form a closed surface.



Creating Solid Part:

- Change the workbench to Part design and using closed surface command create the solid part model.
- The final solid part for lower substrate is as below.



Engineering Features:

Engineering features in automotive trim design are the functional elements that ensure the trim component's performance, durability, and manufacturability, while also considering aesthetics and ergonomics. These features are often hidden from view but play a crucial role in the overall quality and functionality of the trim.

Key Engineering Features

- **Reinforcements:** These structures provide rigidity and strength to the trim component, preventing deformation and damage. They can be ribs, bosses, or webs incorporated into the design.
- **Fasteners and Attachments:** These elements secure the trim to the vehicle's body or other components. They include clips, hooks, snaps, screws, and adhesives.
- **Material Selection:** The choice of material significantly impacts the trim's properties, such as weight, durability, and cost. Engineers consider factors like flexibility, impact resistance, and chemical resistance.
- **Heat Stakes and Welding Points:** These are used to join different parts of the trim component securely.
- **Environmental Considerations:** Trim components must be designed to withstand various environmental conditions, including temperature extremes, humidity, and UV radiation.
- **Cost Optimization:** Engineering features should be designed to be cost-effective without compromising functionality or quality.

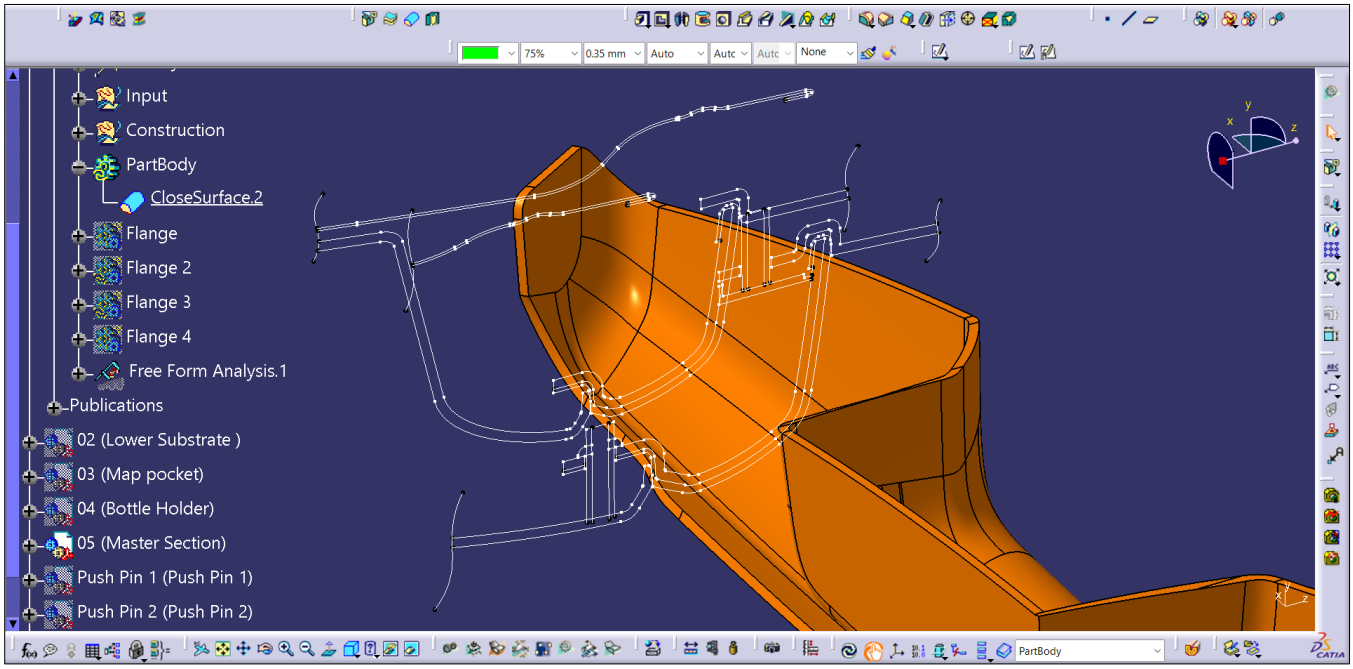
Importance of Engineering Features

- **Functionality:** Engineering features ensure the trim component performs its intended function reliably.
- **Durability:** These features contribute to the trim's longevity by preventing damage and wear.
- **Aesthetics:** While often hidden, engineering features can indirectly impact the visual appeal of the trim by supporting its shape and structure.
- **Manufacturing Efficiency:** Proper engineering ensures efficient production processes and reduces costs.
- **Safety:** In some cases, engineering features can contribute to occupant safety, such as by providing reinforcement or proper attachment points.

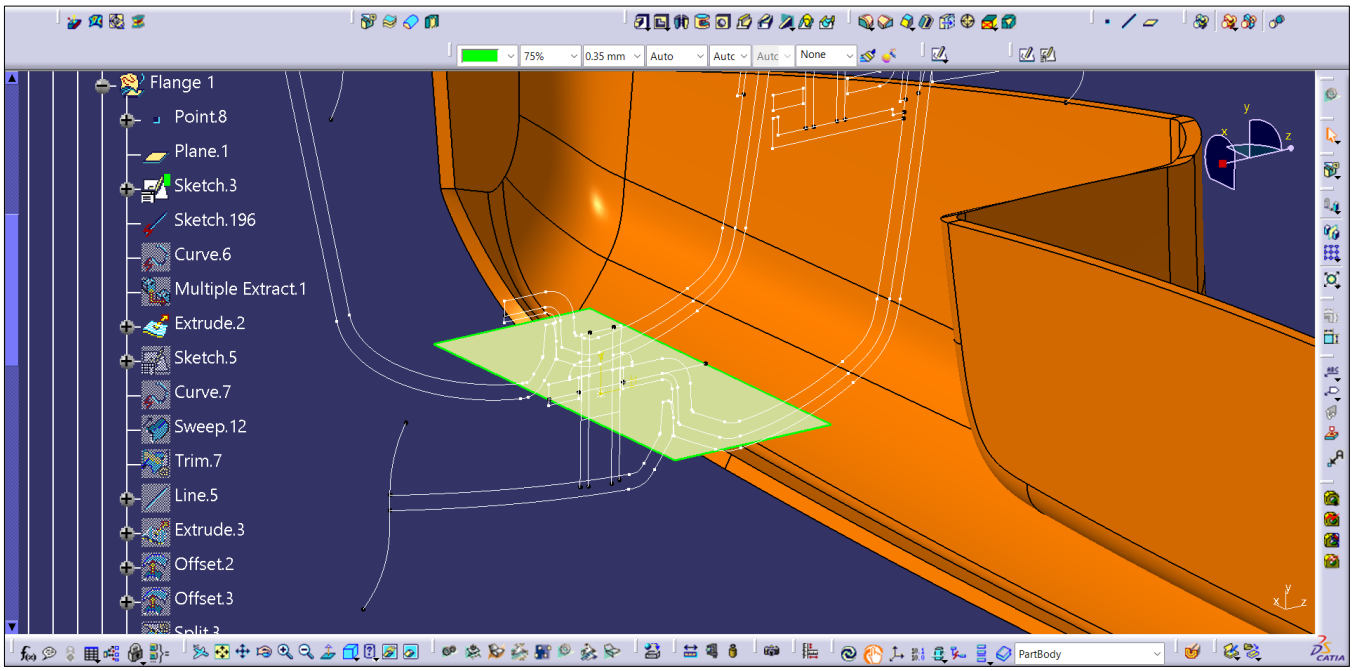
Part 1 Door Panel:

Creation of Flange:

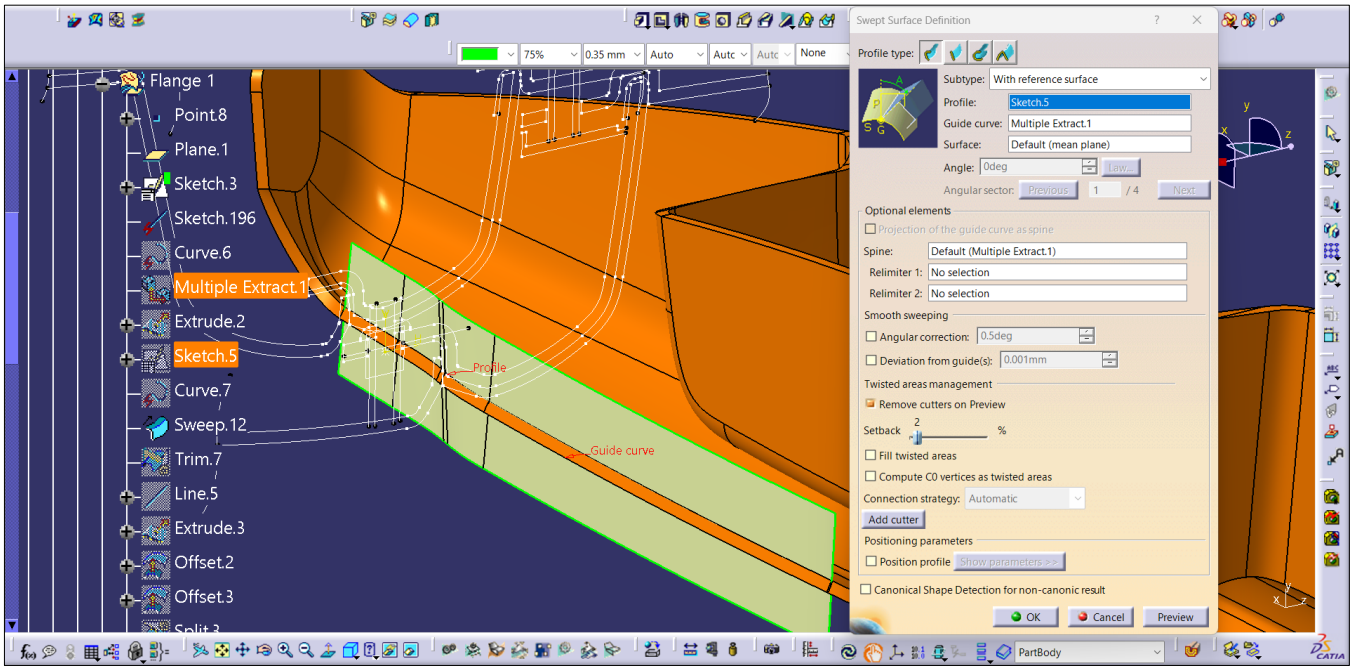
- Create a geometrical set with the name of flange under the Construction geometrical set.
- Define the Flange geometrical set and enable the Master section and observe which engineering feature has to be made and the location of that feature has to be determined.
- Here with the reference of master section, two flanges have to be created on the bottom edges of the door panel.



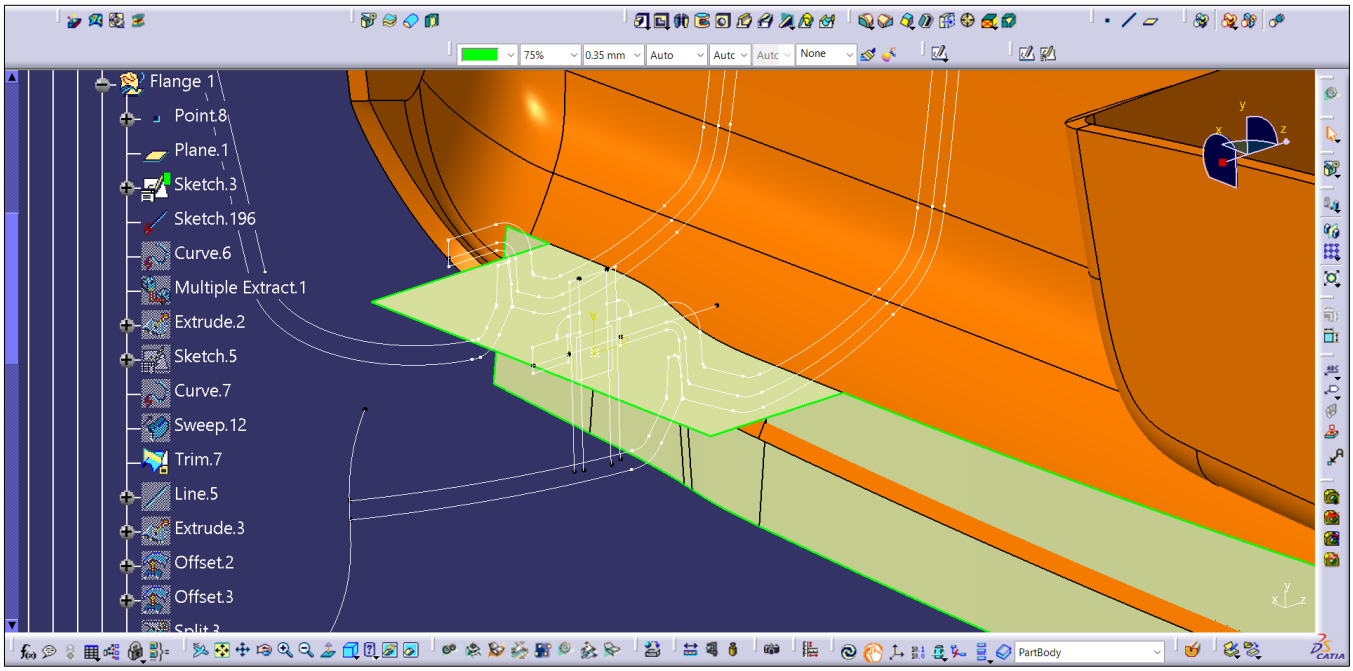
- Create a plane using 3-point method with the master section has a reference.
- Create a sketch on that plane by projecting the line of the flange from the master section.
- Isolate the sketch so that, the sketch won't be linked with the master section part.
- Using extrude command create a surface from the sketch.



