CHAPTER I
INTRODUCTION

I.1 Topic description and background

Universitas Atmajaya Yogyakarta faculty of civil engineering require the students to complete 4 practices that cover the major fields of civil engineering. These 4 practices are: building design and structure, road design, hydraulic design and cost and time management. These practices' aim is to prepare the students for actual real engineering work so they will have understanding of each field after they graduate. These practices gave a degree of freedom for students to create their own design, overcoming certain challenges and tasks during their work thus creating a self-learning experience that's more effective than standard lectures.

I.1.1 Building/structure design practice overview

Building design is a fundamental field for a civil engineer. It's about the design process of a building from sketches to a complete structural design. Students are required to calculate, check and draw every single structural part of the building. But, it's also required that the design would be economically feasible, thus requiring students to create the most efficient design possible.

References used for codes and methods are:

1. Steel code SNI 1729:2015
2. Concrete code SNI 2847:2013
3. Earthquake code SNI 1726:2019
4. Earthquake loading calculation SNI 1726:2012

I.1.2 Road design practice overview

Roads are inseparable part of an infrastructure network. Therefore constructing good quality roads that are efficient is vital to development. Designing a road requires lots of considerations. From the terrain, vehicle speed,

even the traffic flow will require certain adjustments in the design. Then, roads must also build to be comfortable to be driven on, last long and economical to build. Therefore the design must be efficient and detailed, because even the slightest mistake may hinder the entire road network.

Here are the used data and references for this practice:

1.Topography maps (scale 1:1000).

2. Class I.

3. Station A STA 7+500 with coordinate (9000:5800) and azimuth 45°.

4. Design elevation filled a depth of 0.50m.

5. Design speed = 60-70 km/h

6. Shoulder width = 3.5 m with e = 1.5%

7. Curve e_{max} = 10%

8. Drainage: height = 1 m, width = 2 m both sides, distance from shoulder = 0.5 m

9. *Peraturan Perencanaan Geometrik Jalan Raya No. 13/1970*

10. *RSNI T-14-2004 Geometri Jalan Perkotaan.*

All of the cross section drawing was done in Autocad.

I.1.3 Hydraulic structure design overview

Hydraulic infrastructure is an important part of civil engineering because of its role supporting other major infrastructure such as agricultural or residential. Weir is one of the key hydraulic infrastructure for agriculture. It serves as flood control and irrigation distributor for irrigation channels around it. Designing a proper weir require extensive data collecting regarding rainfall, river basin area and determining water flow.

References and data used for the methodology:

1. Map of watershed and river basin

2. 10 years rainfall data from BMKG

3. KP 02: *Standar Perencanaan Irigasi, Bangunan Utama* (Head Works), 2010

4. KP 04: *Standar Perencanaan Irigasi, Bangunan*, 2010

5. KP 06: *Standar Perencanaan Irigasi, Kriteria Perencanaan Bagian Parameter Bangunan*, 2009

All of the cross section drawing was done in Autocad.

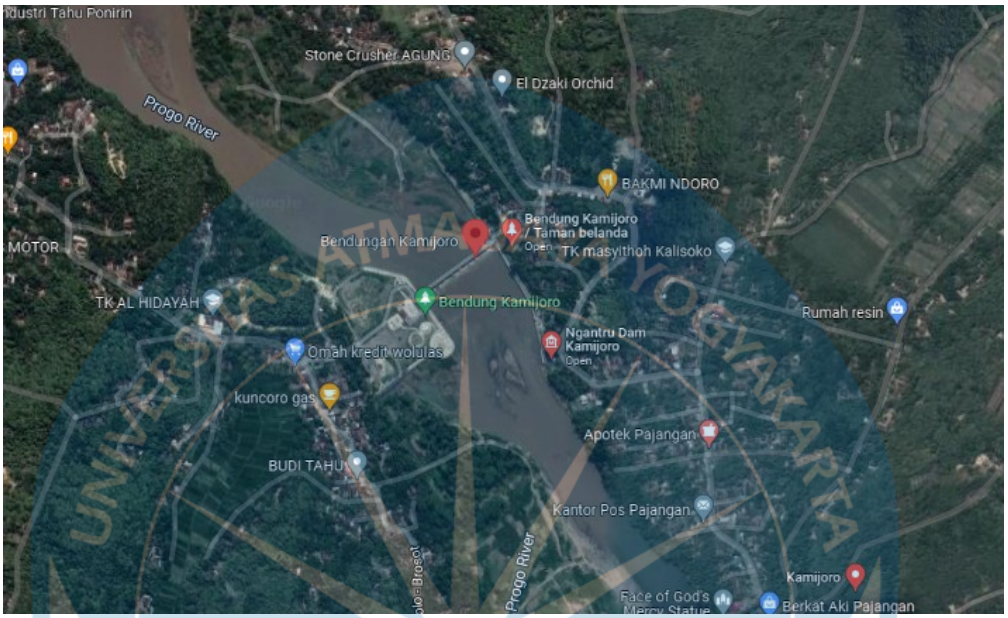

Figure 1: Kamijoro weir location from Google Maps view

I.1.4 Cost and time management overview

Managing cost and time is a constant process during any construction project. A proper management planning can save a lot of cost and time while a bad one can ruin a project before it even started. Cost and time management revolves around cost estimation, work volume calculation, work scheduling, and creating the S-curve wit Microsoft Project. Then, the completed calculations will be compiled into a single building budget plan.

