SUMMARY OF SAFETY CRITERIA IN DESIGN

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INTRODUCTION

Factor of Safety(FoS) is how much could a system withstand beyond the expected loads or actual loads. Factor of Safety which also known as safety factor is often calculated by using ratio of the ultimate load to the allowable load for a model or structural designing in construction such as bridges and buildings. The Factor of Safety is essentially used to assure the structural designing does not occur any unexpected failure or presence of deformation or defect. The smaller the Factor of Safety, the higher chances was there for the design to be a failure. Resulting in an uneconomical and nonfunctional design. As for higher Factor of Safety, the components would be much expensive resulting in a higher cost of the design.

Equipment	Factor of Safety - *FOS* -
Aircraft components	1.5 - 2.5
Boilers	3.5 - 6
Bolts	8.5
Cast-iron wheels	20
Engine components	6 - 8
Heavy duty shafting	10 - 12
Lifting equipment - hooks ..	8 - 9
Pressure vessels	3.5 - 6
Turbine components - static	6 - 8
Turbine components - rotating	2 - 3
Spring, large heavy-duty	4.5
Structural steelwork in buildings	4 - 6
Structural steelwork in bridges	5 - 7
Wire ropes	8 - 9

FIGURE 1: Factors of Safety are a part of engineering design. Typical overall *Factors of Safety*

Applications	Factor of Safety - *FOS* -
For use with highly reliable materials where loading and environmental conditions are not severe and where weight is an important consideration	1.3 - 1.5
For use with reliable materials where loading and environmental conditions are not severe	1.5 - 2
For use with ordinary materials where loading and environmental conditions are not severe	2 - 2.5
For use with less tried and for brittle materials where loading and environmental conditions are not severe	2.5 - 3
For use with materials where properties are not reliable and where loading and environmental conditions are not severe, or where reliable materials are used under difficult and environmental conditions	3 - 4

FIGURE 2: General recommendation for application usage.

Repeated Cyclic loads :

The factors established above must be based on the endurance limit (fatigue strength) rather than to the yield strength of the material. The strength calculations should also include for stress concentration factors.

Impact Shock forces :

The factors given in items 3 to 6 are acceptable, but an impact factor (the above dynamic magnification factor) should be included.

Brittle materials :

The ultimate strength is used as the theoretical maximum, the factors presented in items 1 to 6 should be approximately doubled.

Impact Shock forces :

The higher factors of safety given above (2.5 to 4) may be used but based on stress levels calculated based on the resulting dissipated energy at impact.

Where higher factors might appear desirable, a more thorough analysis of the problem

should be undertaken before deciding on their use.

Extreme care must be used in dealing with vibration loads, more so if the vibrations approach resonant frequencies. The vibrations resulting from seismic disturbances are often important and need to be considered in detail.

Safety criteria in designing that should be taken into consideration to obtain an optimum Factor of Safety.

- The imposed load should be calculated accurately therefore no such failure of unexpected high load occurs.

- Wear estimation of all component and materials used.

- The effect of environment to the structural design

- The consequences of the failure that may occur.

- Cost of over- engineering the materials and component to achieve Factor of Safety.

- Uncertainty due to method of analysis.