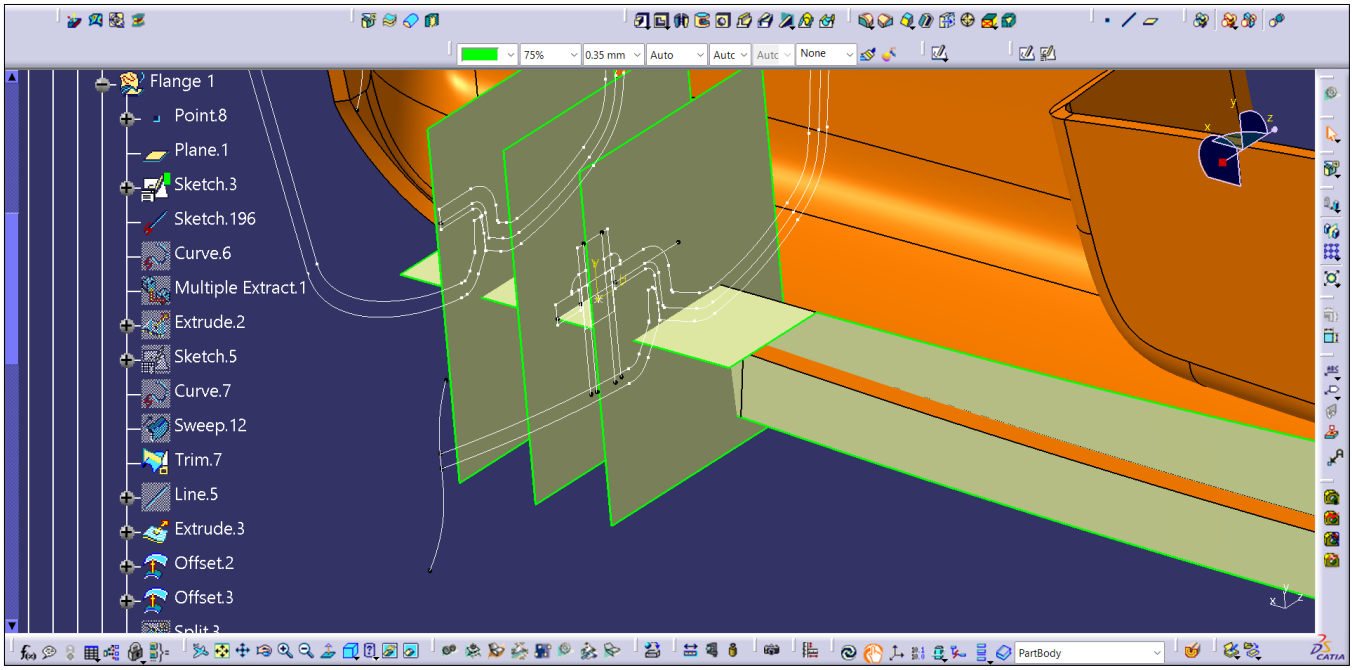
- Extract the lower edge of the door panel part & using sweep command, create a surface with the extracted edge as reference.



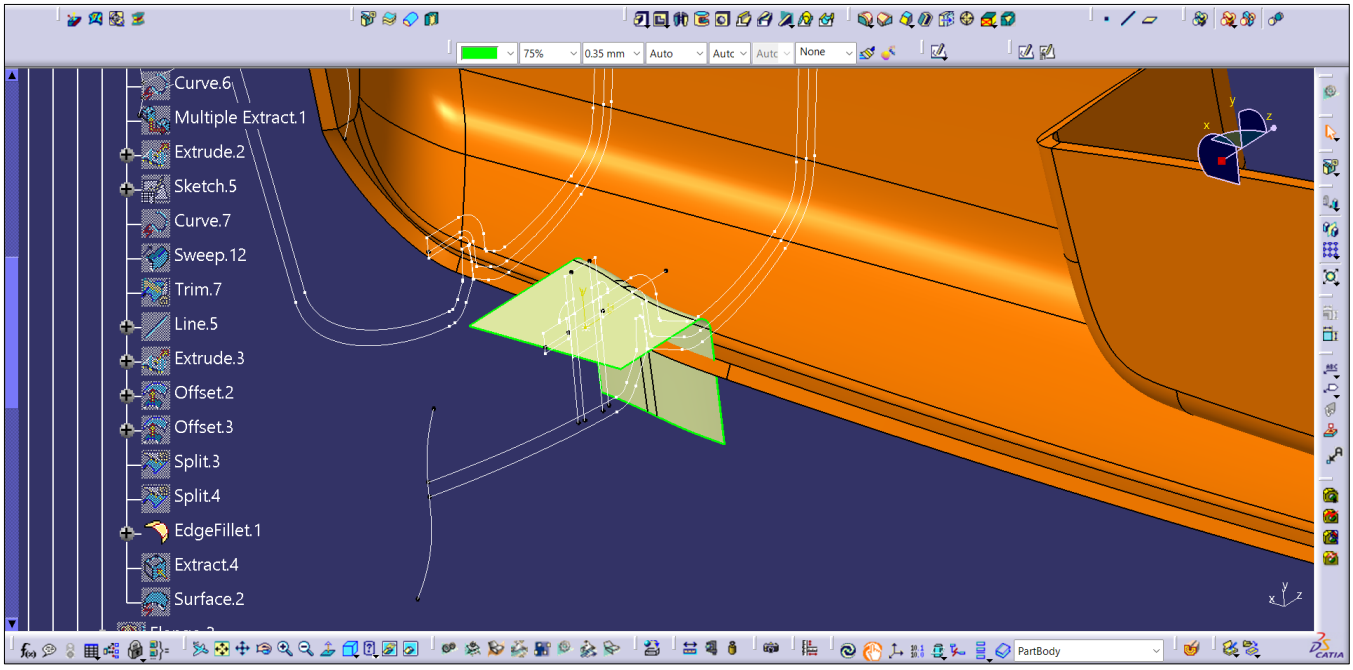
- Using trim command, trim both the extruded surface and sweep surface.



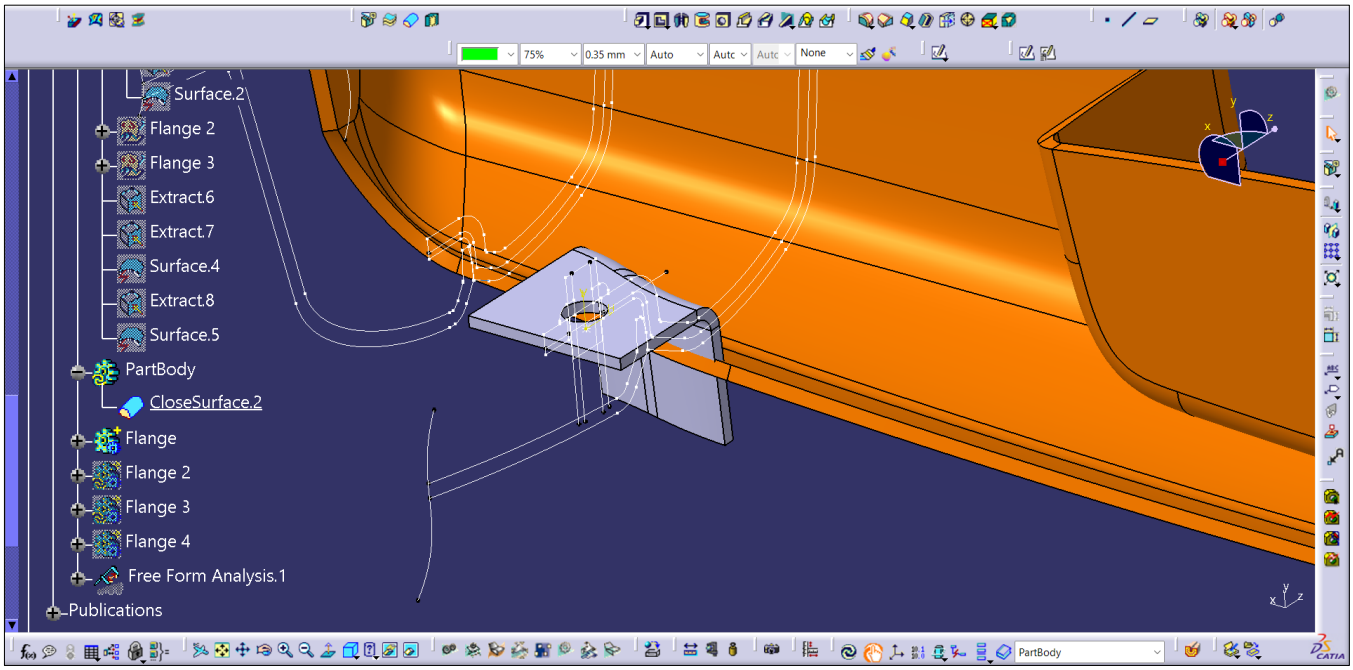
- Create a line along the y-axis and create a surface using extruded surface with the line a base.
- Offset the extruded surface of 15mm on both the side of the extruded surface.



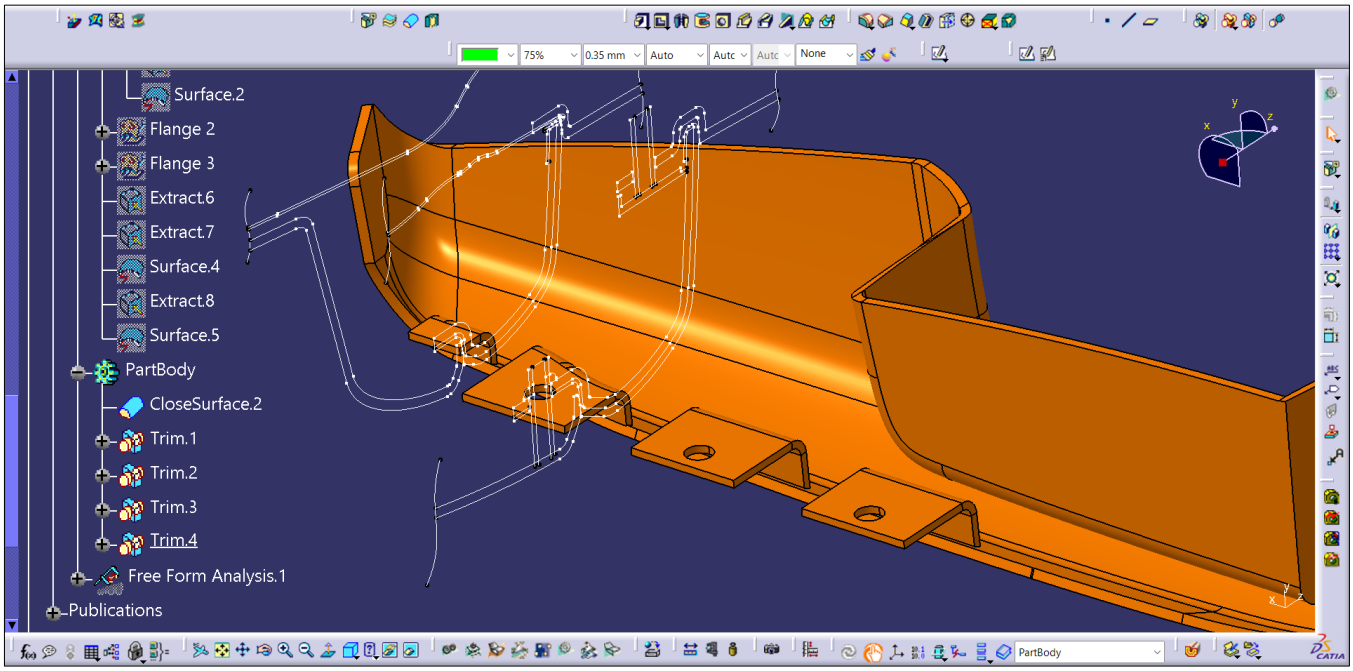
- Using split command, cut the trimmed surface using the two-offset surface.
- Measure the fillet radius on the master section & create a fillet on the edge using edge fillet command.



