REINFORCED CEMENT CONCRETE STRUCTURES

IV SEMESTER CIVIL ENGINEERING

LIMIT STATE METHOD
PART-I

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INTRODUCTION

OBJECTIVES TO BE FULFILLED BY A STRUCTURE:

- TO BEAR ALL LOADS AS A WHOLE WITHOUT COLLAPSE
- ALL ELEMEMTS MUST BEAR THE LOADS COMING ON THEM WITHOUT COLLAPSE
- STRUCTURE MUST SERVE THE PURPOSE FOR WHICH IT IS CONSTRUCTED

- CRITERIA FOR FAILURE AND SERVICEABILITY MAY DIFFER FROM PERSON TO PERSON
- LIMIT STATE METHOD SEEKS FOR ESTABLISHING ACCEPTABLE LIMITS FOR FALIURE AND SERVICEABILITY
- LIMIT STATES OF COLLAPSE INCLUDES-

  1. FLEXURE OR BENDING
  2. SHEAR
  3. TORSION
  4. DIRECT COMPRESSION

- LIMIT STATES OF SERVICEABILITY INCLUDES-

A- PRIMARY

1. DEFLECTION (refer Art.23.2 of IS 456-2000)
2. CRACKING (refer Art. 35.3.2 of IS 456-2000)

B- SECONDARY

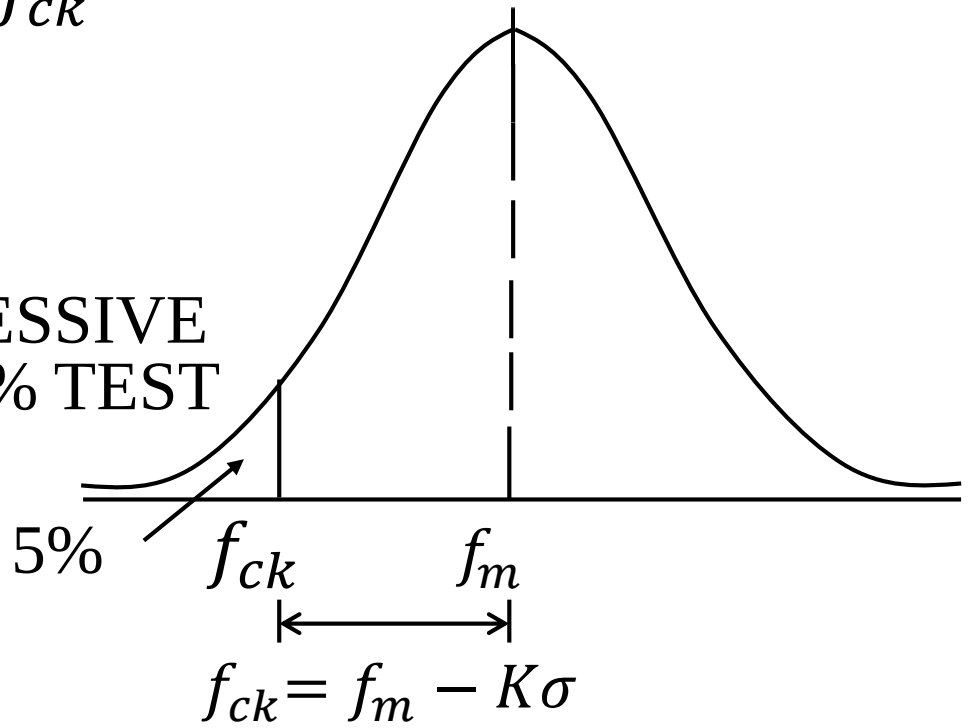
1. DURABILITY
2. FIRE RESISTANCE
3. EXCESSIVE VIBRATIONS
4. FATIGUE

LIMIT STATE OF COLLAPSE: FLEXURE

CHARACTERISTIC STRENGTH OF CONCRETE f_{ck}

$$compressive\ strength = \frac{load\ at\ failure}{area}$$

CHARACTERISTIC STERNGTH IS THAT COMPRESSIVE STRENGTH BELOW WHICH NOT MORE THAN 5% TEST RESULTS FALL



TEST RESULT – One test result is the average of the strength of 3 cubes.

