A Review on Design Considerations for Engineering Materials

Jitendra Sunte

September 6, 2022

A Review on design considerations for engineering materials

Jitendra Sunte: Assistant Professor, Dept. of Mechanical Engineering, Lingaraj Appa Engineering College Bidar.jitendrasunte@gmail.com

Abstract:

This paper is dealing with design concepts while specifications, material selection, bill of materials, dimensions according to load withstanding capability and all. We can design any components by considering factor of safety and strain concepts only for better solutions and results. Further these results are helpful for analyzing predictions whatever we obtained models. Probability of failure is less in case 1

Keywords: Factor of safety, strain concept,

Probability failure

Introduction:

These are a good addition to traditional anal ysis. The standard deviations of the paramet ers can be calculated with the same amount of data are frequently used in situations wit h significantly variable degrees of uncertaint y. appropriate factors of safety case 1:

If we take as an example of crane hook of factor of safety 1 and 10 for two specimens as in case of new trend current and traditional in both cases traditional specimen live longer, long durability, service factor as factor of safety 10. Most of the engine components parts factor of safety is considered for design as 10. The crane will lift maximum capacity beyond predicted value. Suppose designed allowable tonne capacity if he mention 2tonne , definitely it will lift 2.5 tonne also with safety proper work load

Fig, crane hook

Factors of safety operate as a buffer against computation uncertainties and the reality tha t full accuracy is impossible to achieve. Conventions have formed throughout time regarding what values of factor of safety are appropriate for particular scenarios. For longterm slope stability, the United States Army Corps of Engineers and many other agencies utilise F = 1.5. For bearing capacity, most geotechnical engineers recommend F = 2.5 to 3.0, as well as the same range of values for erosion and pipeline safety. Using the same factor of safety for all longterm slope stability or bearing capacity applications is a "one size fits all" approach that will almost certainly result in inadequate factors of safety in some circumstances. A more rational method would take into account the uncertainties in the values used in the computations; and the repercussions of failure or poor performance. This can be achieved, at least roughly, by selecting safety criteria that satisfy the following relationship:

(Reduction in p_f associated with more reliable design)×(cost of failure)<(added cost of more reliable design

Interpretation of ‘‘Probability of Failure’’

As previously stated, not all "failures" are disastrous. Some are better described as ‘‘unsatisfactory performance.’’ It is justified to employ reduced safety factors when the product of the likelihood of failure times the cost of failure or poor performance is negligible. Higher factors of safety are rational where the product of the chance of failure times the cost of failure or unsatisfactory performance is substantial. The quantities in (9) cannot be exactly calculated. Even though approximations and judgement will be required when applying this expression to realworld settings, the relationship described by this expression gives a framework for determining appropriate factors of safety. The retaining wall in Figure 1 is an example of this

A 1% chance of poor performance owing to sliding, for example, would probably not justify the cost of raising the factor of safety over 1.5 unless the effects of sliding were extremely severe. However, in the instance of the LASH Terminal slope in Fig. 1, an 18 percent chance of failure, multiplied by the anticipated cost of failure, would have justified a greater expenditure to enhance the factor of safety and lower the risk of failure. It is advocated that probability of failure be used in addition to factor of safety rather than as a replacement. It is better to compute both the factor of safety and the chance of failure than to compute either one alone

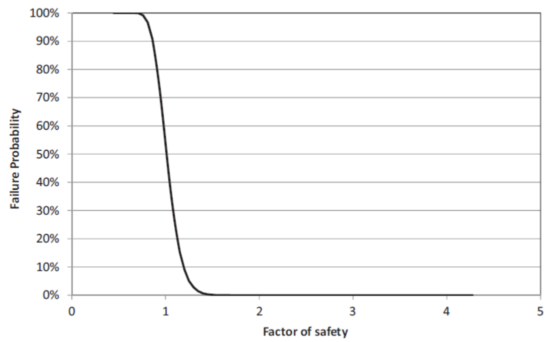

Fig 1.Factors of safety vs. probability of failure

Strain concept:

Suppose we designed any material component as an best example of crane hook, without considering factor of safety i.e., 1, then applying strain concept we built required optimum results. This is how by means is if we know the changes in dimensions, it may be length, width , height etc.by loading results as strain we obtain good results as same as consideration of factor of safety. In crane hook example it will lift only predicted load 2 tonne after it will fail by exceeding load or it may failure improper operation

Conclusion:

1. We design any material component by taking factor of safety
2. Also we can design by taking strain concept
3. Both the cases material is good as first one case for long life span
4. Probability of failure is less in case 1
5. Almost civil construction fields case 1 factor of safety plays vital role
6. For less lower loadings case 2 strain concept is applicable is good
7. **References:**

8. Benson, C. H., Daniel, D. E., and Boutwell, G. P. (1999). ‘‘Field performance compacted clay liners.’’ *J. Geotech. and Geoenvir. Engrg.*, ASCE, 125(5), 390–403.
9. Burland, J. B., and Burbridge, M. C. (1985). ‘‘Settlement of foundations on sand and gravel.’’ *Proc., Inst. of Civ. Engrs.*, Part 1, 78, 1325–1381.
10. Christian, J. T., Ladd, C. C., and Baecher, G. B. (1994). ‘‘Reliability applied to slope stability analysis.’’ *J. Geotech. Engr.*, 20, Dec., 2180–2207.
11. Dai, S.-H., and Wang, M.-O. (1992). *Reliability analysis in engineering applications.* Van Nostrand Reinhold, New York.
12. Duncan, J. M., and Buchignani, A. L. (1973). ‘‘Failure of underwater

slope in San Francisco Bay.'' *J. Soil Mech. and Found. Div.*, ASCE, 99(9), 687–703.

13. Folayan, J. I., Hoeg, K., and Benjamin, J. R. (1970). ''Decision theory applied to settlement predictions.'' *J. Soil Mech. and Found. Div.*, ASCE, 96(4), 1127–1141.
14. Harr, M. E. (1984). ''Reliability-based design in civil engineering.'' 1984 Henry M. Shaw Lecture, Dept. of Civil Engineering, North Carolina State University, Raleigh, N.C.
15. Harr, M. E. (1987). *Reliability-based design in civil engineering.* Mc-Graw-Hill, New York.
16. Kulhawy, F. H. (1992). ''On the evaluation of soil properties.'' ASCE Geotech. Spec. Publ. No. 31, 95–115.
17. Lacasse, S., and Nadim, F. (1997). ''Uncertainties in characterizing soil properties.'' *Publ. No. 201*, Norwegian Geotechnical Institute, Oslo, Norway, 49–75.
18. Tang, W. H., Stark, T. D., and Angulo, M. (1999). ''Reliability in back analysis of slope failures.'' *J. Soil Mech. and Found.*, Tokyo, October.
19. Terzaghi, K., Peck, R. B., and Mesri, G. (1996). *Soil mechanics in engineering practice*,'' 3rd Ed., Wiley, New York.
20. U.S. Army Corps of Engineers. (1997). ''Engineering and design introduction to probability and reliability methods for use in geotechnical engineering.'' *Engr. Tech. Letter No. 1110-2-547*, Department of the Army, Washington, D.C., ^www.usace.army.mil/usace-docs& (30 Sept. 1997).
21. U.S. Army Corps of Engineers. (1998). ''Risk-based analysis in geotechnical engineering for support of planning studies.'' *Engrg. Circular No. 1110-2-554*, Department of the Army, Washington, D.C., ^www. usace.army.mil/usace-docs& (27 Feb. 1998).
22. Wolff, T. F. (1994). ''Evaluating the reliability of existing levees.'' *Rep., Res. Proj.: Reliability of existing levees*, prepared for U.S. Army Engineer Waterways Experiment Station Geotechnical Laboratory, Vicksburg, Miss.