# POLITEKNIK UNGKU OMAR

# A PROPOSAL TO UPGRADE A THREE-JUNCTION TRAFFIC LIGHT TO A FOUR-JUNCTION TRAFFIC LIGHT IN PUO


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**Report submitted in partial fulfilment of the requirement of the award of the Diploma of Civil Engineering Department**

## CIVIL ENGINEERING DEPARTMENT

## SESSION I 2023/2024

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**FEB 2023**

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# A PROPOSAL TO UPGRADE A THREE-JUNCTION TRAFFIC LIGHT TO A FOUR-JUNCTION TRAFFIC LIGHT

1. I am a student's Civil Engineering Diploma, Polytechnic Ungku Omar, whose address is at Jalan Raja Musa Mahadi, 31400 Ipoh, Perak.
2. I acknowledge that the 'A Proposal To Upgrade A Three-Junction Traffic Light To A Four-Junction Traffic Light 'and its intellectual property in it is my original work/design without taking or copy any intellectual property from other parties.
3. I agree to release the intellectual property ownership of 'A Proposal To Upgrade A Three-Junction Traffic Light To A Four-Junction Traffic Light 'to meet the requirements for award Civil Engineering Diploma to me.

**Done and truly acknowledge by the said.**

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In front of me, En Kamarudin bin Yunus as a Project Supervisor in June 2023

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# ABSTRACT

Traffic management plays a crucial role in ensuring the smooth flow of vehicles and pedestrians within educational institutions like polytechnics. Efficient traffic signal systems are essential to enhance safety, minimize congestion, and perfect traffic operations. This proposal aims to upgrade a three-junction traffic light system to a four-junction traffic light system at Polytechnic, with the objective of improving traffic management and enhancing the overall transportation experience on campus. The proposed upgrade involves installing an additional traffic light at a key intersection within the polytechnic campus to accommodate the growing traffic demands and address existing congestion issues. By upgrading from a three-junction to a four-junction traffic light system, the new installation will offer better control and coordination of vehicular and pedestrian movements, effectively reducing delays and potential accidents. The project begins with a thorough analysis of the current traffic conditions and patterns within the polytechnic campus. This analysis will provide valuable insights into the existing traffic volume, peak hours, and pedestrian behaviour. Based on this data, an optimized traffic signal plan will be developed, considering the new junction and its impact on the overall traffic network. The upgrade will involve the installation of additional signal heads, detectors, and controller units at the proposed four-junction location. The new system will incorporate advanced technologies such as vehicle and pedestrian detectors, adaptive signal control algorithms, and synchronization with nearby traffic signals, if applicable. These enhancements will ensure efficient traffic flow, reduce congestion, and prioritize pedestrian safety. Additionally, the proposal considers the integration of smart features, such as real-time monitoring and data collection capabilities, into the upgraded traffic light system. This will enable the polytechnic's transportation department to gather valuable traffic data, which can be used for future planning, system optimization, and decision-making. The proposed upgrade aims to create a safer and more efficient transportation environment within the polytechnic campus,

benefiting students, staff, and visitors alike. The project will require careful coordination with relevant stakeholders, including the transportation department, local authorities, and construction teams, to ensure a seamless transition and minimize disruption during the implementation phase. In conclusion, upgrading the existing three-junction traffic light to a four-junction traffic light at Polytechnic represents a significant step towards improving traffic management and enhancing the overall transportation experience within the campus. The proposed project incorporates advanced technologies and optimized signal plans to achieve efficient traffic flow, reduce congestion, and prioritize pedestrian safety. This upgrade will establish a foundation for future advancements in traffic management systems and pave the way for a smarter and more sustainable transportation network within the polytechnic campus.

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# CHAPTER 1

# INTRODUCTION

## 1.1 BACKGROUND OF STUDY

The study of roads involves the examination of the design, construction, maintenance, and management of transportation infrastructure used for vehicular and pedestrian travel. This includes studying the physical characteristics of roads such as their width, slope, alignment, and surface materials, as well as the safety and operational considerations that are necessary for safe and efficient travel.

The history of roads can be traced back to ancient civilizations, where the earliest roads were built to facilitate trade and transportation. Over time, roads have become increasingly important for the movement of goods and people and have evolved to include several types of roads such as highways, freeways, and local roads.

