CHAPTER II

LITERATURES REVIEW

2.1. General

Moment-resisting frames carry lateral loads primarily by flexure in the members and joints. Joints are designed and constructed so they are theoretically completely rigid, and therefore any lateral deflection of the frame occurs from the bending of columns and beams.

The Intermediate Moment Resisting Frame (IMRF), which is a concrete or steel frame with less restrictive requirements than special moment-resisting frames. However, intermediate frames cannot be used in high risk seismic zones.

Moment-resisting frames are more flexible than shear wall structures or braced frames; the horizontal deflection, or drift, is greater. Adjacent buildings cannot be located too close to each other, and special attention must be paid to the eccentricity developed in columns, which increases the column bending stresses (Purwono, R., 2005)

The selection of structural systems of buildings is influenced primarily by the function of building usage, architectural considerations, 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 damaged 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 at the site. Structures do not collapse, parameter that determined is ductility.

2.2. 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 it is generally knowledge, there is no shear reinforcement in slab.

2.3. 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.

2.4. 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. (Badan Standarisasi Nasional, 2002).