- Change the workbench to part design and using thick surface command, create a solid body from the created surface.



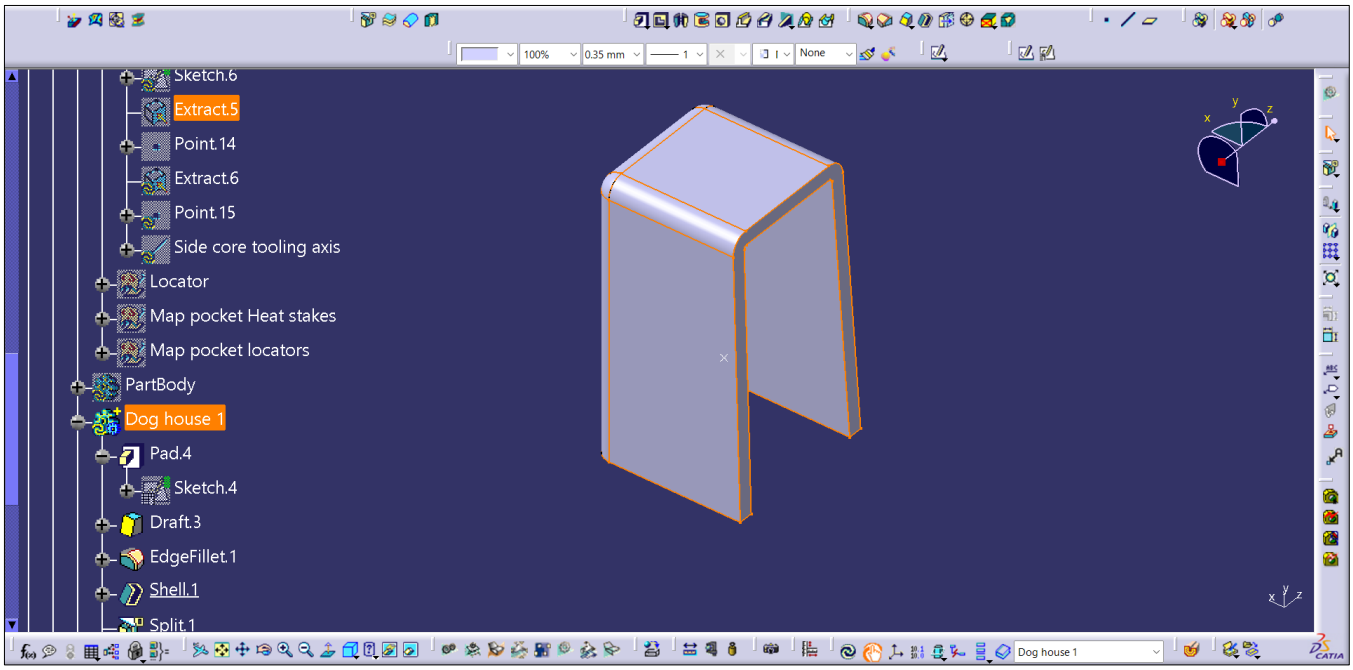
- Using Union trim command merge the flange with the Door panel part body.
- Repeat the same process and create 2 or 3 flanges on the same edges.



Part 2 Lower Substrate:

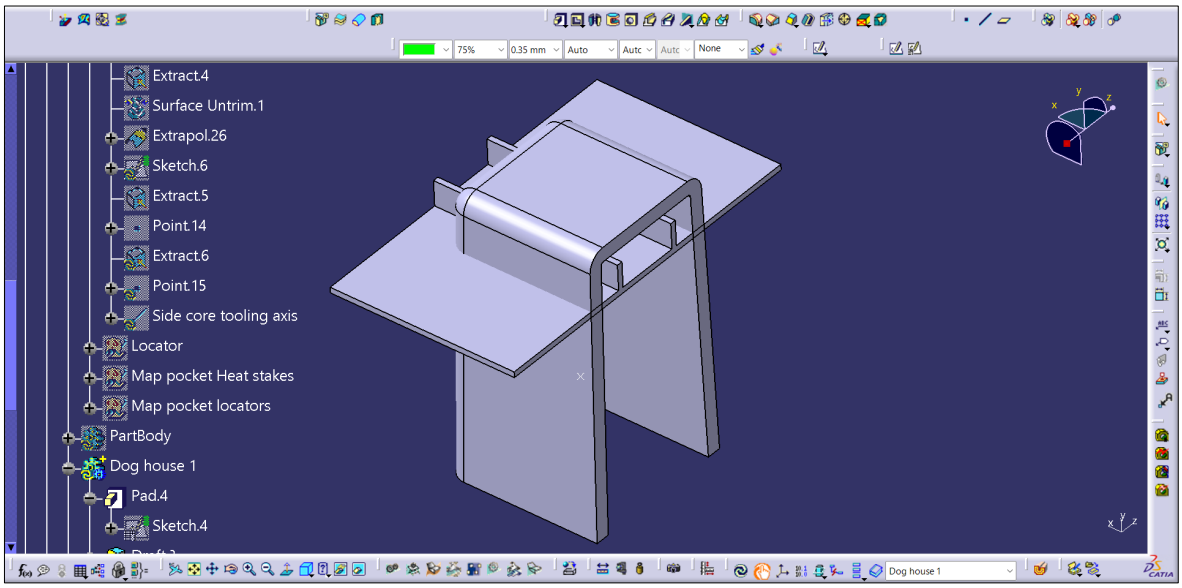
Creation of Dog house:

- Create a Geometrical set in the name of Doghouse.
- Create a plane parallel to the ZX plane with the given point as origin.
- Create a sketch of 27x27 of width & breadth and convert that sketch into a solid body with height of 50mm.
- Create a draft with a draft angle 1.5° at all the four vertical sides of solid by keeping the plane as neutral axis and create an edge fillet of 3 mm and top and rear side corners of the doghouse.
- Use shell command to create a shell at the front and bottom of the dog house.

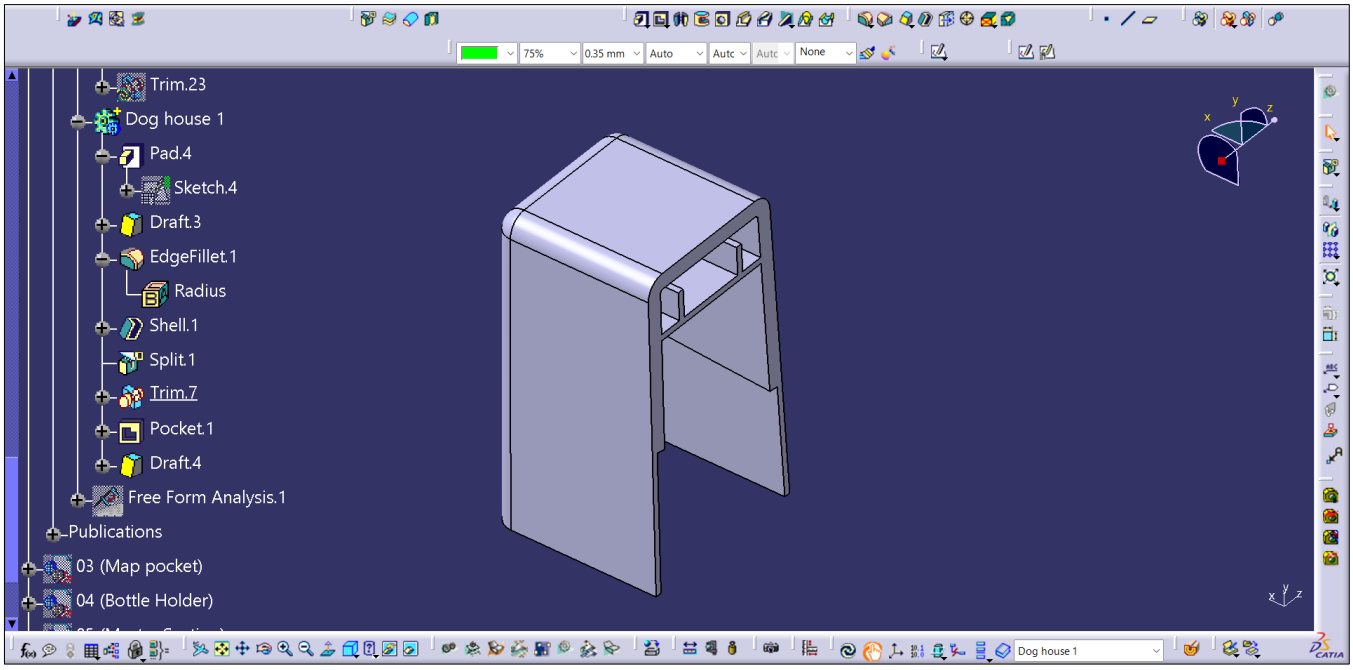


Creation of Rib:

- Create a sketch of the rib according to the pushpin geometry & pad it so that it intersects both front & rear portions of the dog house.
- Extract the front surface of the Dog house and untrim the surface using untrim command, split the frontal rib portions with the untrimmed surface.

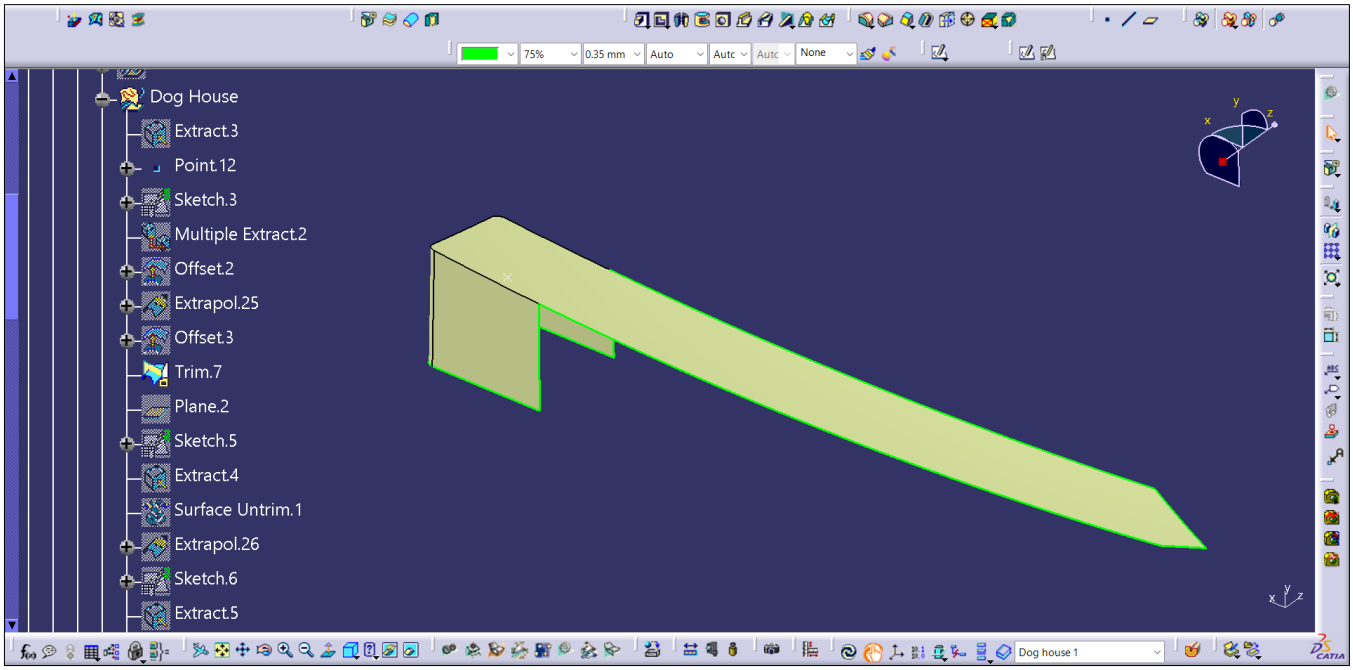


- Using union trim command, blend the ribs with the doghouse & select portions of the ribs which are inside the doghouse and the result will be as below.

