Design freezes

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

Definition of design freeze

- Figure 1 shows a typical stage-gateway process that can be found in similar forms in.

- At least in theory the specifications are frozen before conceptual design begins, which in turn is frozen before detailed design starts.

- Before manufacturing can start the entire design needs to be frozen.

- However, reality is often far more fluid and processes can iterate across different stages.

- Freezes of the complete design or its details play a vital role throughout the entire design process, arising from within the company or coming from outside.

- 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.
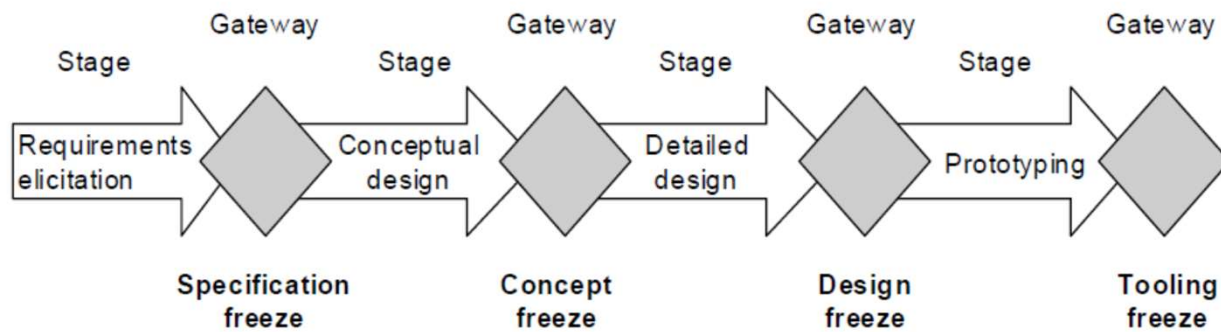
Figure 1. Different freezes in a stage-gateway process

- In figure 1, the term "design freeze" refers to one point in time at the end of the detailed design phase at which the final version of the technical drawings is signed off and released to production.

- However, it was already pointed out that different parts and parameters of a design need to be finalized earlier and at different times.

- Lead times for parts differ.

Freezes in the product hierarchy

Freezes occur on three levels of detail:

Product freezes:

- as was indicated, the term design freeze is most commonly used in the literature to describe the definition of the whole product design at once.

- It is a single point in time that marks the end of the design phase.

Part freezes:

- these refer to single parts or groups of parts that are frozen at the same time ("system freeze").

- A typical freeze of a group of parts is a "style freeze" in the automotive industry.

- By this point in time, the interior design of a car is frozen, and the shape and the available room for all parts in the passenger cabin has been defined.

- Of course, such a freeze is done in conjunction with the engineers responsible for the separate parts.

- Individual parts are frozen at different times to allow for design continuation of dependent components.

- Part freezes are frequently driven by lead time.

- For example, in one car interior design process the airbag was the longest lead time item and needed to be defined within a few months from starting work on the car, thus fixing many of the airbag's interface parameters. The benefits and drawbacks of part freezes are discussed in detail below.

Parameter freezes:

- parts are not usually frozen at a single point in time.

- Instead, parameters, features and the interfaces to other parts are frozen individually before the whole part is approved.

- Key parameters that determine the performance, function and manufacturability of the whole part are usually set first.

- For example, while the material of a part may be decided early on to allow procurement, the exact part shape is only set later.

- Even the shape can be set in stages, as long as "metal-off" is possible, i.e. the part can be machined into its final form.

- Parameter freezes structure the design process.

- The dependency of key parameters sets a type of internal logic of the product, which governs process planning as well as decision ordering throughout the entire product.

- Without defining key parameters dependent decisions cannot be finalized.