The design of roads involves consideration of the road's purpose, traffic volume, and expected travel speed. Engineers must also consider factors such as topography, climate, and geology when designing a road, as these can impact the construction and maintenance of the road.

Construction of roads involves materials such as asphalt, concrete, and gravel to build a sturdy and durable roadway. Construction crews use heavy equipment such as bulldozers, excavators, and pavers to prepare the roadbed, lay down the surface material, and install drainage systems.

Maintenance of roads is essential for ensuring their longevity and safety. Maintenance activities include routine tasks like patching potholes and repairing pavement cracks, and more extensive repairs such as resurfacing or rebuilding a section of roadway. Maintenance also includes winter snow and ice removal, and the repair or replacement of signs, signals, and guardrails.

Management of roads involves planning and coordinating activities like road repairs, traffic flow management, and safety initiatives. Transportation agencies and local governments work to ensure that roads are well-maintained and that the needs of all road users, including motorists, cyclists, and pedestrians, are addressed.

## 1.2 PROBLEM STATEMENT

Here are some problem statements that can be used to create traffic from junction three to junction four:

- How to plan traffic from junction three to junction four to facilitate mobility and reduce congestion in the area?
- What are the obstacles and challenges that must be faced in making traffic from junction three to junction four?
- How to determine the right lane to make traffic from junction three to junction four?
- How to optimize the use of available land to create traffic from junction three to junction four?
- What is the optimal layout to create traffic from junction three to junction four to minimize the risk of accidents and improve safety?
- How to make traffic from junction three to junction four environmentally friendly by reducing vehicle exhaust gas emissions?
- How to ensure good accessibility for people who use traffic from junction three to junction four, including pedestrians, bicycles, and public transport users?
- How to determine the optimal technology and facilities to make traffic from junction three to junction four, such as traffic lights, road signs, and road markings?

By knowing the exact problem statement, this can plan and implement traffic development from junction three to junction four more effectively and efficiently.

## 1.3 IMPORTANT ACTIVITY

The activity of creating traffic from junction three to junction four has several interests, among others:

- Facilitating Mobility: Making traffic from junction three to junction four will facilitate the mobility of vehicles and people passing through the area. This will help reduce traffic jams and the travel time needed to travel.
- Improving Accessibility: With better traffic, the community will have easier access to various facilities and services around junction three and junction four, such as hospitals, markets, schools, and workplaces.
- Increase Economic Potential: With better traffic, increased accessibility, and reduced congestion, the economic potential in the area can also increase. This can encourage the growth of new businesses and improve the economy in the area.
- Improve Safety and Security: With regular and directed traffic, the risk of accidents and safety can be reduced. This will provide a sense of security for the community passing through the area.
- Improving Environmental Quality: By reducing traffic jams and travel time required, vehicle exhaust gas emissions can also be reduced. This will have a positive impact on air quality and the environment around junction three and junction four.

Thus, making traffic from junction three to junction four has a vital importance in improving mobility, accessibility, economic potential, safety, and security, as well as the quality of the environment in the area.

## 1.4 OBJECTIVE

The objective of this project are as follows:

- To design a three-junction traffic light to a four-junction traffic light.
- To develop a flow of traffic lights.
- To test traffic light flow using Infraworks.

## 1.5 SCOPE OF STUDIES

The scope of the proposal to upgrade a three-junction traffic light to a four-junction traffic light will involve several key considerations. Here are some key factors to keep in mind:

- Traffic flow: The first consideration when proposing an upgrade from a three-junction traffic light to a four-junction is the current traffic flow in the area. If there is a significant increase in traffic or congestion at an intersection, adding an additional intersection can help alleviate some of the issues.
- Budget: Upgrades to four-way traffic lights may require additional equipment, installation, and ongoing maintenance costs. Therefore, the budget must be considered before proceeding with any proposal.
- Environmental Impact: The upgrade may also have an impact on the environment. Additional electrical power may be required, which can increase energy consumption and greenhouse gas emissions.
- Safety: One of the most important considerations when proposing any upgrade to traffic lights is safety. Adding other intersections may require additional safety measures, such as new crosswalks or additional signage.
- Legal requirements: Any upgrades to traffic lights must comply with local and national laws and regulations. It is important to ensure that the proposed upgrade meets all legal requirements before implementation.
- Community Input: Finally, it is important to gather feedback from the community about the proposal. Community input can provide insight into potential issues that may arise from upgrades and help identify potential solutions.