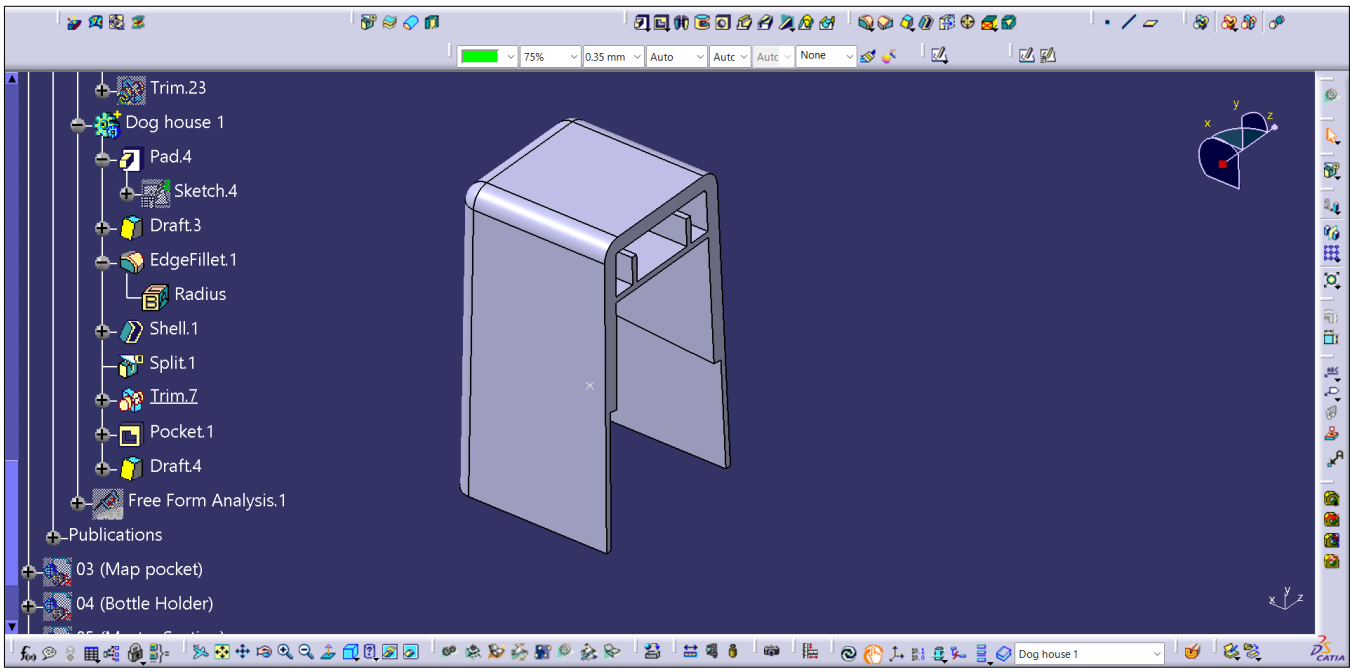


Creating cavity of doghouse mold:

- Extract the side faces of the doghouse using extract command & offset the extracted surface with 1mm and extrapolate the offset surface with 2mm approx.
- Create a line parallel to the base plane with the point a reference and create a surface with that line with the extrude command.
- Using trim command, trim both the extrapolated surface and the extruded surface and the result will be as below.

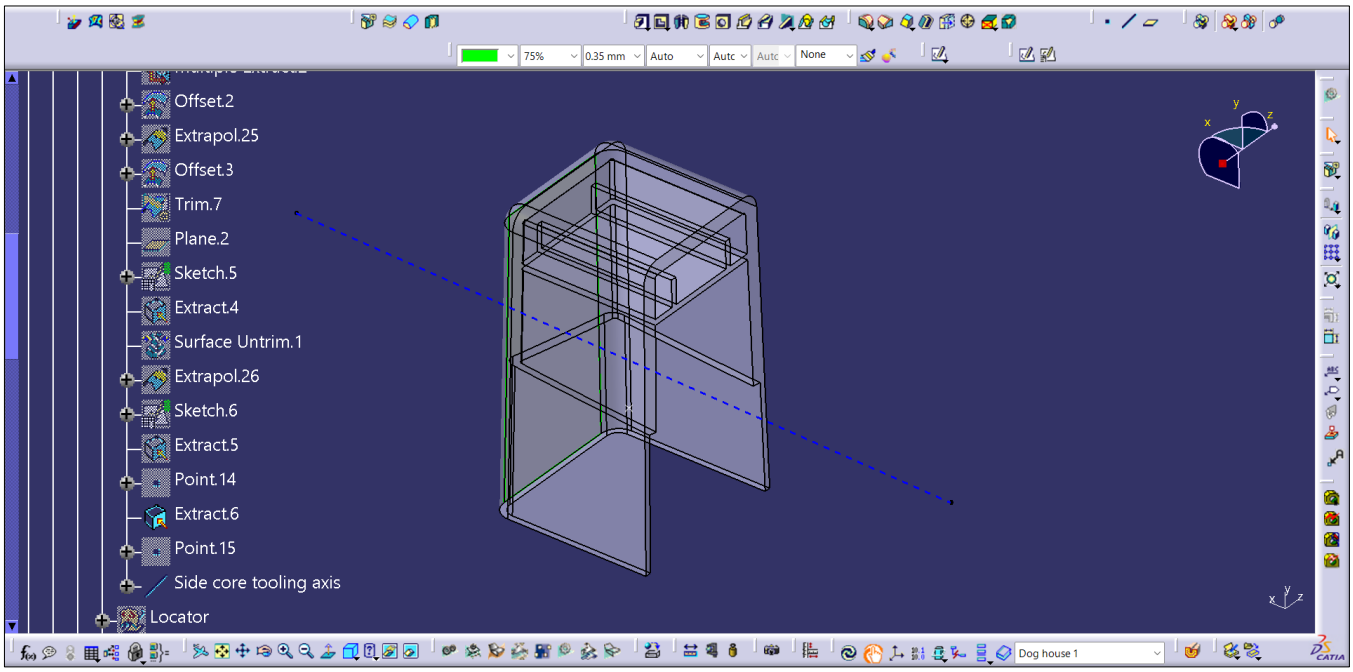


- Change the workbench to part design, and using split command, cut the solid model of the doghouse.



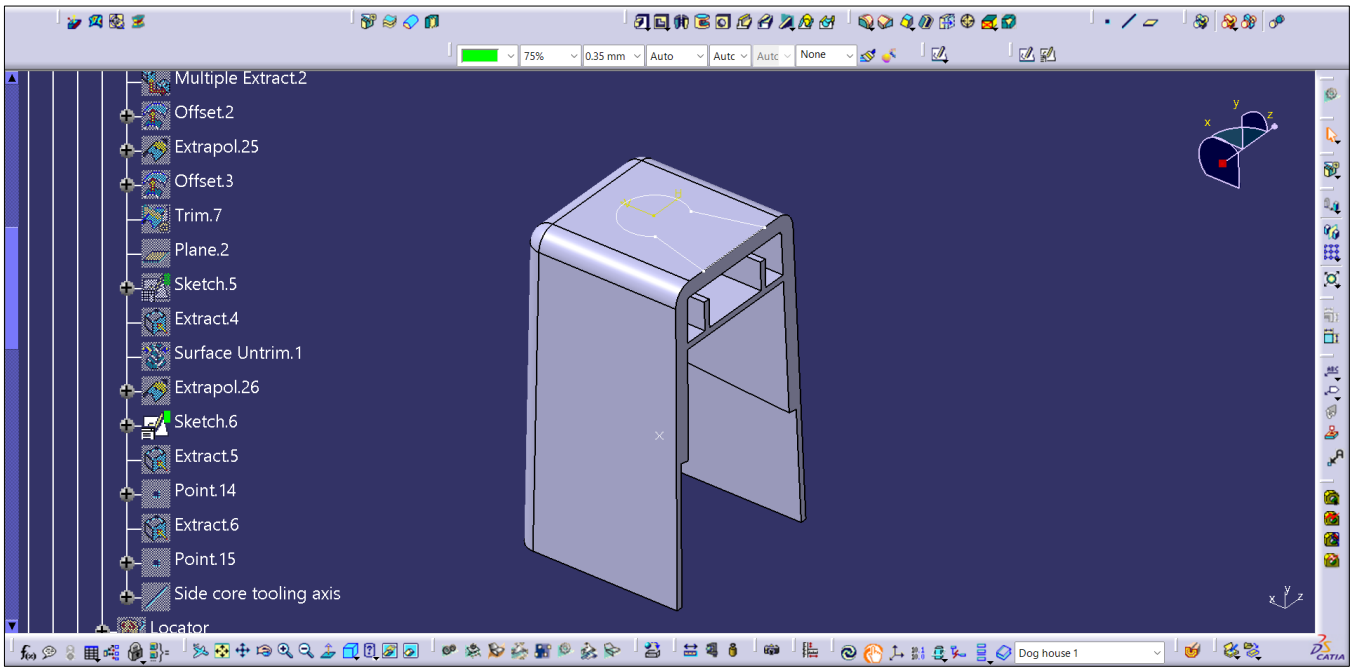
Creating tooling axis for doghouse:

- Extract the rear surface of the doghouse and create a point on the extracted surface.
- Create a line normal to the extracted surface with the created point as reference.

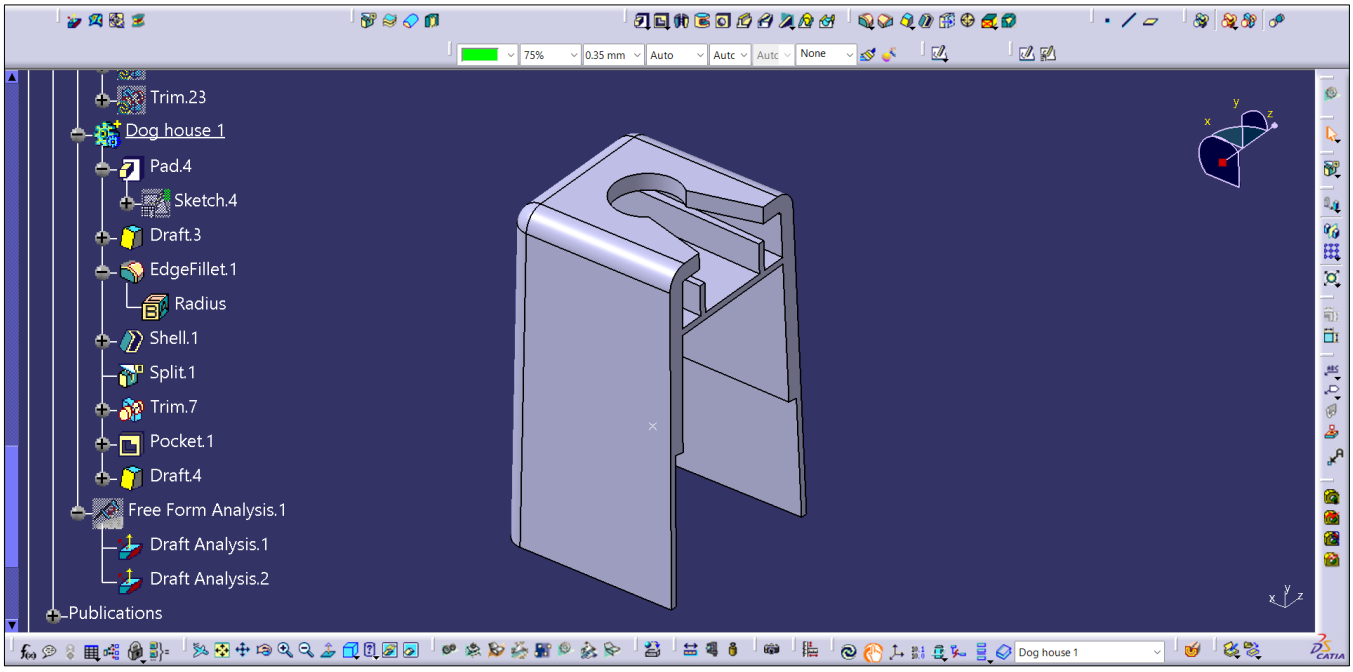


Creating pushpin slot:

- Create the pushpin slot sketch at the top face of the doghouse & using pocket command, create the pushpin slot on the top of the doghouse surface.

