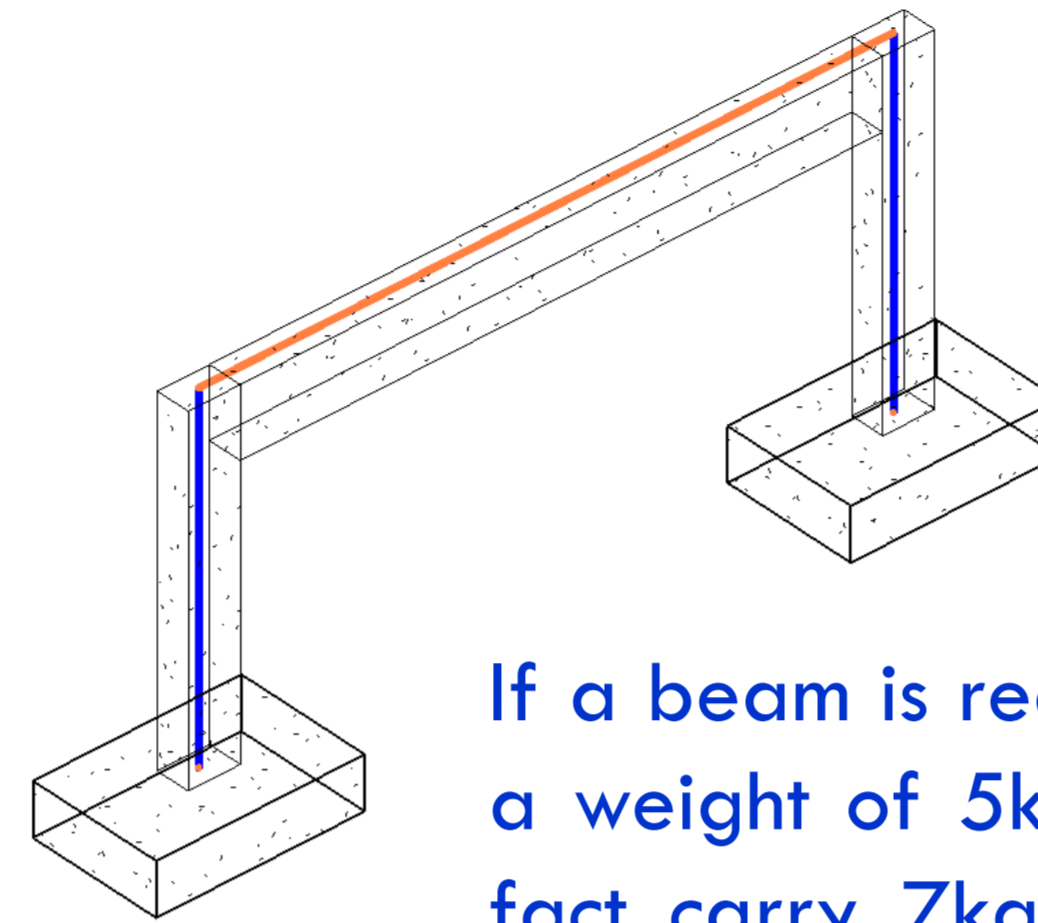


## Introduction

Designing new products is generally done by modifying existing ones introducing new technologies or using new materials.

To be reused, a component or a system needs to be able to meet new requirements using the existing design, i.e. there is a need to be sufficient margins in the old design.

