Comparison between Limit State Method & Working Stress Method for R.C.C Structure

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ABSTRACT
Now a days R.C.C & steel structures are used in massive ways. Recently all the consultants are designed the R.C.C Structures by plastic method & its design by limit state method. The analysis & design of R.C.C buildings consists of beam, column, slabs & footings. The analysis & design of R.C.C Structures carried out by limit state method & working stress method. The sections obtained by limit state method should be comparing with sections obtained by working stress method to check the economy in design.
Keywords— I.S 456-2000, Limit state method, Working stress method, sections, comparisons etc.

1. Introduction
Since in last centuries following design philosophies has been evolved: a) working stress method b) limit state method c) Ultimate load method.
In current scenario limit state method is used as compare to working stress method .now a days all R.C.C structures are designed by limit state method still working stress method is introduced in all technical education so it is important to understand the difference between limit state method & working stress method.
Working stress method
In the working stress method the section is so designed that the stress resulting from axial load which is computed by linear elastic theory does not exceed prefixed allowable stress. The silent features of working stress method are as below.
1) The working stress method is not applicable to concrete structures: working stress method assumes that both concrete and steel obey hook's law but fact is that only steel follow hook's law and concrete not able to do so.
2) Due to nonlinear stress strain relationship modulus of elasticity varies so we cannot used constant modular ratio.
3) it does not predict the true margin of safety as we consider only elastic region the strength in plastic region will be as it is so we cannot utilize the additional load carrying capacity in plastic zone.
4) it consider ultimate stress as limit of safety but safety is function of ultimate strain: the experimental results shows that the member will not fails due exceed stress but it will fail due to extreme strain.
5) the effect of creep & shrinkage of concrete is totally ignored: the working stress method ignores the effect of creep & shrinkage which changes the modulus of elasticity.
6)the failure load calculated by working stress method is less than obtained by experimental result.
7) as the structure is subjected to different types of loads so failure criteria should from load & not from stress.
Limit State Method
As we all know that limit state ensures safety at ultimate load & serviceability at working load.in limit state both ultimate load and durability can be considered so it is most useful method for R.CC.

design. The silent features of working stress method are as below.

1)it consider the almost actual behaviour of the structure during entire loading up to the failure.

2)the method is based on statistical probabilistic approach.

3) it adopts the concept of fitness of structure to serve the desired function during the service life & defines the limiting state of fitness as the limit state.

4) it attempts t to define quantitatively the margins of safety on some mathematical foundations rather than on adhoc basis of experiment & judgment.

5)the method, adopts the idea of probability of structure becoming unfit,& attempts to achieve the minimum acceptable probability of failure.

II.COMPARISION OF L.S.M & W.S.M

For comparison of these two methods we consider a singly reinforced beam section so that we can conclude the result easily. We choose singly reinforced section of different sizes and calculate load carrying capacity of these sections with limit state method & working stress method by applying all constants.
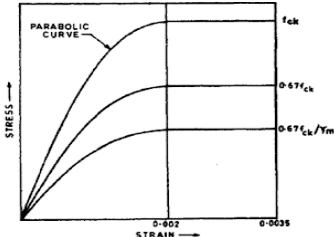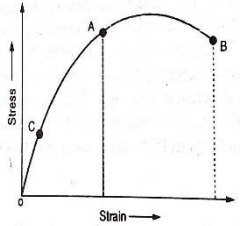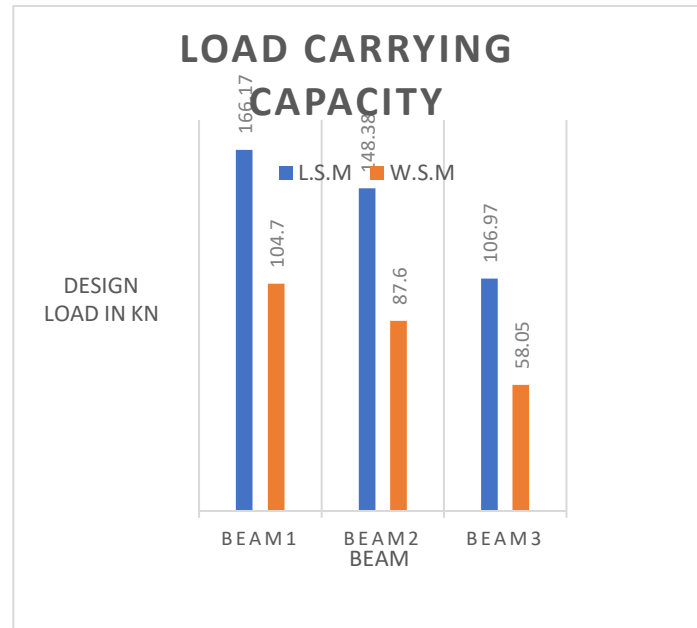
L.S.M	W.S.M
This method gives economical design.	This method gives uneconomical design.
Factor of safety used for different loads	Factor of safety not used for different loads
Stress strain graph of concrete is nonlinear.	Stress strain graph of concrete is linear.
It gives idea about ultimate load the section can carry.	It does not gives idea about ultimate load the section can carry.
Cross section of member is reduced.	Cross section of member is increased.
Material strength are fully utilized.	Material strength are not fully utilized
This method is is applicable to concrete structure.	This method is not applicable to concrete structure.

TABLE NO.1:

Analysis of singly reinforced section by L.S.M & W.S.M & compare load carrying capacity.

Member	cross section	load carrying capacity in L.S.M (KN)	load carrying capacity in W.S.M (KN)
BEAM	300MM X 650MM	166.17	104.7
BEAM	250MM X 550MM	148.38	87.6
BEAM	250MM X 500MM	106.97	58.05

CONCLUSION

The limit state method considers actual behavior of structure rather than working stress method. Both methods used partial safety factors but limit state method uses partial safety factors according to loading conditions and same will not follow by working stress method i.e factor of safety is constant for all conditions.

As limit state method gives strength up to collapse which gives ultimate strength. When we compare limit state method with working stress method it is observed that 40% increase in strength due to which we can reduce the size of the section.

Overall limit state method is best suited to R.C.C structure as compare to working stress method.

The limit state method is widely used method in reinforced concrete structure for design as it gives true value of ultimate strength & follows nonlinear behaviour of concrete.

The working stress method is not used for R.C.C Structures because it consider only linear behavior of concrete & not gives true margin of safety also modular ratio does not gives true value.

Limit state method is heart of analysis & design of structure.

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