Department of Civil Engineering
Indian Institute of Technology Guwahati

CE 302: Structural Analysis II (2019-2020)

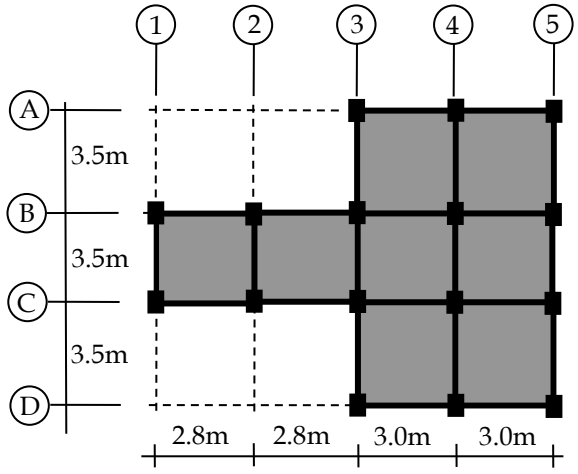
Term Project Sheet :: Group 2

Part I

An eight-storeyed moment-resistant reinforced concrete frame building with unreinforced brick masonry infill walls, has the following details:

Soil conditions at the site	: Rocky
Floor-to-floor height	: 3.2 m
Height of foundation storey	: 3.2 m
Thickness of floor slabs and roof slab	: 115 mm
Size of beam	: 250 mm × 400 mm
Size of column	: 400 mm × 400 mm
Grade of concrete	: M30
Thickness of infill wall	: 115 mm
Depth of strut for infill wall	: 0.25 × Diagonal length of strut
Modulus of elasticity for brick masonry	: 6,300 MPa
Live load on roof	: 1.5 kPa
Live load on floor	: 3 kPa
Load combinations	: (a) 1.5 *DL* + 1.5 *LL*, (b) 1.2 *DL* + 1.2 *LL* + 1.2 *HL* (*DL*, *LL* and *HL* are the dead load, live load and the horizontal load)

Unreinforced brick masonry infill wall is present in all the stories of the building (*including the foundation storey*). Other inputs are given as follows:



Typical Floor Plan

Level	Total Horizontal Force (kN)
Roof	140
Seventh floor	115
Sixth floor	100
Fifth floor	75
Fourth floor	45
Third floor	28
Second floor	20
First floor	10
Ground floor	5

(a) Model the entire building in SAP2000 by (i) representing the infill walls as equivalent single struts, (ii) considering beams (consider $0.35I_{gross}$ for modelling), columns (consider $0.7I_{gross}$ for modelling) and struts as frame members and (iii) considering only the load distribution from slabs (*do not model the slabs, assign rigid diaphragm constraint for the in-plane stiffness of the slabs*).

(b) For the mentioned load combinations, obtain the design shear forces and bending moments in the beams and the columns for separate load application along the two directions.

(c) For the mentioned load combinations, show the locations of the members (along with the member number in the model) where the design forces and moments are observed.

Documents to be submitted: (a) Only the *.sdb* file of the SAP2000 model (no other accessory file),
(b) MS Excel file showing the design shear forces and the bending moments, and
(c) load calculations and any other explanation (*soft copy* or *hard copy*)

Part II

A three storied moment-resistant reinforced concrete frame building, without unreinforced brick masonry infill walls, has the **same** (a) **building plan**, (b) **overall dimensions**, (c) **section sizes** of the **beams, columns** and the **slabs**, (d) the **grade** of **concrete, and** (e) **the live loads** on the **floors** and the **roof,** as the **building in Part I**. The lateral loads at the different floor levels are shown in the table below:

Level	**Total Horizontal Force (kN)**
Roof floor	50
Second floor	40
First floor	18
Ground floor	8

(a) Model the building in SAP2000 by (i) beams (consider $0.35I_{gross}$ for modelling) and the columns (consider $0.7I_{gross}$ for modelling) as frame members and (ii) considering only the load distribution from the slabs (*do not model the slabs, do not assign any rigid diaphragm constraint*).

(b) For the mentioned load combinations, obtain the design shear forces and bending moments (*for the same load combinations as mentioned in Part I*) in the beams and the columns for separate load application along the two directions.

(c) Write a computer program in MATLAB for analyzing the same frame, using stiffness matrix method.

(d) Compare the results of the MATLAB program output with those obtained in (b).

Documents to be submitted: (a) Only the *.sdb* file of the SAP2000 model (no other accessory file),
(b) MS Excel file showing the design shear forces and the bending moments,
(c) load calculations and any other explanation (*soft copy* or *hard copy*),
(d) soft copy of the MATLAB program and its output, and
(e) any other file for explaining the program.

Dates of submission

1. Part I : 10 October 2019
2. Part II : 13 November 2019