Overall, the scope of the proposal to upgrade three-junction traffic lights to four-junction traffic lights involved careful consideration of numerous factors such as traffic flow, budget, safety, legal requirements, and community input. By taking all these considerations into account, a proposal can be developed that meets the needs of all stakeholders and ensures a successful upgrade.

## 1.6 DEFINITION

A proposal to upgrade a three-junction traffic light to a four-junction traffic light refers to a plan or proposal to modify the existing traffic control system at a particular intersection by replacing the existing three-junction traffic signal with a new four-junction traffic signal.

Three-way traffic lights control the flow of traffic at three-way intersections, while four-way traffic lights control traffic flow at four-way intersections. The proposed upgrade will involve the installation of new traffic lights, signal heads and guards to enable traffic management at the fourth junction.

The goal of such proposals is to improve traffic flow, increase safety, and reduce congestion at intersections by providing a more comprehensive traffic control system. This upgrade will allow for the implementation of advanced traffic management features such as crosswalks, dedicated turning lanes and better coordination with adjacent intersections.

# CHAPTER 2

# LITERATURE REVIEW

A literature review is a critical summary and analysis of previous publications and research on a particular subject is called a literature review. It includes deliberately looking and investigating academic articles, books, and various sources pertinent to the examination question or subject in question.

A literature review aims to provide a foundation for the development of new research questions and hypotheses, highlight key debates and controversies, identify gaps in the literature that require additional investigation, and identify the current state of knowledge on a subject.

A literature review provides a coherent and comprehensive overview of the topic's existing knowledge and research by synthesizing and evaluating the findings from various sources. It is used to demonstrate the researcher's familiarity with the existing literature and their capacity to critically analyze and synthesize complex information. It is an essential component of most research papers, dissertations, and theses.

## 2.1 INTRODUCTION

Jalan Raja Musa Mahadi is a major road in Ipoh, Malaysia, in the state of Perak. It is in front of Polytechnic Ungku Omar, a well-known local educational establishment. The road is known for having a lot of traffic, especially at peak times. The traffic situation at Jalan Raja Musa Mahadi is a frequent problem that has an impact on students, faculty, and locals' day-to-day lives. The road is frequently jammed, resulting in long car lines and traffic delays for those passing through the area. The substantial number of buses, cars, motorcycles, and trucks that use the road to get around is primarily to blame for the congestion.

Safety concerns have also arisen for pedestrians who must cross the road to reach the Polytechnic Ungku Omar because of the traffic issue. This problem is made worse by the absence of safe pedestrian and zebra crossings, as people frequently must cross the road in a risky way. At Jalan Raja Musa Mahadi, efforts have been made to improve the traffic situation. This includes constructing a roundabout close to the Polytechnic Ungku Omar and installing traffic lights at specific intersections. However, there is still work to be done to improve the situation, such as creating more effective public transportation options and pedestrian bridges to reduce the number of private vehicles on the road.

Overall, the traffic situation at Jalan Raja Musa Mahadi remains a significant challenge that requires continued attention and action from local authorities to ensure the safety and convenience of the community.

## 2.2 TRAFFICLIGHT HISTORY

The history of upgrading the traffic lights at the Ungku Omar Polytechnic intersection in Ipoh has been a response to the increasing traffic demands and the need for improved traffic management. Efforts have been made to optimize the traffic control systems to accommodate the growing volume of vehicles at the intersection. This includes the consideration of upgrading the line-rate of current traffic control systems to enhance their capacity and efficiency (Andrade et al., 2010).

Furthermore, the history of upgrading the traffic lights at the intersection involves the implementation of advanced traffic management techniques. This includes the exploration of smart traffic management systems, such as fuzzy logic-based approaches, to reduce the average waiting time of vehicles, especially during adverse weather conditions (Abdou et al., 2022).

Additionally, the history of upgrading the traffic lights at the Ungku Omar Polytechnic intersection may have also involved the evaluation of network topology evolution generators to efficiently manage the increasing traffic and distribution models.