K = constant whose value is 1.65

σ = standard deviation

f_m = mean strength

STRENGTH OF CONCRETE IN STRUCTURE

A SAFETY FACTOR OF 1.5 HAS BEEN CONSIDERED

$$f = \frac{f_{ck}}{1.5}$$

$$f = 0.67 f_{ck}$$

IN ADDITION TO THIS A PARTIAL SAFETY FACTOR FOR MATERIAL $\gamma_m = 1.5$ HAS BEEN USED

DESIGN STERENGTH

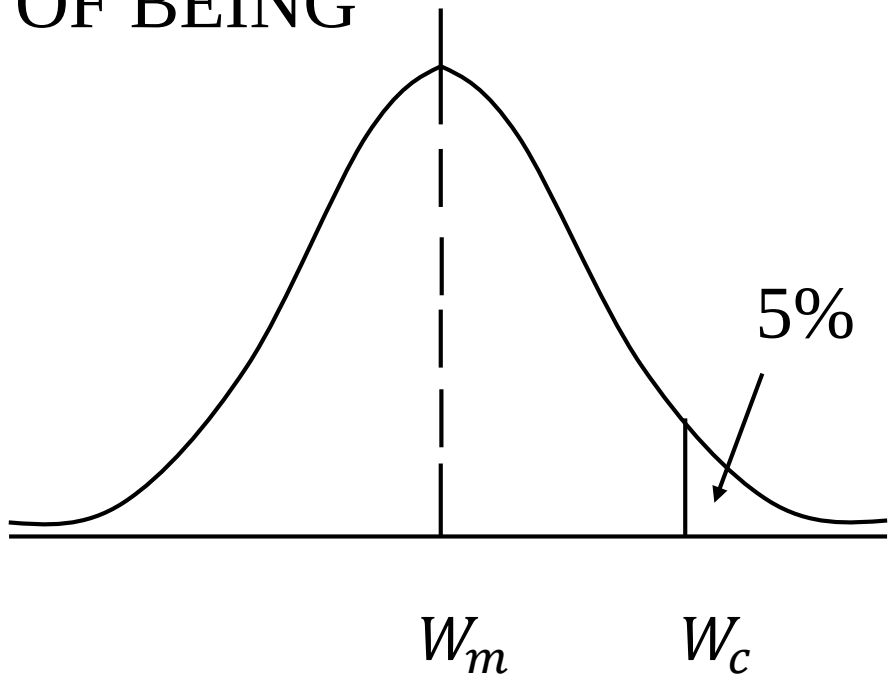