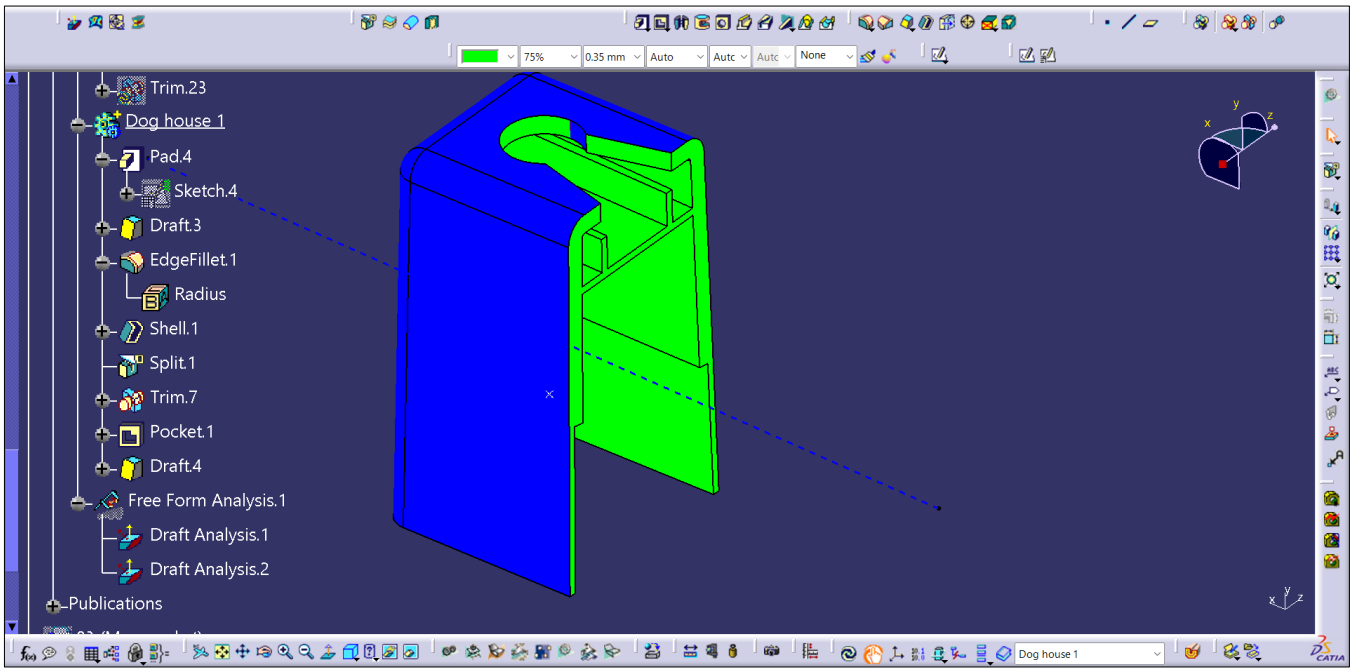


- The final dog house solid model will be as below.

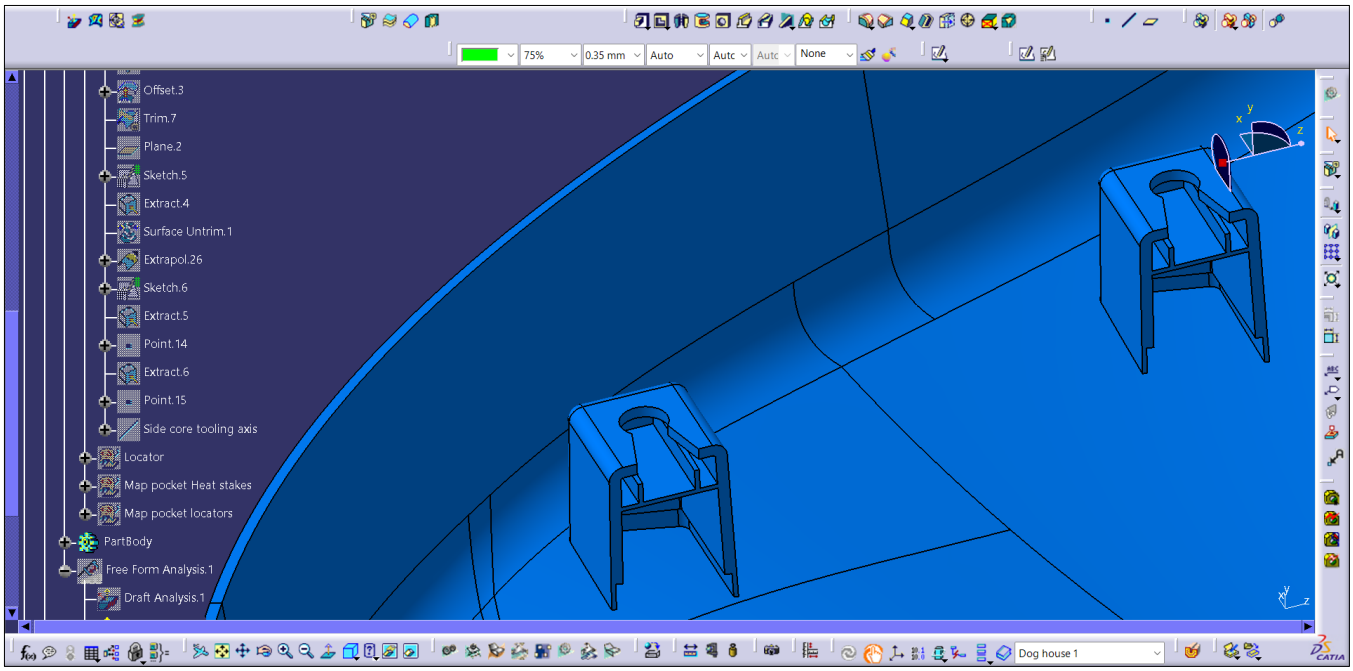


Checking Feature draft analysis for doghouse:

- To check whether the created doghouse will pass the tooling axis, use feature draft analysis command.

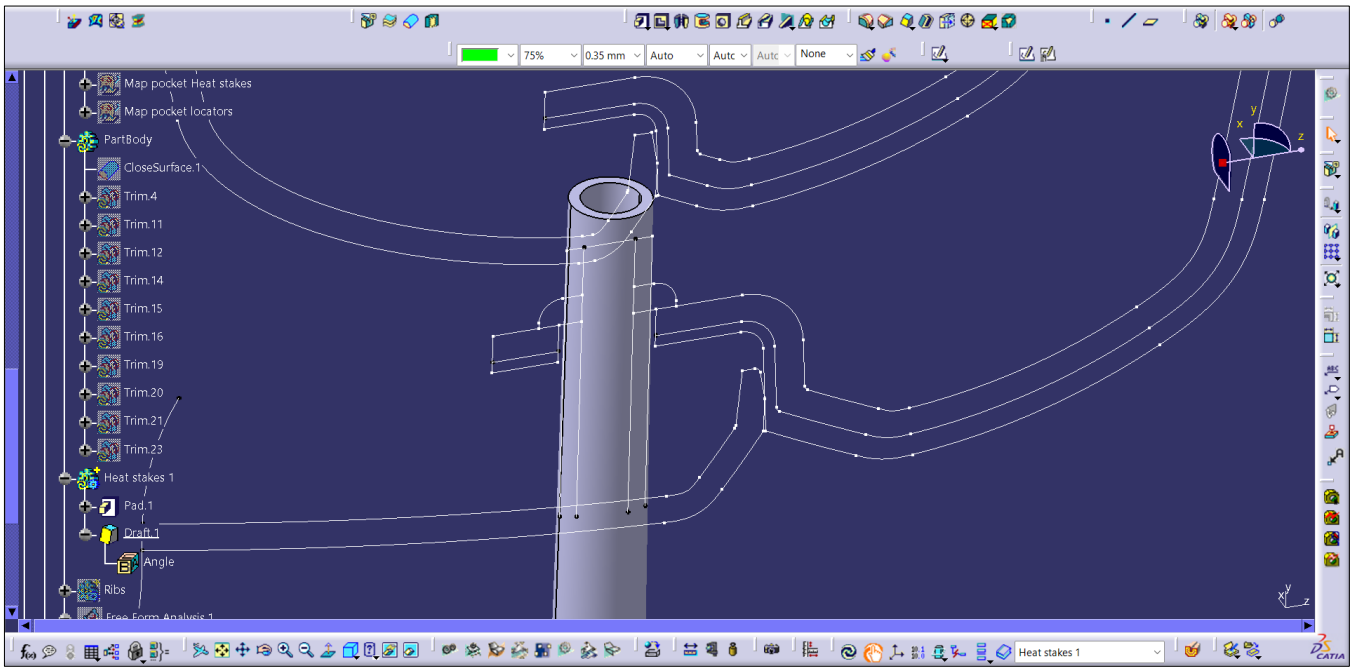


- Using union trim command blend the doghouse model & select excess portions of the doghouse which is below the lower substrate part model.
- Create another point in the nearby surface & using translate command, create a duplicate solid model with reference to that point too.
- The final result will be as below.

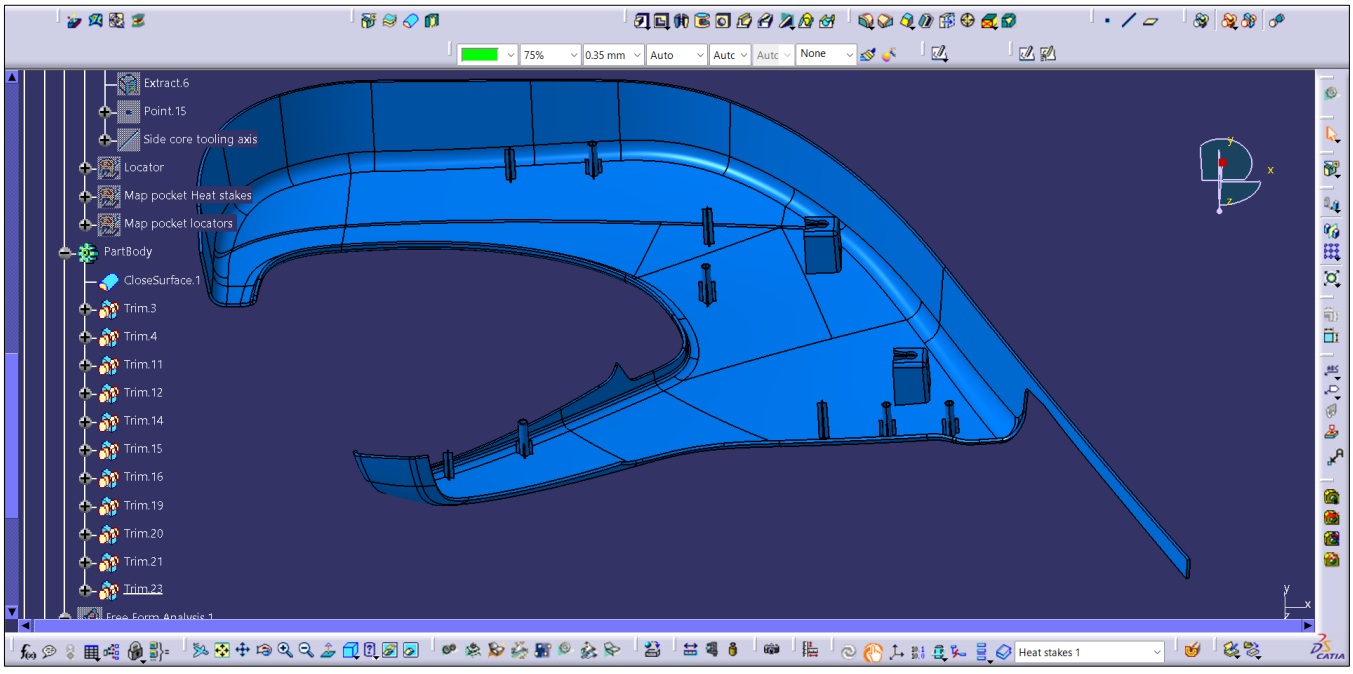


Creating Heat-stakes:

- With the master-section as reference create a solid body with the draft angle of 0.5° at the inner & outer portions.



