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STRUCTURAL MECHANISM AND FAILURES: THE IMPLICATIONS, CONSEQUENCES, AND REMEDIES:-A REVIEW

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ABSTRACT: Structures are generally known to be a product of Engineering materials, characteristics and behavior with regards to the anticipated loadings and other environmental requirements. The engineering materials of structures includes steel, reinforced concrete, Timber, plastics, glass etc. The material strength are usually considered as the main criterial in determining specific functional application and also the design consideration. The effects of loads and forces on physical structures are determined by structural analysis, which is an important procedures in structural design and construction processes. Structures are loads bearing substances and arrangements of interactive and inter-related elements for that purpose should therefore ensure stability. This study examined structural mechanism, consequences, and remedies with concluding remarks for consideration.
Keywords: - Structural, Mechanism, Failures, Implications, Consequences, Remedies.

INTRODUCTION

Basic structural concepts generally, structures are usually designed as load bearing structures and arranged as interrelated elements. Structures usually includes man-made objects such as bridges, buildings etc. Built structures are broadly categorized as building structures, architectural structures, such as civil engineering structures like silos, Damns, Bridges etc. The effects of loads or forces on physical structures are usually determined by known principles of structural analysis, which is an important procedure for any structural design and general construction work. Structural elements can be classified as are dimensional type (i.e struts, beams, arches) and two-dimensional like plates, slabs. Shells, etc. the three dimensional structures are solid masses space frames. The structural elements in this group are combined in structural systems or assemblages, where the applied loads can be easily be placed on the structures (e.g floor slab) to the fixation of the structure firmly on the ground through an adequate sub-structure. The majority of the load-bearing structures are generally section- Active structures, like frames which are primarily composed of one-

dimensional (bending) structures other are vector-active structure such as fusses surface-active structures.

Concepts of Structural Stability: The stability of structures is usually the resistance that is provided by a structure to undesirable movement; such as sliding, collapsing, overturning etc. the stability of structures usually depends upon the supports conditions in ensuring that the structures are being held firmly in a static, rest position, and also on the rigid position of the structural components from the point of loading to the actual sub-soil, thereby forming a stable structural system. Structure is said to be stable, if it can resist the applied load sufficiently and will be unstable when not all the available forces can actually resist the actions of the load without undergoing displacement of subjected excessive deformation.

Structural Deflection:- Deflection of structural elements (e.g beams, slabs, columns etc) usually deflects from their original positions. The amount by which such structural elements deflects depends upon their cross sectional areas and the bending moments. In most modern design offices, the major criteria for the deflection of structural elements are the strength and the stiffness. The designed elements are usually expected to be strong enough to resist the bending moments and the shear forces. Structural elements are also expected to be stiff enough to resist the deflection or not to deflect more than the permissible limit under the action of loadings.

Structural Deformation and Failures:- Structural deformation is known as the transformation of a body from its stable position to a current unstable configuration. A configuration is a set containing the positions of all particles of the body, which is considered at rest and static for the equilibrium consideration of structures. Deformation generally may be caused by the action of external loads, forces, temperature changes, moisture contents, or by chemical actions, affecting their usual stable and configurations and stability.

Strain is usually a description of deformation in terms of relative displacement of particles in the body that excludes rigid body motions under a continuous body, the relation between stresses and induced strains is usually expressed by

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constitutive equations of Hooke's law for linear elastic material. Since strain is a measure of the deformation representing the displacement between particles in the body which is relative to a reference length, the deformation can be analytically presented in the form:- X=f(x), where x is the reference position of the material points within a body. Therefore, the strain on the body can be defined as:-

P=u?x(p-x)=fi-l

Where l is the identity or an initial configuration. Strain dimensionless and is usually expressed as a decimal fraction; or in percentage, since it measures how much a given deformation differs locally from a rigid body dimension.

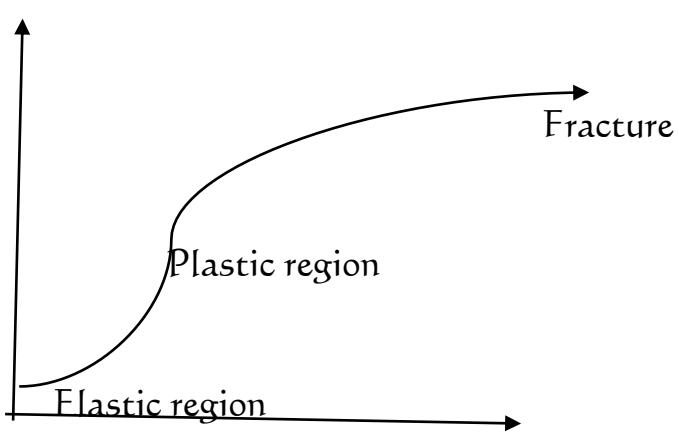

Fig 1:- A typical stress deformation diagram.

