



Value Engineering (Material Reduction) of Round Base for Supporting Chairs and Stools

Case Study

About CCE

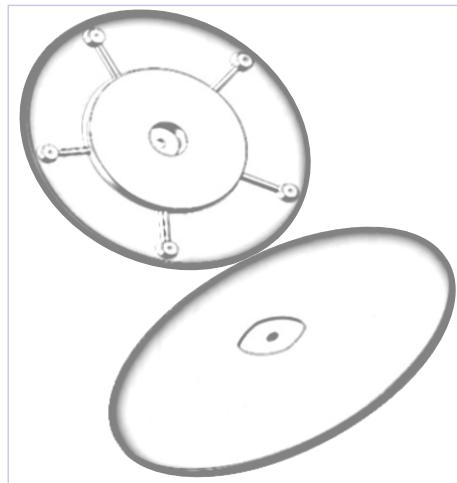
CCE is an ISO 9001 certified, Michigan corporation, in business since 1989, with offices in Michigan, New Jersey, and India. CCE has delivered cost-effective product realization solutions through a customer-focused service model. This service model seamlessly integrates product conceptualization, design, prototyping, manufacturing, and sustaining services to our clients, worldwide.



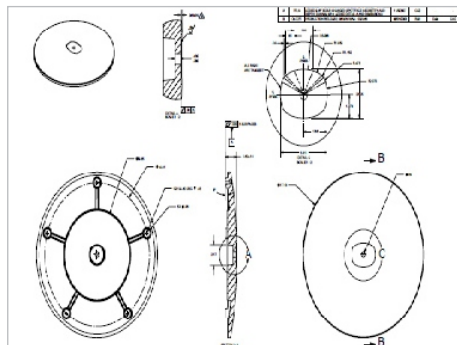
Our flexible business model enables customers to choose any combination of our engineering and manufacturing services to accelerate their time-to-market strategy, with significant cost reduction. CCE focuses on mid-to-low volume programs, with higher complexity, characterized by products with high-tolerance, complex machining, and zero-defect expectations. CCE offers services to mechanical OEMs in the industrial/commercial, semi-conductors, consumer goods, energy and utilities, aerospace, and off-highway transportation industries.

Value Engineering (Material Reduction)

One of CCE's customers is a furniture manufacturer. They have a round base that is used as base support in chairs and bar stools. The customer wanted CCE to investigate if there were opportunities to reduce material, used in manufacturing the round base, without affecting design intent or performance. They provided CCE with 3D CAD models and 2D drawings of the part.



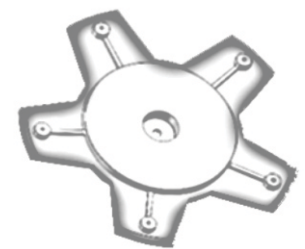
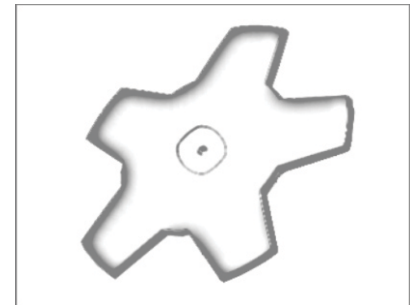
Input 3D CAD Model



Input 2D Drawing

Functional Study and Product Re-design

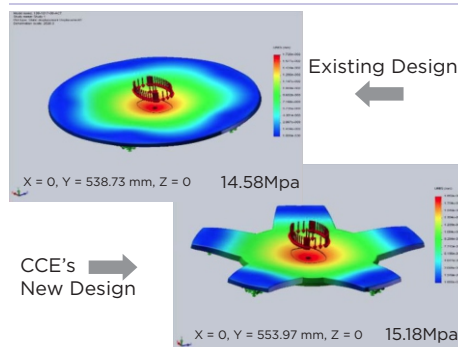
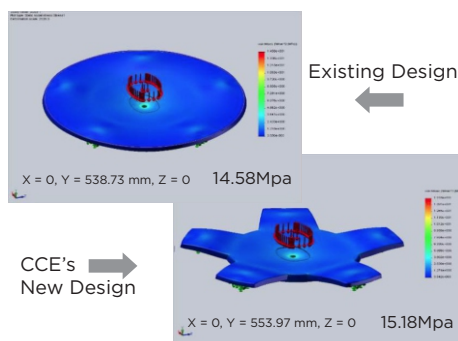
CCE's engineers studied the functional application of the round base and how it was being used at the base of chairs and stools. It was learned that the material of the round base was FG 30 with Poisson Ratio of 0.27 and Elastic Modulus of 6.6×10^4 MPa. CCE's engineers redesigned the part by removing excess material from the round base that was not adding any structural value. Special care was taken to avoid any impact on the aesthetics of the part. CCE's new design had a weight of 15.5 kg., compared to the original weight of 20.5 kg. The CAD modeling was done using SOLIDWORKS software.



3D CAD Model of New Design

Static Analysis


CCE's engineers performed FEA (static analysis) to validate their design. Based on the results of the functional study, the material assigned was FG 30 with Poisson Ratio of 0.27 and Elastic Modulus of 6.6×10^4 MPa. The first step in the analysis involved defining the boundary conditions. The bottom resting legs were constrained and a vertical load of 150 kg. (330 lbs.), equivalent to a person's weight sitting on the chair, was applied to the center of the base. The results of the analysis revealed that the maximum stress (load) and displacement value were higher in the new design when compared with the original. However, the center of gravity did shift along Y-axis in the new design, but the shift was minimal and did not affect the balance considerations of the design.



Project Highlights

Key highlights of this project include:

- Reduction in material - component weight reduced by 25%, from 20.5 kg. to 15.5 kg.
- Safer design - Von-Mises Stress and Displacement max values were higher in the new design as compared to the original
- Better balance - Center of gravity shift is minimum and Y-axis is adjustable
- Based on customer feedback, CCE's design was aesthetically superior to existing design
- Proposal very well-received by the customer; design has been prototyped for manufacturing



**Component
Weight
Reduction: 25%**

"The customer confessed that while they were manufacturing this part for the past 10 years, they never had the opportunity to revisit the design. They acknowledged that CCE's D2D model was ideal for companies to quickly reduce cost without significant upfront investments in time and engineering resources."

-VP Engineering
Major Furniture Manufacturer

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