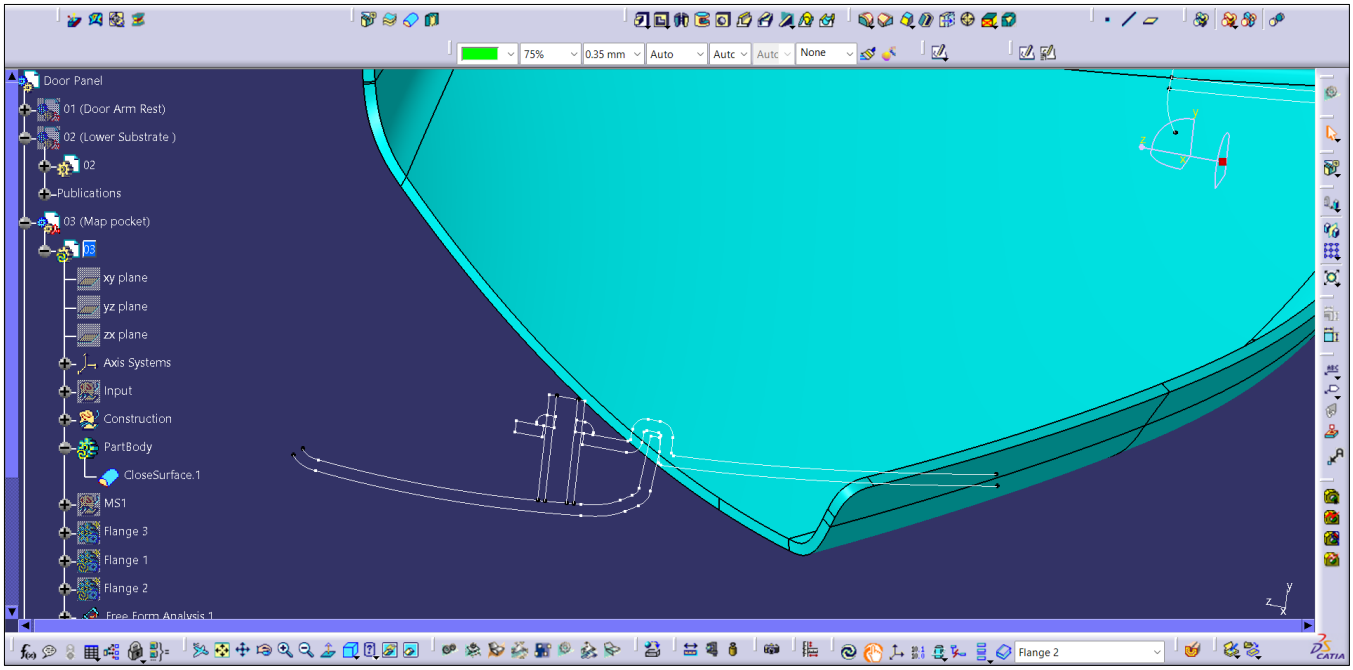
- Create a sketch of ribs on the heat-stakes plane and pad it with the height of 15mm & draft angle of 0.5°.
- Using union trim command, blend both the ribs & heat stake part model.
- Again, using union trim command, blend the heat stakes with the lower substrate part model.
- Duplicate the heat stakes and locators as dump solids & create the points on the surfaces where the flanges are coming in contact with the heat stakes & locators.
- The final result is as below.



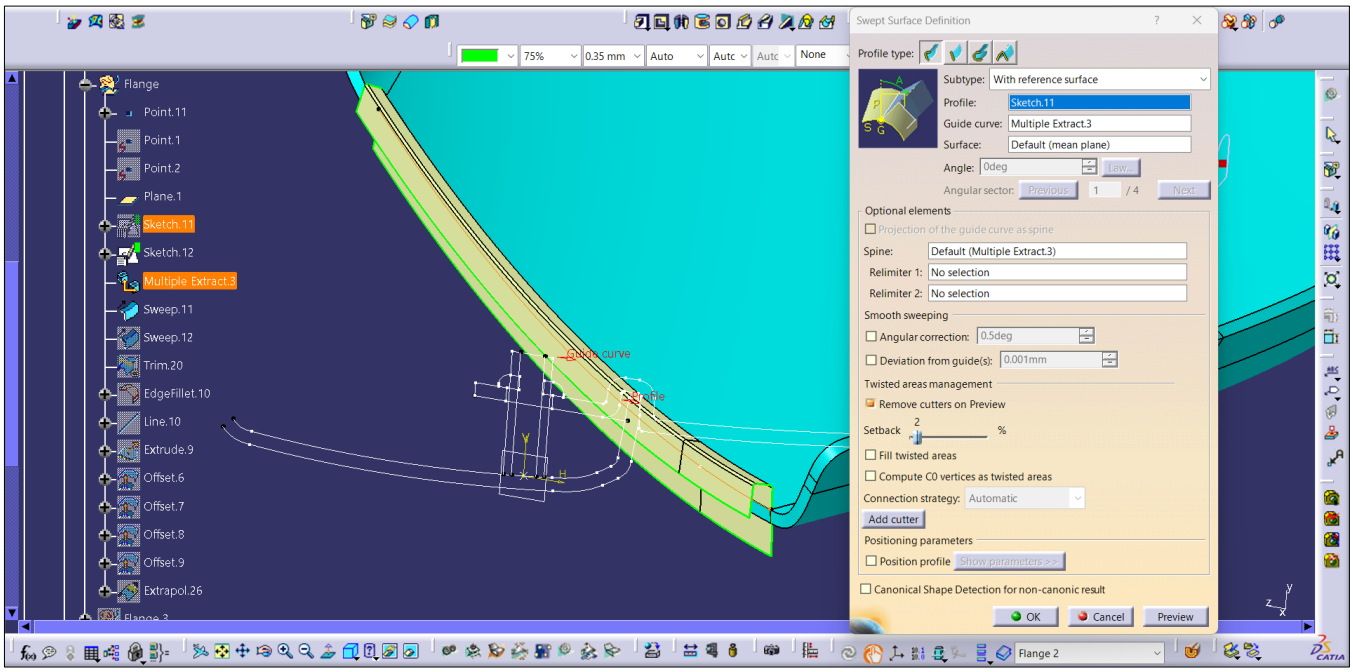
Part 3 Map Pocket:

Creation of Flange:

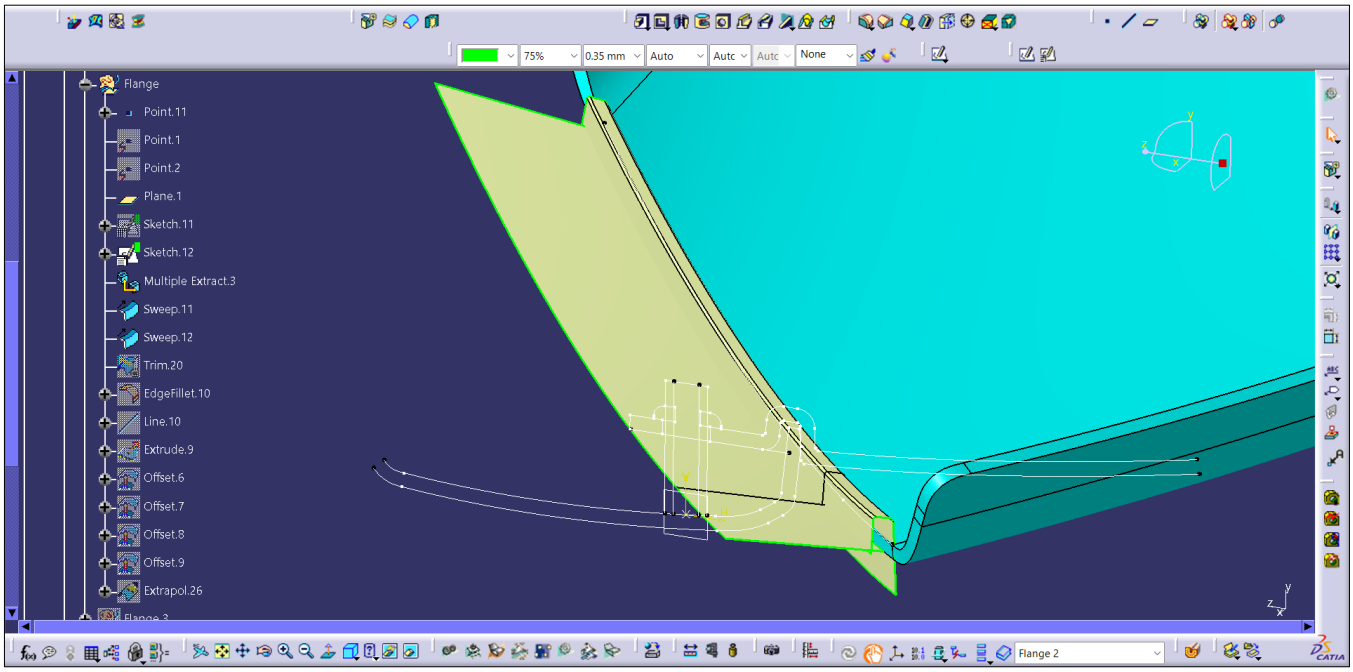
- Create a geometrical set with the name of flange under the Construction geometrical set.
- Define the Flange geometrical set and enable the Master section and observe which engineering feature has to be made and the location of that feature has to be determined.
- Here with the reference of master section, two flanges have to be created on the edges of the map pocket.



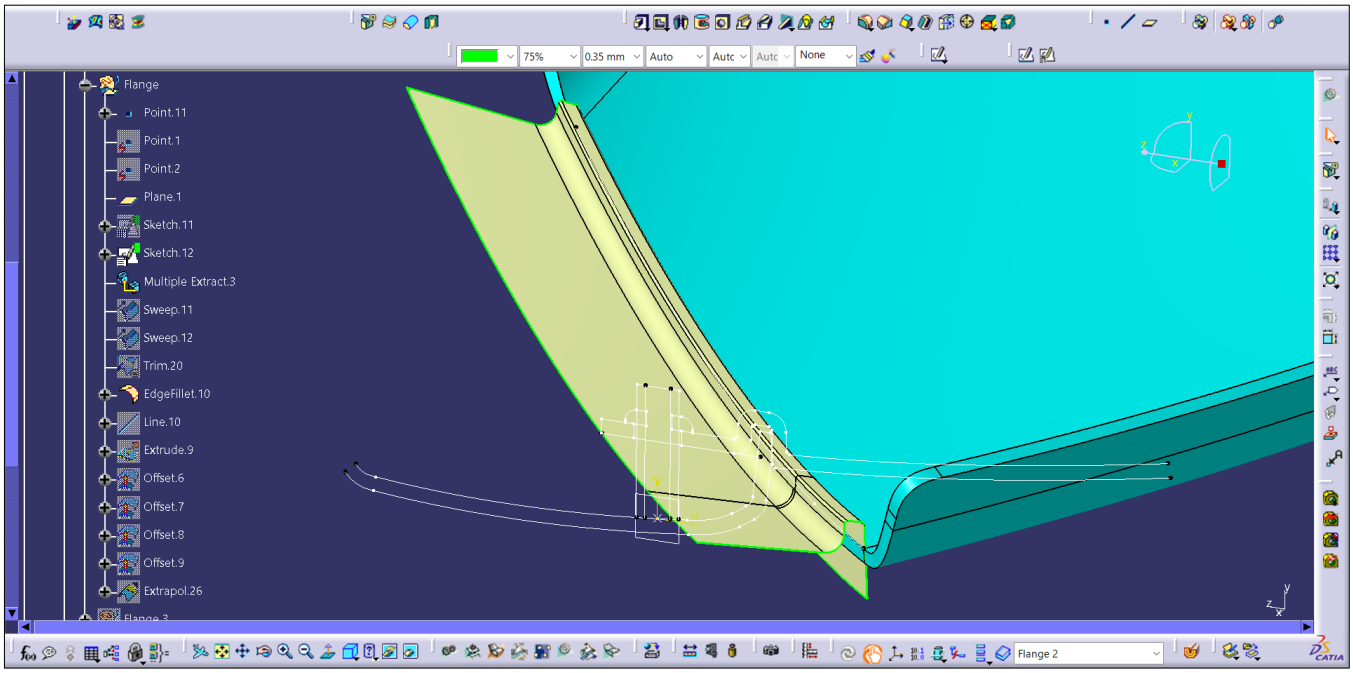
- Create a plane using 3-point method with the master section has a reference.
- Create a sketch on that plane by projecting the line of the flange from the master section.
- Isolate the sketch so that, the sketch won't be linked with the master section part.
- Using sweep command create a surface from the sketch.



