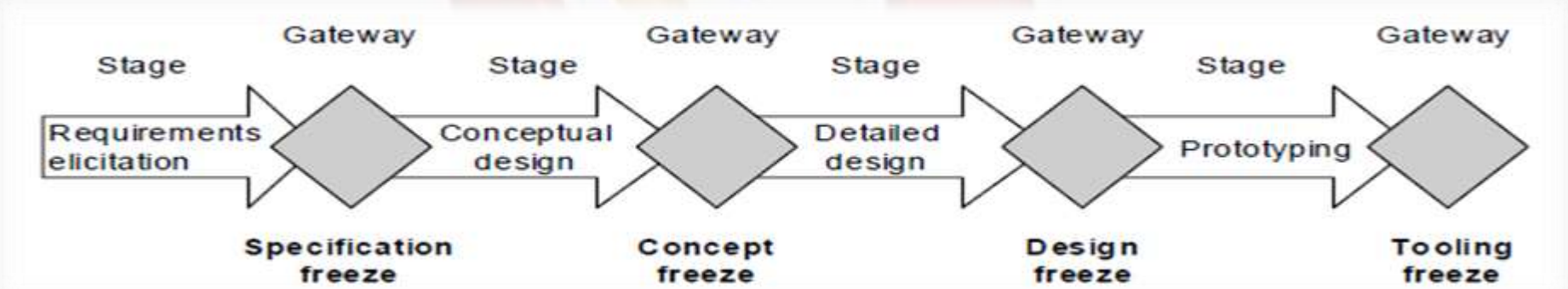
Freezing the Design and Design Modifications

What is Design Freezing ?

‘Design Freeze' describes the end point of the design phase at which a technical product description is handed over to production.

Freezeing plays a major role during product development. Many companies use high-level stage-gateway processes for new product development , where freezes mark the end point of a development stage



A design freeze is a binding decision that defines the whole product, its parts or parameters and allows the continuation of the design based on that decision.

An aim of design freeze is also the reduction of the likelihood of further engineering changes.

For example:- Freezes avoid cost reductions that can be implemented in the next product generation. However, other changes like safety issues, problem corrections or new customer requests may still have to be included. Changes that need to be implemented after freeze may be more costly if tooling etc. is already in place. Quality control norms like ISO 9000 require a freeze point for change control to distinguish between the design phase and change implementation afterwards

Four freeze categories result that either address the product concept as a whole or part details in particular:

- **External conceptual freezes** arise from customer requirements or tooling constraints;
- **External detailed freezes** include detailed customer specifications, lead times and the use of pre-defined parts like platform parts, legacy parts or standard components that need to be incorporated into the design;
- **Internal conceptual freezes** reflect the fundamental decisions made about the concept of the design throughout the iterative refinement of the product;
- **Internal detailed freezes** occur when components, features or parameters of parts are frozen at any time throughout the design process; this typically occurs as a means of structuring the design process.

Use of freezes in industry:- The freeze terminology was used in larger companies both in the US and in Germany. Managers and designers referred to freeze and it featured in the official process documentation of some companies.

Official freezes were mainly found in companies with large design teams. Here, freezes were used to structure the design process, control changes and force the completion of design stages on time.

Although freezing the design seems to play an important role in industry, there is little academic literature on the topic. Some papers use terms like “design freeze” or “specification freeze” but hardly any paper defines these terms or describes the functions, benefits or drawbacks of freezes.

A design modification is a change made to a product.

A design modification can be made at any stage the design process and is usually implemeted to fix a fault or improve a product.

A design modification is the change conducted to the product. It can happen at any stage in the product development process.

The design changes or modification that happen early in the design process are less expensive when compared to those that take place after it is introduced into full-scale production. The cost of the change increases with its development time. Fundamentally, the design changes can be classified into pre production and post production design changes. The pre-production changes can happen in the conceptual design stage, prototype stage, detailing stage, testing stage. The post - production stage change will happen almost immediately the product is introduced into the production. This might be due to several reasons such as market response, design faults uncovering, design mistakes, not meeting customer requirements, so on and so forth. One of the tools to minimize this type of design change is House of Quality.

Designs can be changed or modified at any stage in the life cycle.

Depending on the stage at which the change is made, the knock-on effect of managing the change may be more complex and require greater effort to ensure risk is mitigated. Some scenarios are described below.

- Changes made during the conceptual phase are part of the natural process. The detailed design phase only starts once all concepts are approved and checked from safety and economic perspectives.

- During detailed design, change is sometimes required due to the late discovery of impractical construction of for cost reasons. It is important that, despite the change, the final design still complies with the original rationale or is deemed to satisfy rules. The final design communicated to the next party must be safe for use and not contain any unsafe aspects.

- The modifications of existing plant can only happen once the effect of the design changes on the original design and stage of life are assessed.

For example, overhead travelling cranes experience fatigue from dynamic loading and have a defined fatigue life.

Changes made to the loading frequency or runways of an existing crane that differ from its original design intent constitute a design change and need to be carefully considered.

- Knowledge of the original design intent
- Clear communication between all parties at all stages of the life cycle
- Quality control during all phases to ensure any change or modification is managed.