$$f_d = \frac{0.67 f_{ck}}{1.5}$$

$$f_d = 0.446 f_{ck}$$

CHARACTERISTIC LOAD

THAT LOAD WHICH HAS ONLY 5% CHANCES OF BEING EXCEEDED IN THE LIFE OF THE STRUCTURE

$$W_c = W_m + K\sigma$$

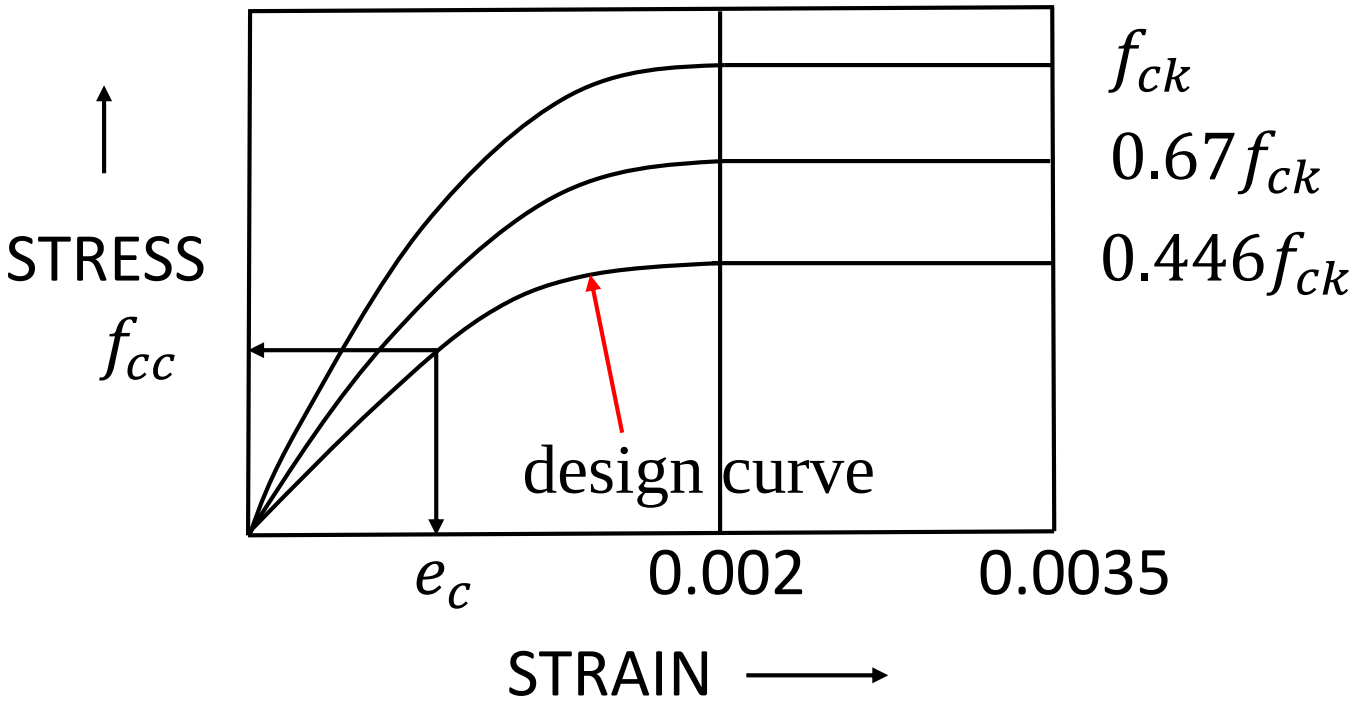


K = constant whose value is 1.65

σ = standard deviation

W_c and W_m are characteristic and mean loads respectively

DESIGN CURVE FOR CONCRETE