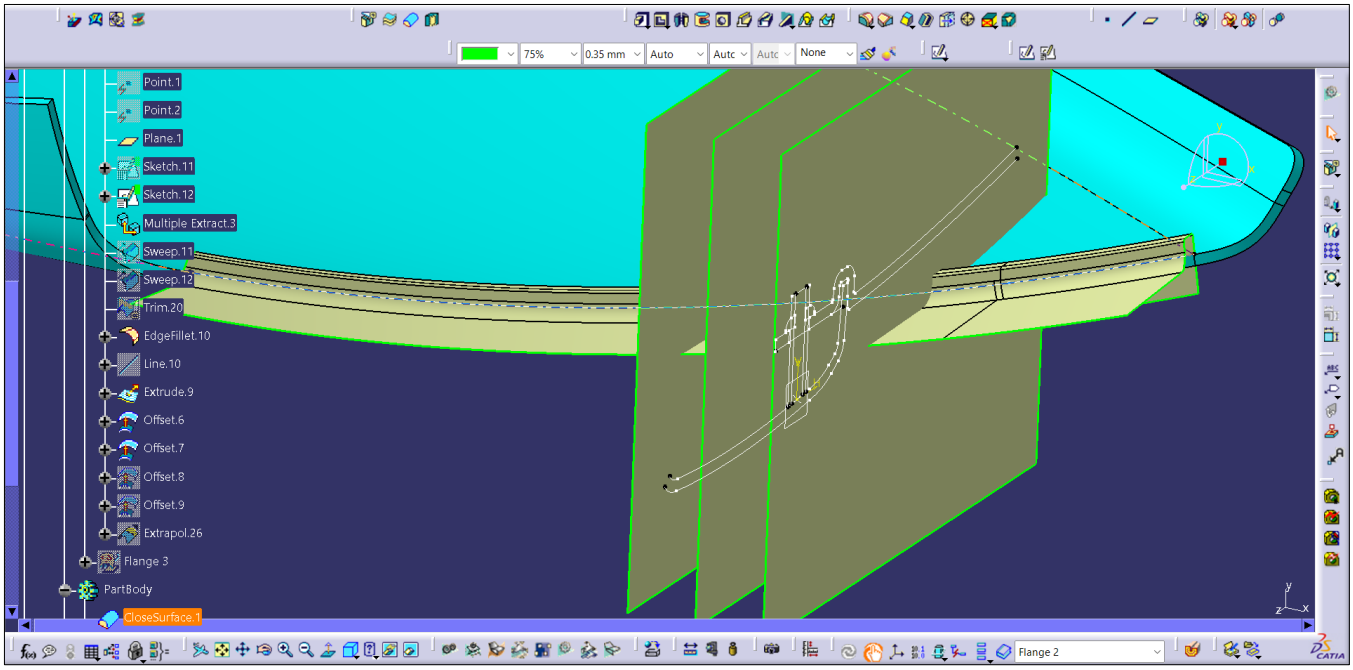
- Extract the upper surface line of the flange from the master section of the map pocket part & using sweep command, create a surface with the extracted line as reference.



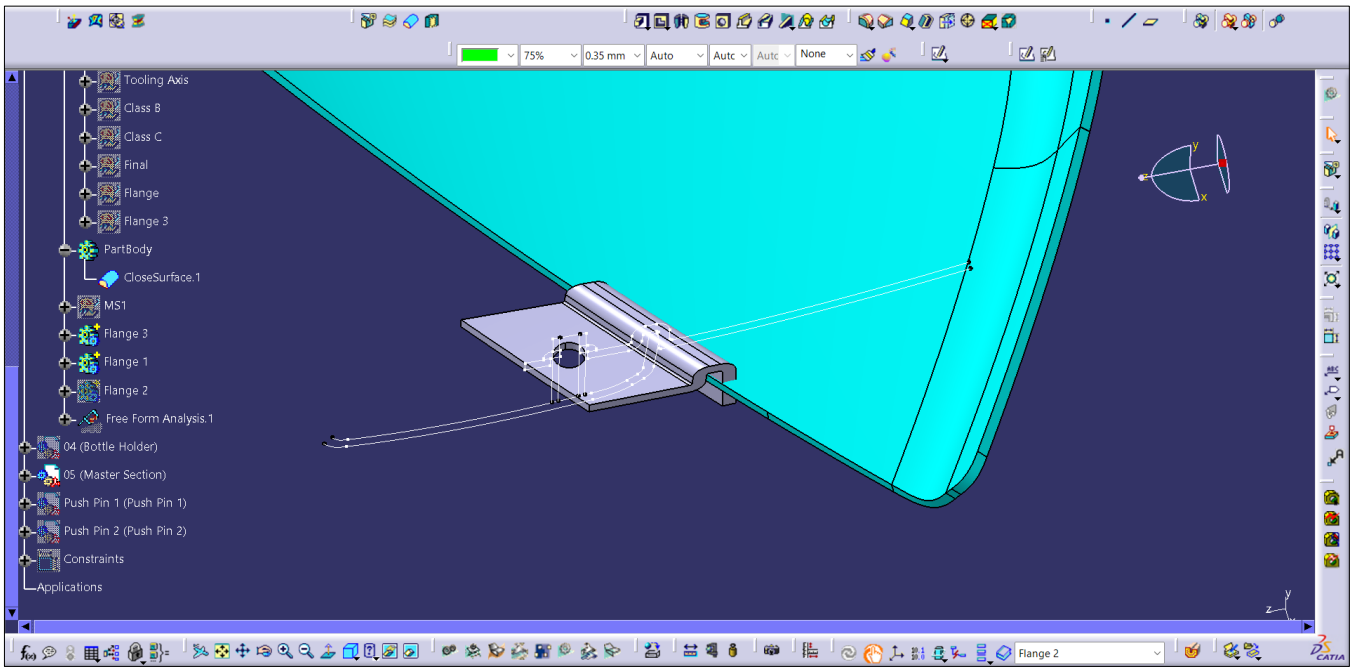
- Using trim command, trim both the extruded surface and sweep surface. And using the edge fillet command, create a fillet on the lower edge of the trimmed surface.



- Create a line along the y-axis and create a surface using extruded surface with the line a base.
- Offset the extruded surface of 15mm on both the side of the extruded surface.

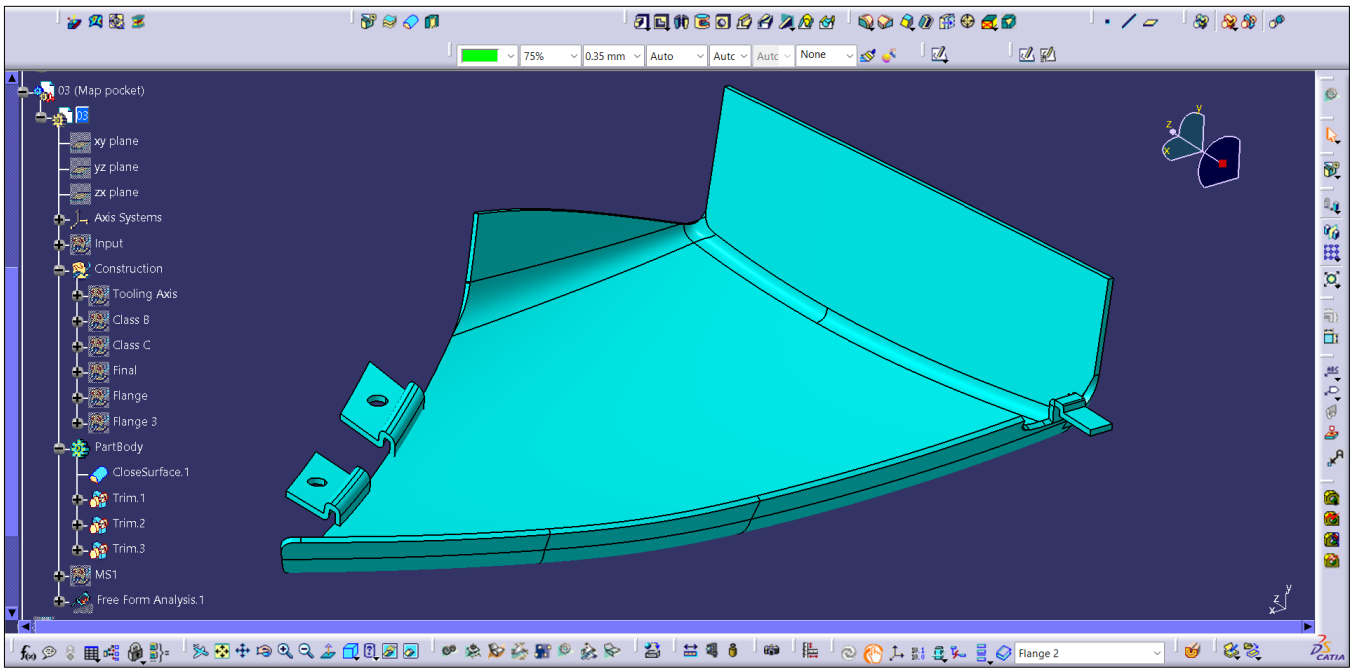


- Using split command, cut the trimmed surface using the two-offset surface.
- Measure the fillet radius on the master section & create a fillet on the edge using edge fillet command.
- Change the workbench to part design and using thick surface command, create a solid body from the created surface.



- Using Union trim command merge the flange with the Door panel part body.
- Repeat the same process and create another flange on the same edge & one flange on the rear side as per the master section.
- Using the union trim command, blend the flanges with the map pocket solid body.

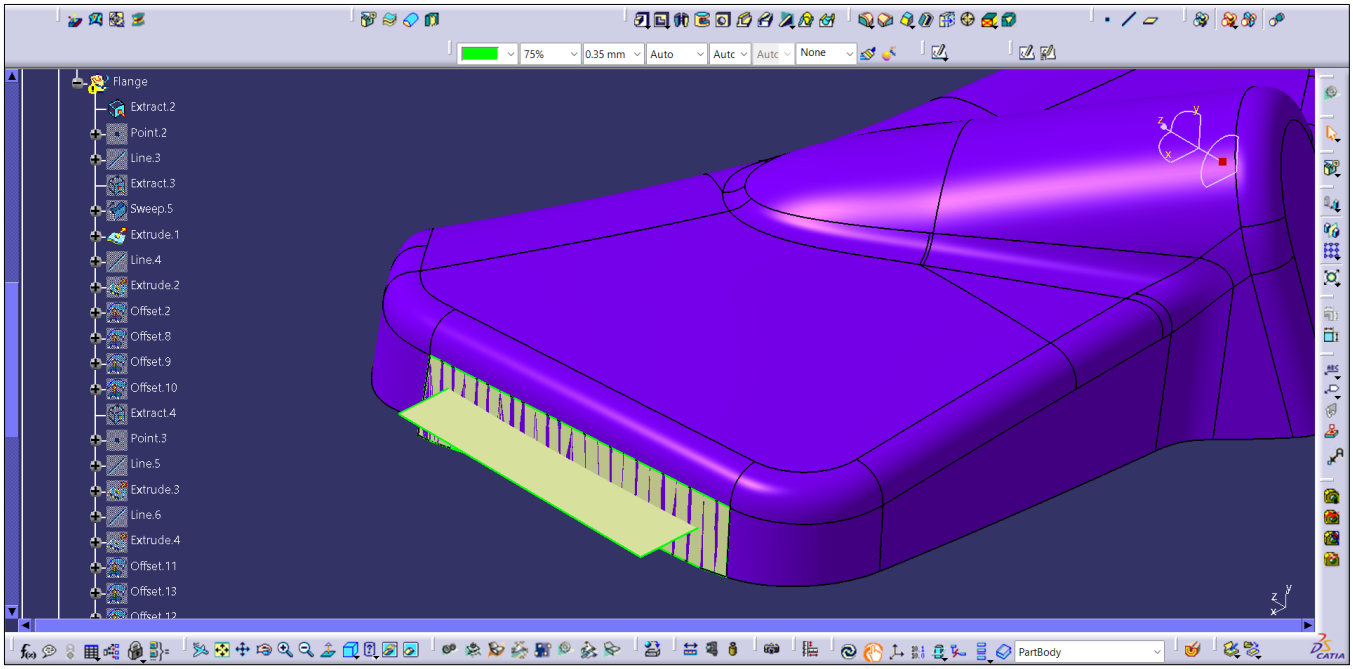
- The final result of the map pocket will be as below.



