CHAPTER II

LITERATURE REVIEW

The structural of building should fulfill the requirement “Strong Column Weak Beam”, it means when building structure get the seismic design load, plastics hinge in the building structure can occur at the end of beams, at the bottom of columns and at the bottom of structural walls (BSN, 2002).

Objectives of design should satisfy four criteria (Macgregor, 1997):

1. Appropriateness, the arrangement of spaces, spans, ceiling heights, access, and traffic flow must complement the intended use. The structure should fit its environment and be aesthetically pleasing.
2. Economy, the overall cost of the structure should not exceed the client’s budget. Frequently, teamwork in design will lead to overall economies
3. Structural adequacy, structural adequacy must be strong enough to safely support all anticipated loadings and also must be no deflect, tilt, vibrate, or crack in a manner that impairs its usefulness.
4. Maintainability, a structure should be designed to require a minimum of maintenance and to be able to maintained in a simple fashion.

The selection of structural systems for buildings is influenced primarily by the intended function, architectural considerations, internal traffic flow and also economics aspects. According to Paulay and Priestley (1991), the degree of protection desired and the increase in costs to the resistance of the structures against earthquake during their service life are consists of three parts:

1. Seismic Design Limit State (50 – years – return period earthquake), no damage which is caused by minor intensity of ground shaking. Parameter that determined is stiffness.
2. Damage Control Limit State, for medium intensity of ground shaking, some damage may occur and the building can be repaired, some of reinforcement is designed to be damage to release seismic dissipation energy. Parameter that determined is strength.
3. Survival Limit State, loss of life should be prevented even during the strongest ground shaking feasible the site. Structure do not collapse, parameter that determined is ductility.

2.1. Concrete Slab

Slabs are elements of buildings that can be supported by beams, girders or columns. Slabs experience bending and shear. Tension side in flexural slabs may be reinforced with steel. The shear stress in slab normally must be resisted by the concrete itself. Therefore, generally, there is no shear reinforcement in slab. (Arfiadi, 2005)

2.2. Beam

A beam is a structural element that carries load primarily in bending (flexure). Beams generally carry vertical gravitational forces but can also be used to carry horizontal loads (i.e. loads due to an earthquake or wind). The loads carried by a beam are transferred to columns, walls, or girders, which then transfer the force to adjacent structural compression members.

Five assumptions are taken as follows (Macgregor, 1997):

1. Section perpendicular to the axis of bending which are plane before bending remain plane after bending
2. The strain in the reinforcement is equal to the strain in the concrete at the same level
3. The stresses in the concrete and reinforcement can be computed from the strains using stress - strain curves for concrete and steel.
4. The tensile strength of concrete is neglected in flexural strength calculations
5. Concrete is assumed to fail when the compressive strain reaches a limiting value.

Depending on the properties of a beam, flexural failures may occur in three different ways, there are:

1. Tension failure, reinforcement yields before concrete crushes (reaches its limiting compressive strain) such a beam is said to be under - reinforced
2. Compressive failure, concrete crushes before steel yields. Such a beam is said to be over - reinforced
3. Balance failure, concrete crushes and steel yields simultaneously. Such a beam has balanced reinforcement.

2.3. Column

A column is a vertical structural element that transmits, through compression, the weight of the structure above to other structural elements below. Column normally support combined bending moment and axial load, under certain conditions column may support axial tension and bending moment, for example under earthquake and wind load.

Generally columns have several types there are tied columns, spirally columns and composite columns. For spiral columns are used when ductility is important or where high loads make it economical to utilize the extra strength resulting from the higher strength reduction factor, and also for seismic area.

It is highly desirable that plastic hinges form in the beams rather than in the columns, because the dead load must always be transferred down through the columns, the damage to the column should be minimized. That is why the structural of building should fulfill the requirement “Strong Column Weak Beam”, it mean when building structure load the seismic design, plastics hinge in the building structure can occur at the end of beams and at the bottom of columns and structural walls. (BSN, 2002).

2.4. <u>Foundation</u>

The function of the foundation is to transmit safely the high concentrated column and/or wall reactions or lateral loads from earth-retaining walls to the ground without causing unsafe differential settlement of the supported structural system or soil failure.

If the supporting foundations are not adequately proportioned, one part of a structure can settle more than an adjacent part. Various members of such a system become overstressed at the column-beam joints due to uneven settlement of the supports leading to large deformations. The additional bending and torsional moments in excess of the resisting capacity of the members can lead to excessive cracking due to yielding of the reinforcement and ultimately to failure.

If the total structure undergoes even settlement, little or no overstress the supporting soil highly yielding such that a structure behaves similar to a floating body that can sink or tilt without breakage. (Nawy, 2009)

Pile foundations. This type of foundation is essential when the supporting ground consists of structurally unsound layers of material to large depths. The piles may be driven either to solid bearing on rocks or hardpan or deep enough into the soil to develop the allowable capacity of the pile through skin frictional resistance or a combination of both. The piles could be either precast, and hence driven into the soil, or cast in place by drilling a caisson and subsequently filling it with concrete. The precast piles could be reinforced or prestressed concrete. Other types of piles are made of steel or treated wood. In all types, the piles have to be provided with appropriately designed concrete caps reinforced in both directions. (Nawy, 2009)