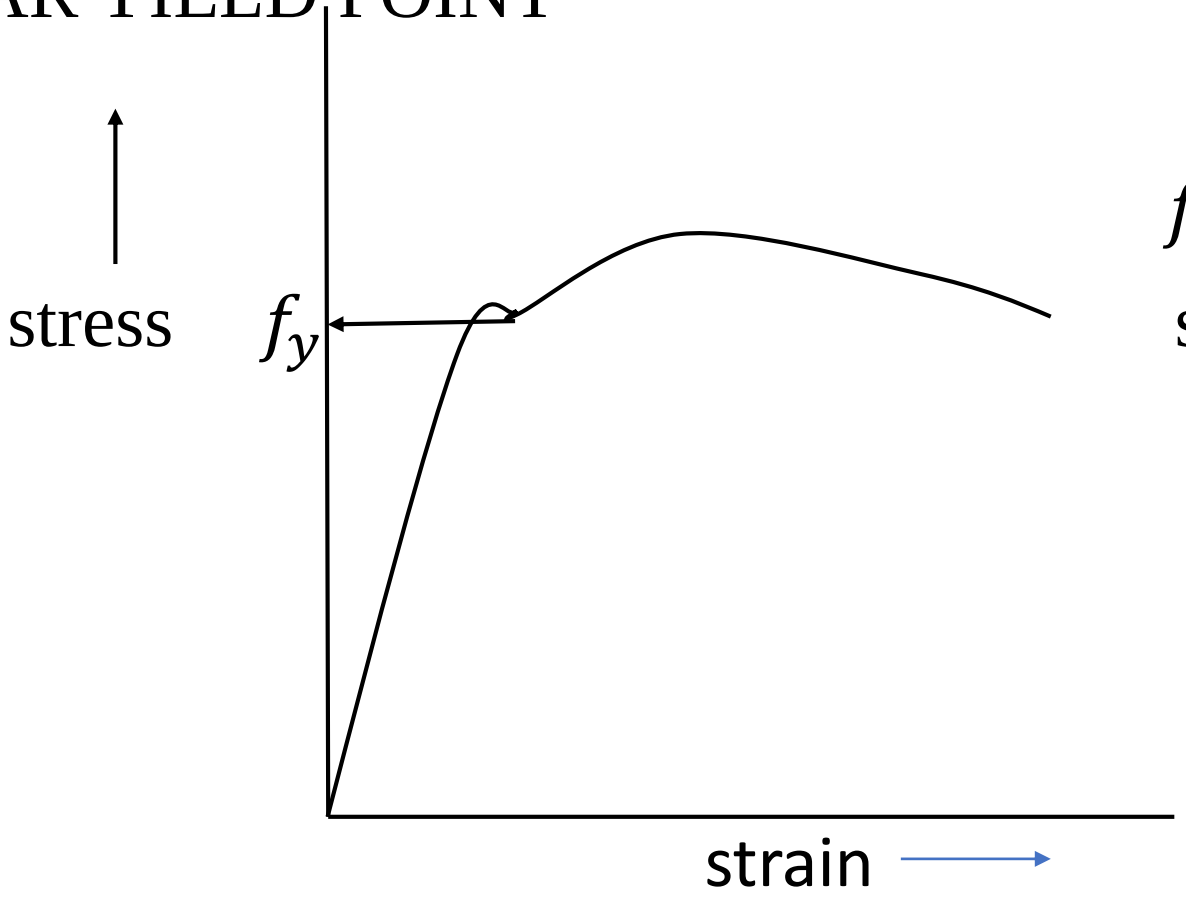


curve is parabolic up to a strain of 0.002

equation of parabolic part of design curve is $f_{cc} = 446f_{ck}(e_c - 250e_c^2)$

CHARACTERISTIC STRENGTH OF STEEL

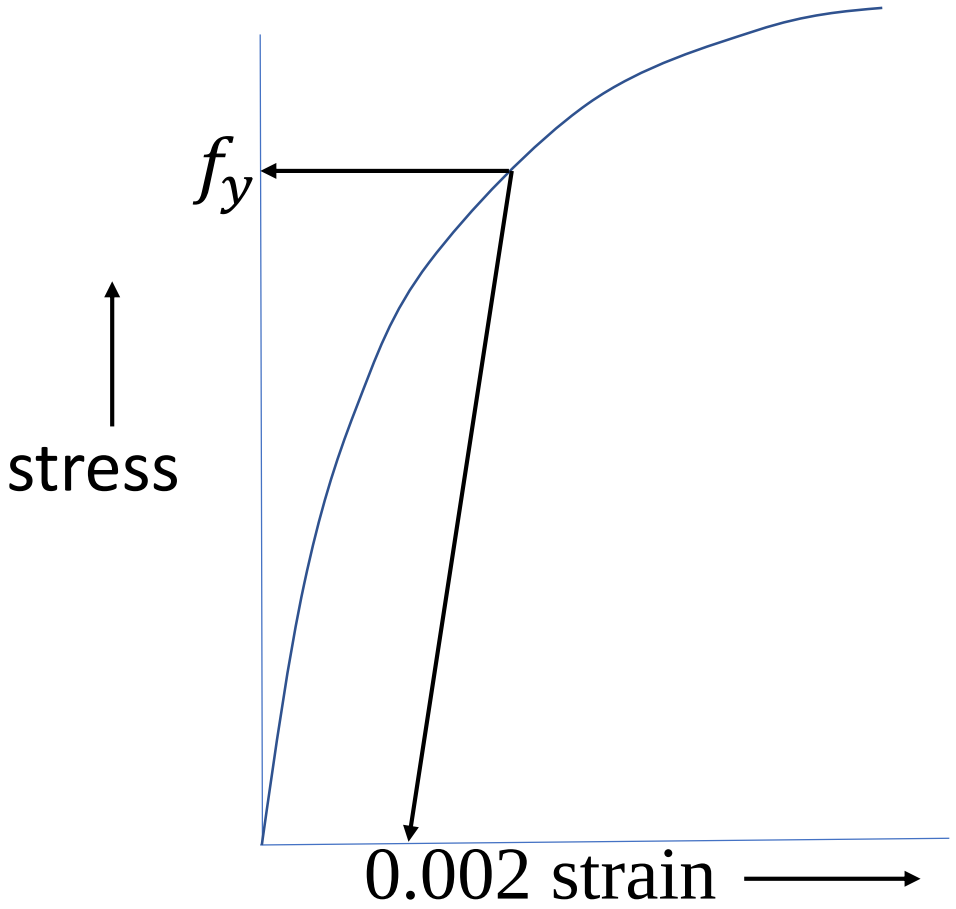
- MINIMUM YIELD STRESS OR 0.2% PROOF STRESS
- 0.2% PROOF STRESS IS TAKEN FOR MATERIALS HAVING NO CLEAR YIELD POINT