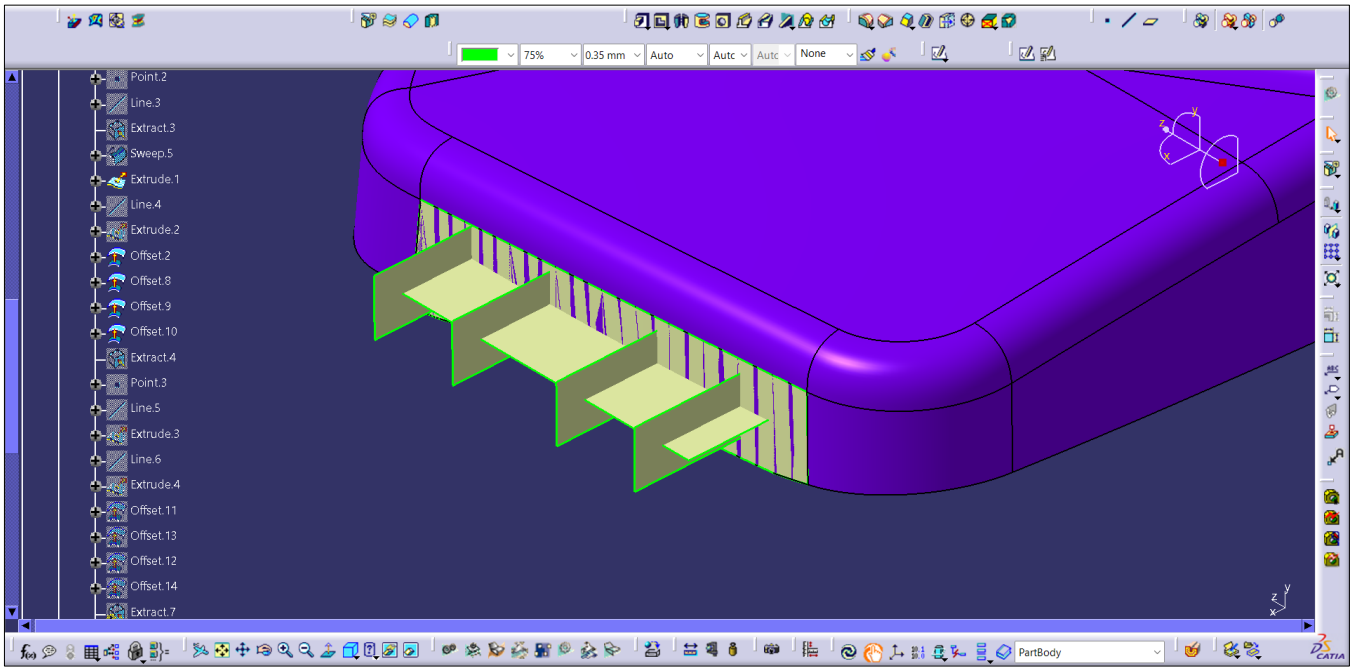
Part 4 Bottle holder:

Creation of Flange:

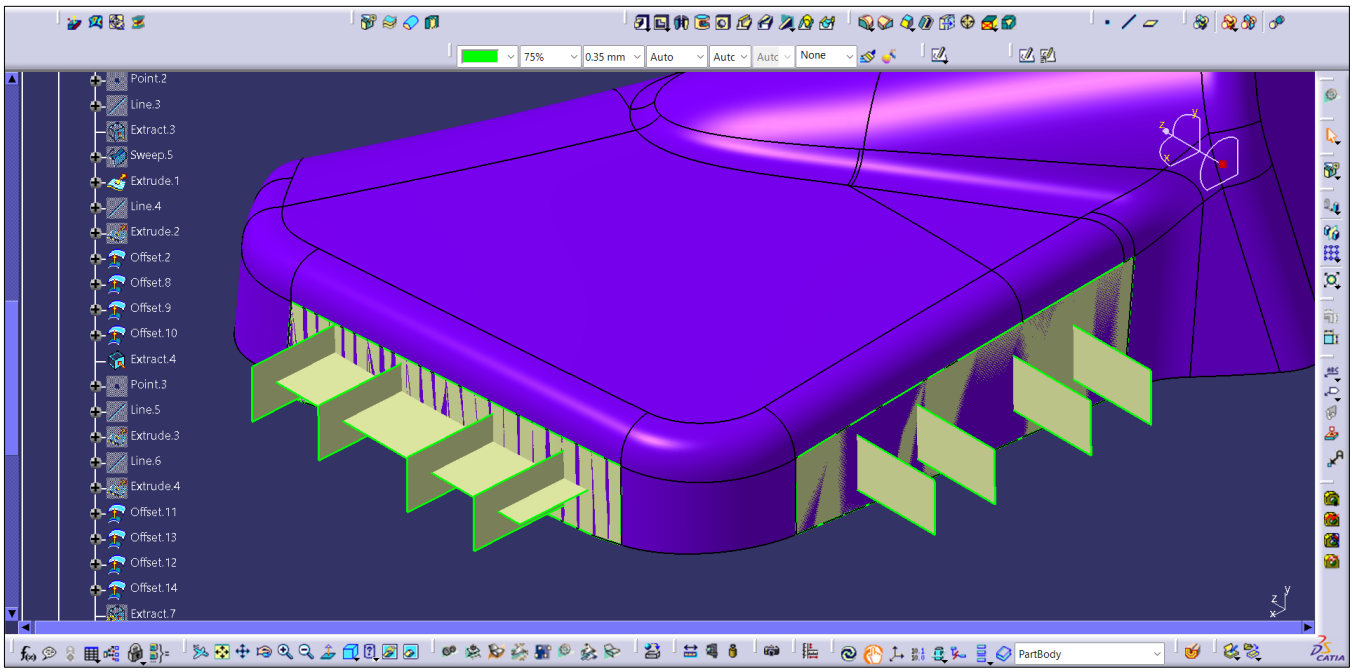
- Create a geometrical set with the name of flange under the Construction geometrical set.
- Define the Flange geometrical & extract the side face of the bottle holder where the flanges has to be created.
- Create a line on the x-axis direction & using extrude command, create a surface with the line as reference.



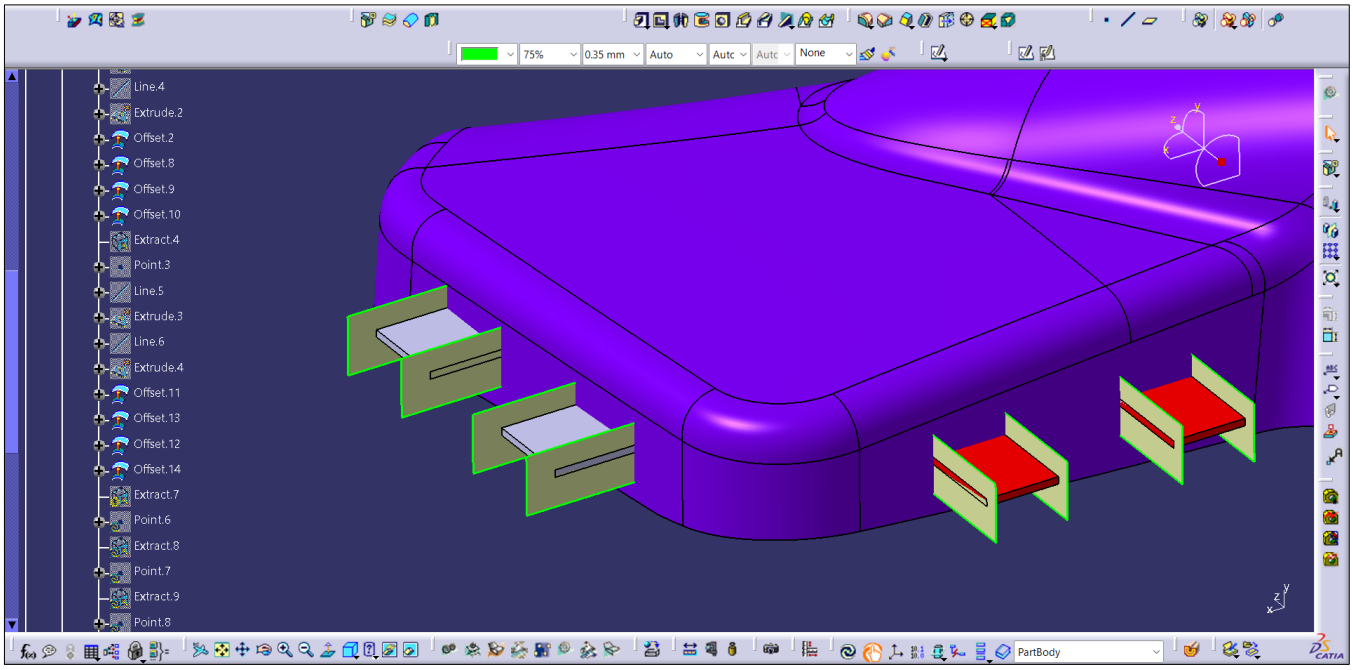
- Create a line on extracted surface in y-direction and using extrude command, create the surface using the line as reference.
- Using the offset command, offset the extruded surface according to which the flanges has to be positioned.



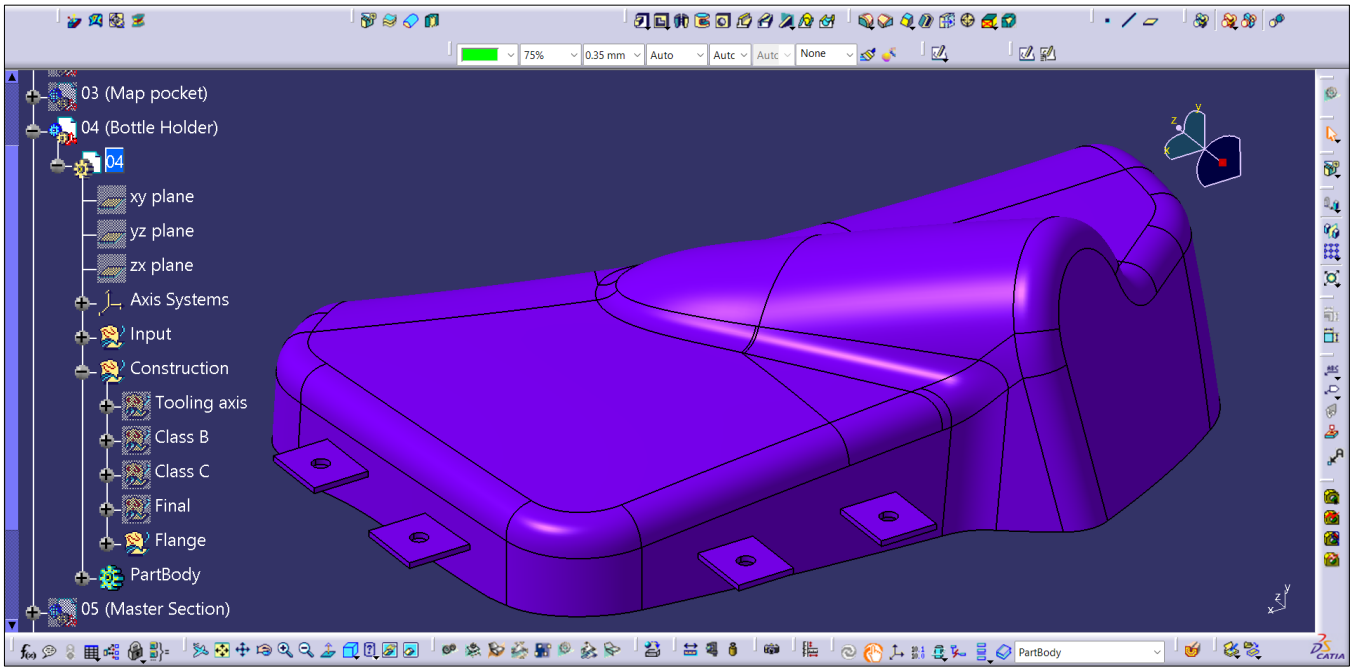
- The same procedure has to be repeated on the other face too, where the flanges has to be created.



- Change the workbench to part design, & convert the surface into a solid body using thick surface command.
- Split the thick surface using the extruded surface.



- Using union trim command, blend the flanges to the part body.
- The final result of the bottle holder will be as below.



Final Assembly:

- Change the workbench to assembly design and import the two push pins and assemble them to the dog house on the lower substrate.
- The final result of the Door trim panel will be as below.