I.1.4.1 SNI guidelines for work volume and coefficient

1. *Peraturan Walikota Yogyakarta Nomor* 67 *Tahun* 2017 *tentang Analisa Harga Satuan Pekerjaan Konstruksi dan Jasa Lainnya di Lingkungan Pemerintah Kota Yogyakarta*

2. SNI 2835:2008, *Tata cara perhitungan harga satuan pekerjaan tanah untuk konstruksi bangunan gedung dan perumahan*

3. SNI 2836:2008, *Tata cara perhitungan harga satuan pekerjaan pondasi untuk konstruksi bangunan gedung dan perumahan*

4. SNI 2837:2008, *Tata cara perhitungan harga satuan pekerjaan plesteran untuk konstruksi bangunan gedung dan perumahan*

5. SNI 3434:2008, *Tata cara perhitungan harga satuan pekerjaan kayu untuk konstruksi bangunan gedung dan perumahan*

6. SNI 7394:2008, *Tata cara perhitungan harga satuan pekerjaan beton untuk konstruksi bangunan gedung dan perumahan*

7. SNI 7395:2008, *Tata cara perhitungan harga satuan pekerjaan penutup lantai dan dinding untuk konstruksi bangunan gedung dan perumahan*

I.1.4.2 SNI guidelines for work cost and salaries

1. AHS SNI 2017-2018 *Lingkup Pekerjaan Arsitektural dan Sipil*

2. AHS SNI 2017-2018 *Lingkup Pekerjaan Mekanikal dan Elektrikal*

3. SNI *Daftar harga Satuan Bahan dan Upah* 2017-2018

4. *Peraturan Gurbernur Daerah Istimewa Yogyakarta Nomor* 40 *Tahun* 2018 *tentang Standar Harga Barang dan Jasa Daerah*

I.2 Problem statement and methodology

I.2.1 Building design practice

I.2.1.1 Problem statement

Design a 4 story building with hip roof type, 10,5 meters wide from the side and 27 meters wide from the front, with stairs as means of traveling in between floors. Each floors will have 4 meters of interstorey space. The office building will be located in the Babarsari, Yogyakarta, near Universitas Atma Jaya Campus 2 Building. Building structure such as: roofs, stairs, bordes, slabs, beams, columns and foundations meet safety check and earthquake safety check. Resulting building design must be usable as an office and efficient in materials.

I.2.1.2 Methodology

Start with roof design, which includes purlin, truss and joints design. Continue with stair and bordes design. At this point, begin slab calculations as well. Beams and columns can be designed with the slabs because their forces interact with each other. Then check their earthquake safety. After all design is clear, design the foundations and do a final check for safety. Programs such as ETABS, IKOLAT, and SAP 2000 help analyze and check structural safety. Autocad was used for architectural drawing, structure drawing and structural component drawing.

I.2.2 Road design practice

I.2.2.1 Problem statement

Design road from point A to Point B with no minimum curve using: full circle, spiral-circle-spiral, spiral-spiral. The road will have design elevation filled depth of 0.50m. Design speed will be 60-70 km/h and shoulder width = 3.5 m with e = 1.5%.

I.2.2.2 Methodology

This practice focus on a part of road design, which is geometric design. I am required to plan and design the best possible route from point A to point B without minimum curve using the following types of curve: full circle, spiral-circle-spiral and spiral-spiral. It's also required to draw the superelevation line, elongated profile, and transverse profile. Drawing the transverse profile must be done every 50m for each tangent line and 25m for each curve. Then, calculate where the edges of pavement and centerline of highway would be. After all the profiles were calculated and drawn in autocad, evaluate the earthwork (cut and fill). Finally, design and draw the drainage of highway.

I.2.3 Hydraulic structure design practice

I.2.3.1 Problem statement

This practice will require redesigning the existing Kamijoro weir into a completely new design that's calculated from the ground up.

I.2.3.2 Methodology

Use the given maps to create Thiessen polygon and determine watershed area (A) that flows into Progo river. From there, determine station areas based on the polygon and use rainfall data from each station to proceed towards frequency analysis. Frequency analysis will start with determining appropriate distribution type. From there, do rainfall distribution check using Chi-square and Smirnov-Kolmogorov method. Once finished, the value of Q_{flood} for 50 and 100 years must be acquired along with Q_{depend}. Weir design can begin once those previous data are acquired. Once the design is complete, verify the stability against earthquake, sliding, overturning, uplift and soil support.

I.2.4 Cost and time management practice

I.2.4.1 Problem statement

The project for this practice is of a single story house on a 142.8 m^2 land. Complete drawing of the house are given, this include all the necessary material names, dimensions and furnishings needed to complete the cost estimation research. Using these given data, create a budget plan and S-curve for weekly costs and completion percentage for the project.

I.2.4.2 Methodology

In order to assemble the budget plan report, one must obtain the volume of every work, estimate its cost and create the S-curve for the schedule.