

UNIVERSITI TEKNOLOGI MARA

**ECS 358
CIVIL ENGINEERING DESIGN PROJECT**

**REINFORCED CONCRETE BUILDING DESIGN
PROJECT**

**PROJECT BASED LEARNING(CASE
STUDY)**

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1.1. Introduction

Structural engineering is considered as sub-discipline of civil engineering that trained structural engineers to design and build of man-made structures. Structural engineers must have the skill to design and calculate stability, strength, and rigidity of a built structures. The calculation for those parameters were done by following the design prepared by the architect that often supervise the construction of the project by contractors on site. Structural engineers play an important role as they need to have the responsibilities of making sure that the design is adequate and efficiently using the funds, materials, and structural elements to achieve the goals of the construction. It is also crucial to make sure the design is complied with the standards to avoid any structure failure after the construction is done.

For this two storey house project, it is started by preparing the project schedule. Project schedule act as a guideline that indicates what need to be done, when the project is due, and which resources need to be utilized. It also acts as a timetable which consist of start and end dates that must be followed by the workers to make sure the project is complete within the time. Moreover, the Work Breakdown Structure (WBS) will indicate and distribute evenly work among the team members. It also can be described as a document that collects all the work needed to deliver the project on time.

Next step is to prepare the structural key plan for the building. Structural key plan for this 2 storey house consist of 3 drawings which are ground floor key plan, first floor key plan, and roof key plan. The drawings of structural key plan provide a clear information about the position and number of the structural components which are useful for the construction stage. It also provides details dimension and a general arrangement plan or layout necessary for site construction proper. Structural key plans are prepared based on the architectural drawing prepared by the architect.

There are several main structural components of a house which are slab, beam, column, foundation and staircase. Those structural components are important to be designed as it will determine whether the building is safe to live in. Slabs of a building are built at the building site by using formwork. Formwork act as a box where the concrete is poured into it to form a slab. The reinforcement bars are placed in the formwork box before the concrete is poured in. reinforcement bars are essential to have for concrete slab as it provides additional strength for the structural

3.1 summary of design work

In a nutshell, the objective of the project which is to design main structural component of a building and also failure check are achieved. The design and calculation are done based on requirement of Uniform Building By-Law (UBBL). The design calculations of all the structural components are pass without any failure. This is achieved by considering the suitability of the diameter bar size used to ensure the strength of structural components. Besides, the bar size used are economical as they are not too big based on the as required from the structural components.

Moreover, the size for each structural component is determined. It is determined by using assumptions formula for example the slab thickness is assumed using the formula of $l_x/d=30 + 30$. However, the beam size estimated earlier needed to be change because of the failure occurred on the crack check. Changing the size of diameter bar could not help the beam to pass the cracking check thus, the beam size is changed to a bigger size compared to the size used by assumptions formula. The size of column used for design is based on the beam breadth which is 200mm. The column shape is square thus the size of the column is 200 mm x 200 mm. For pad footing, the size obtained from the formula equation and the size recorded for this pad footing design is 1500 mm length and the thickness of pad footing is 150 mm. The staircase size is designed based on the provided architectural drawing.

3.2 Recommendations/Reflections

It is recommended to use reinforced concrete (RC) to build the two-storey house for this project as it reflects the strength by increasing the overall strength of concrete. Concrete is described as brittle material which means that it is strong under compression but less in tension. Rebar that were added in the concrete can withstand tensile forces. It is also recommended to use the approach of cast-in-place for reinforced concrete. This is to make sure the cost is maintained and within the allowable budget because precast concrete is more expensive. However, the use of cast-in-place concrete has the disadvantage in time. This approach takes time because concrete will need to have curing time but this problem can be consider as small issue because only one house is going to be build thus, the duration time for the project completion will not be too long. Manual calculation used a slightly different formula compared to software prokon for example, manual calculation used the formula of $wl^2/8$ to get the maximum bending moment for simply supported beam but prokon software is auto generated to find maximum moment. The different in formula gives slightly different A_s required for each design element. However, the value of A_s required will not be much differet for manual and prokon calculation thus, the difference is acceptable.