THE BASIC REQUIREMENTS FOR STRUCTURES

The general objectives of any structural design are to prepare the designed structure for stability, required strength and serviceability. The designed structure should also be economical and should possessed good aesthetic when finally constructed or built. The following are essentially adequate for any structure to perform adequately:-

1. **Economy and Aesthetic-** These are major criteria that are used in the design of a sustainable and adequate structures. The common aesthetic design principles usually includes ornamentation, texture, flow, solemnity and harmony.
11. **Stability and Strength-** Theses are necessary design characteristics for a structure and the service consideration to prevent excessive deformation,

overturning, sliding or buckling of the structure, and component parts under the usual action of applied loads.

III. **Structural System:-** The structural system refers to the load –resisting sub-system of structure. The structural system transfer the loads through the interconnected structural components of all members. Structures are generally categorized based on the type of the primary stress that may arise in the members of the structures under major design loads and forces. In some cases, two or more structural types may be combined in a single structure, such as buildings, dam or bridges.

STRUCTURAL MECHANISM AND FAILURES

Structural mechanism and failure is noted as the loss of loads- carrying capacity of the components of the structural members. Structural failures is usually initiated when the material of the structure is stressed to its usual strength limit, thereby causing excessive irreversible deformation and fracture, which normally leads to ultimate collapse i.e. when the permissible strength limit of a material is exceeded by the applied stress. It is therefore advisable that the strength of structures be determined after the reasonable period of use in order to ensure the safety and allow for the confidence of the structures and also for public utilization.

The failure mechanism of any structure can therefore be considered as those factors that usually contribute to the structural failure, which could affect the performance efficiency of the structure. The factors that contributes to the failures are:-

I. **Fatigue Failure: -** This is the weakening of a material that is caused by repeated applied loads. The progressive localized structural damage occurs when a material is subjected to cyclic loading. The nominal maximum stress that causes such damage is usually less than stress life, strain life and the linear elastic fracture

II. **Fracture:-** Fracture is the separation of an object or material into two or more parts, under the actions of applied stresses. Fracture usually occur due to the development of certain displacement of discontinuous surfaces within the solid condition. If a displacement development is perpendicular to the surface discontinuity surfaces, it is called a normal tensile crack and

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when the development is tangential, it is called shear crack or slip band dislocation.

III. **Cracks: -** This is the failure which usually commences at a weak point, known as the point of stress concertation within the mass of a structural components such as beams, columns, slabs etc. crack is initiated by dislocation and it continues by growing.

REMEDIES FOR STRUCTURAL MECHANISM AND FAILURES

I. **Structural Integrity and Testing:-**Structural integrity is an aspect of Engineering that deals with the ability of any structure that support the design loads without breaking or collapsing. Structural integrity applies to the evaluation or performance of structural elements. It usually indicates that a constructed structure will perform Its designed function during its service lifetime.

II. **Essential of Structural Testing:-**structural testing is an integral part of the modern construction techniques and Engineering procedures and practice and are usually done to establish the standards and adequate performance. Actual structures may require testing by test situation or in the development of models in order to determine the possibility that an existing building can meet the standard and functional performance.

III. **Engineering Validation Test:-** This is usually performed on engineering prototypes in order to ensure that the basic unit performs according to the actual design goals and specification. Identifying the design problems and solving them at early stage of the design is a good measure for professional practice. A design verification test is an intensive testing program, which is performed to deliver objective; comprehensive testing; verifying all product specifications and standards.

IV. **Design Refinement:-** This is an iterative design methodology that is based on a process that is based on a process of prototyping; testing; analyzing and refining a product or process. The outcome of the tests, changes and refinements are carry out before subjecting the models to actual construction. This procedure is intended to improve the quality and the functionality of any design; which when properly applied will ensure a process, which will be the best solution for the design.

V. **Stress Test Analysis:-** stress analysis can be carry out through classical mathematical techniques; analytical modeling or computational simulation and experimental testings techniques or a combination of methods. The ultimate goal of stress analysis is towards the use sage of the structures and for specific loading criteria.

CONCLUSION

Consequences of structural failures: - Failure consequences are the results of damages, which are the effects of component deformation or material failure in a structure, and the corresponding damaging remedies that are associated with such failures. Failure of engineering systems could lead to fatalities and severities Engineering Regulation and Monitoring (ERM), which is a unit in COREN, should make their activities more active and effective in the construction processes; so that their role can be disaster averting and be prevented in any construction activities. There should be modalities for reporting professionalism in all engineering works with standard specifications for construction execution. There should be adequate quality control checks in construction as it progresses until the time of project completion.

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