f_y = yield stress

stress – strain curve for mild steel

Stress-strain curve for Fe415 /Fe500



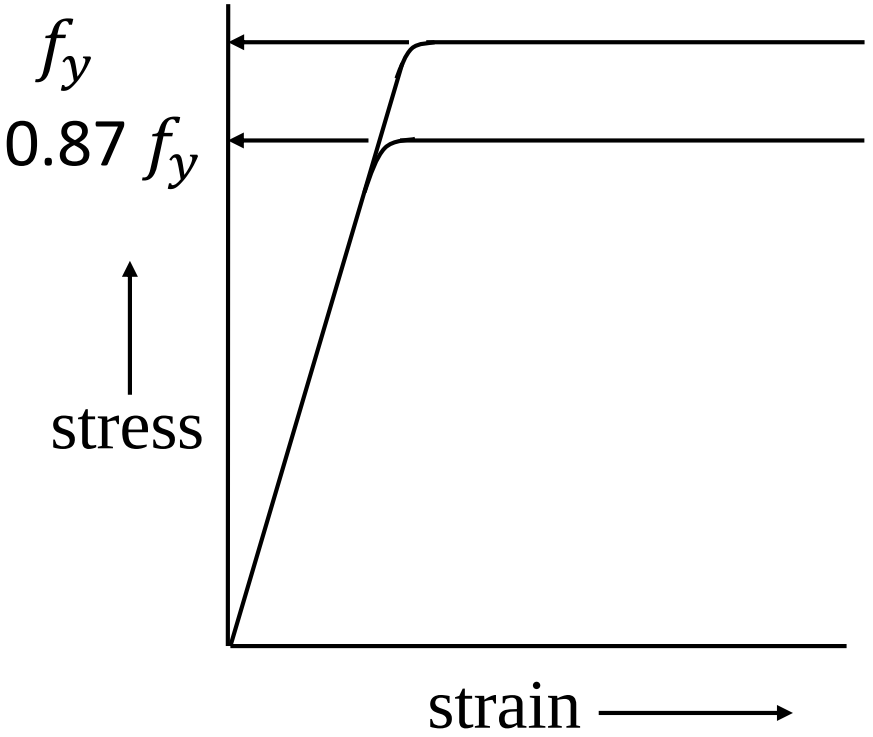
f_y= yield stress corresponding to 0.002 strain

DESIGN STRESS FOR STEEL

- PARTIAL SAFETY FACTOR FOR STEEL $\gamma_m = 1.15$
- DESIGN STRESS

$$f_d = \frac{f_y}{1.15}$$

$$f_d = 0.87 f_y$$



Ideal design curve for mild steel (Fe 250)

THANK YOU