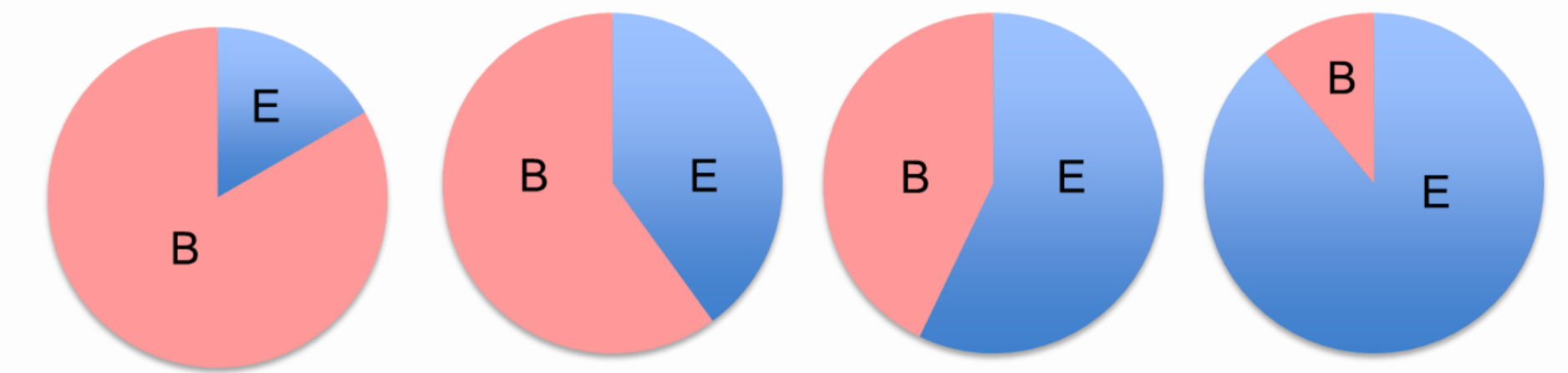
## What is a margin ?



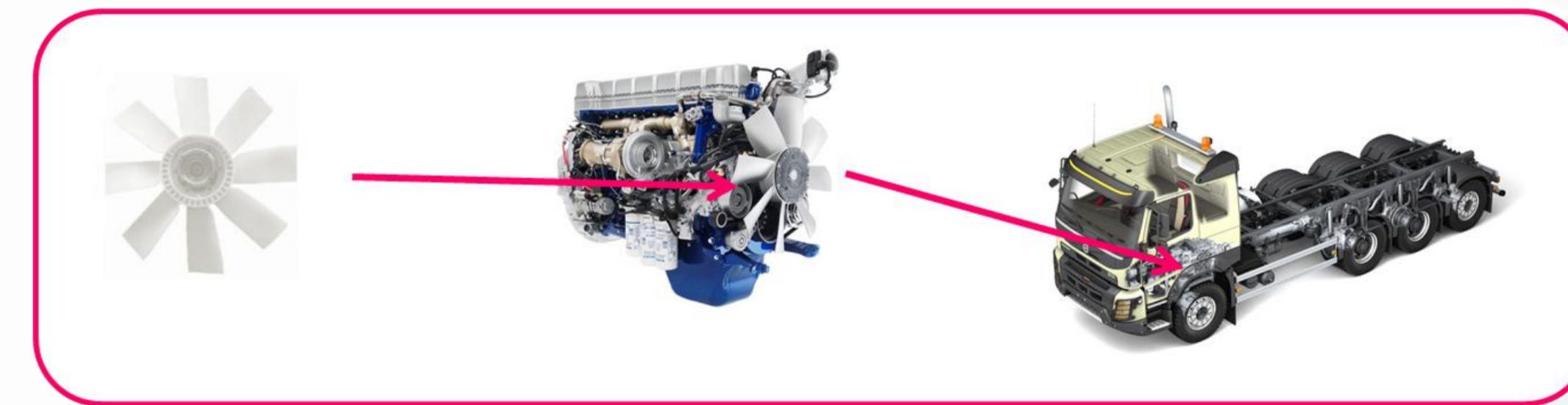
If a beam is required to carry a weight of 5kg, but could in fact carry 7kg Then it has a margin of 2kg.

## Results

A margin can be seen as a buffer B which is used to cater for uncertainties, and an excess E which is the part of margins that the designers can make use of to deal with changes.



Reducing uncertainty by reducing buffer and increasing excess



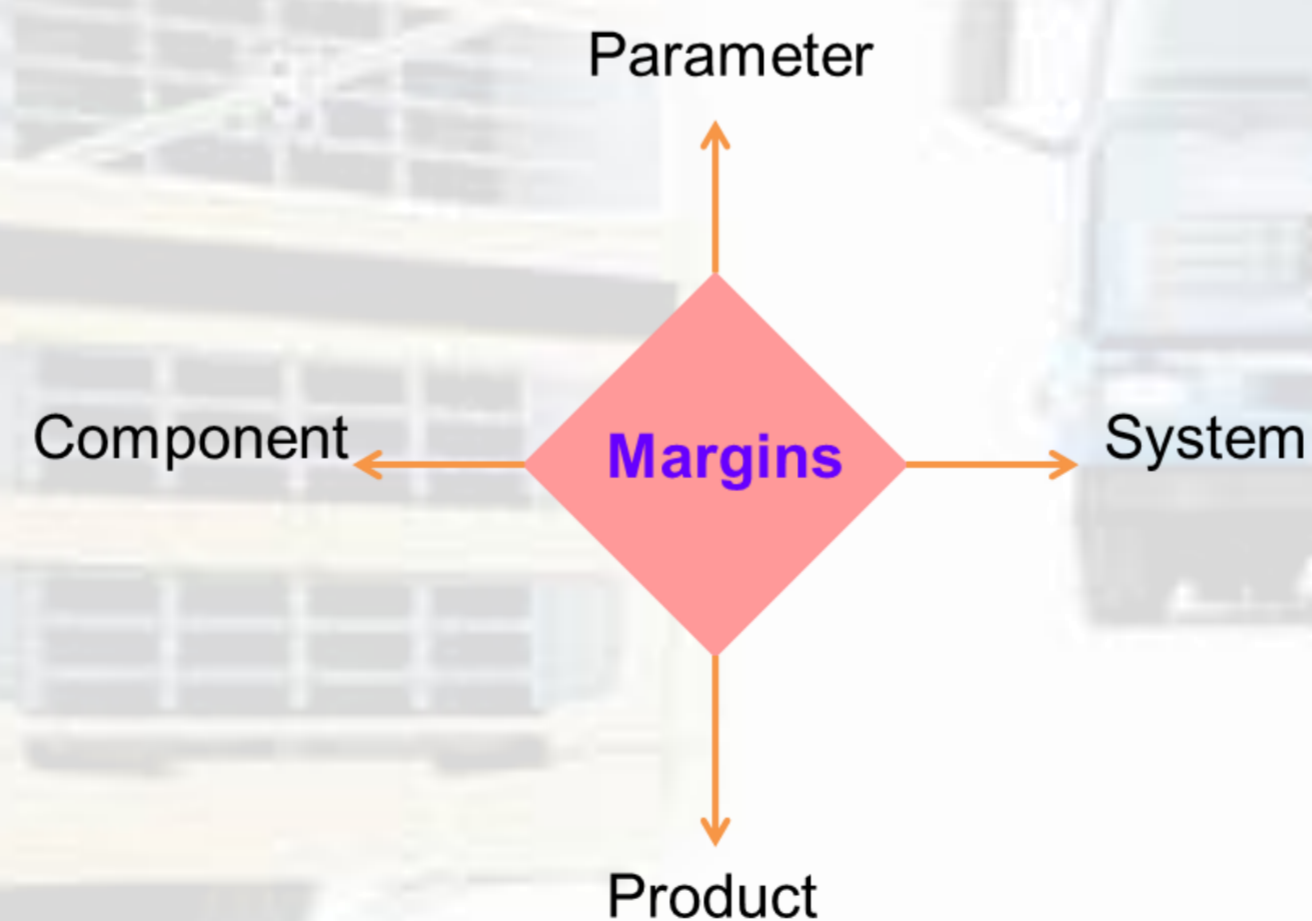
A right balance between buffer and excess guide the designers in the design process

## Methodology

- Semi structured interviews to understand how margins are conceptualised across the design process.
- DSM and CPM methods were used to model the interaction among components in the system and assess indirect risk of change.

Engineers often add margins to requirements to cater for potential misuse by customers or future design developments where the component or system needs to be reused.

Change Propagation Matrix "Major changes"	Coolant Pump	Engine	Radiator	Expansion tank	CAC	Turbo	Grille	Fan module	Thermostat	Engine oil cooler	Recirculation shield	Connection pipes	By pass line
Coolant Pump	█												
Engine	█	█											
Radiator			█										
Expansion tank				█									
CAC					█								
Turbo						█							
Grille							█						
Fan module								█					
Thermostat									█				
Engine oil cooler										█			
Recirculation shield											█		
Connection pipes												█	
By pass line													█



There are different types of margins at different levels of the product hierarchy.

## Conclusion

The design process is shaped by specific margin. Understanding and tracking margins on key components at different levels are important ways to better understand how changes can be made to a design in order to satisfy new requirements. The outcomes of this research will benefit carrying out engineering change processes efficiently.