In conclusion, the history of upgrading the traffic lights at the Ungku Omar Polytechnic intersection in Ipoh reflects a response to the escalating traffic demands, the adoption of advanced traffic management techniques, and the exploration of innovative approaches to enhance traffic control systems.

## 2.3 COMPARISON 3 JUNCTION AND 4 JUNCTION TRAFFIC LIGHT

The comparison between three-junction and four-junction traffic lights involves numerous factors such as traffic flow, average travel times, and traffic management strategies. Research by (2008) highlights that self-control of traffic lights can lead to a considerable reduction in average travel times and their variation, indicating potential benefits for traffic flow and efficiency (Lämmer & Helbing, 2008). Additionally, the study by Brockfeld et al. (2001) emphasizes the importance of global strategies such as green wave and random switching strategies in optimizing traffic lights to enhance throughput, which can be relevant for both three-junction and four-junction configurations (Brockfeld et al., 2001).

Furthermore, the impact of traffic light control on traffic flow and delays is a critical consideration (Pandit et al., 2013). demonstrated that adaptive traffic signal control algorithms can significantly reduce delays experienced by vehicles at intersections, which is pertinent to both three-junction and four-junction traffic lights (Pandit et al., 2013). Moreover, the potential for reduced traffic delays and improved traffic flow is also supported by (Aleko & Djahel, 2020), who found that an efficient adaptive traffic light control system led to a significant reduction in the average travel time of vehicles, particularly in synchronized directions (Aleko & Djahel, 2020).

In contrast, the references by Box (2014) and Zhang et al. (2018) focus on innovative approaches such as supervised learning and virtual traffic lights, which may have implications for traffic light control at both three-junction and four-junction intersections, but the direct comparison between the two configurations is not explicitly addressed (Box, 2014; Zhang et al., 2018).

In conclusion, the comparison between three-junction and four-junction traffic lights involves factors such as traffic flow, average travel times, and traffic management strategies. While research indicates potential benefits in terms of reduced travel times and improved traffic flow for both configurations, further studies directly comparing the performance of three-junction and four-junction traffic lights would provide valuable insights into their relative effectiveness.

## 2.4 ISSUE

To ensure the safe and effective movement of vehicles on Raja Musa Mahadi Road, traffic management and control are crucial. Any road network would be incomplete without traffic lights, which regulate the movement of cars at intersections. By gathering information or opinions from students and staff at Ungku Omar polytechnic, this project seeks to make it easier for students, assistants, and contractors to pass through gate C. The project's main goals are to increase intersection safety and traffic flow while reducing congestion, making it easier for heavy equipment to enter the Ungku Omar Polytechnic, and improving traffic flow.

Overview of the Current System. The project's first stage involved analysing the three-junction traffic light system that is currently in place. This analysis will assist in identifying its drawbacks, such as clogged roads, prolonged wait times, and potential security issues. We can identify the areas where a four-junction system would be useful by understanding the shortcomings of the current system. (Welz, 2023)

The current system needs to be upgraded to make room for a fourth intersection, which calls for careful planning and infrastructure changes. The goal of this phase is to optimise the design and choose the best location for additional traffic lights by analysing the volume and pattern of traffic at the intersection. The effects of suggested design changes on traffic flow and safety will be evaluated using traffic simulation and modelling. (Dhingra et al., 2021; Pau et al., 2018)

The synchronisation and coordination of traffic signals is one of the major difficulties in upgrading the system. Time Control and Optimisation Mechanism. This project will investigate sophisticated control strategies and signal change time optimisation algorithms. By doing this, all four intersections' traffic will flow smoothly and effectively, reducing obstructions and delays. The project will also investigate how adaptive control systems and smart sensors can be combined to dynamically change signal timing based on current traffic conditions. (Scandella et al., 2022)

Safety Considerations. Safety is paramount in any traffic management system. Upgrading to a four-junction traffic light system requires a thorough analysis of potential safety risks. This phase of the project will focus on the implementation of safety measures, such as pedestrian crossings, dedicated turning lanes, and appropriate signage, to reduce any hazards. The project will also consider the impact on vulnerable road users, such as cyclists and pedestrians, ensuring their safe navigation through the intersection. (Zhang et al., 2014)

The project's final stage will involve assessing the performance of the upgraded four-intersection traffic light system and making recommendations for the future. Performance indicators like waiting times, traffic flow, and accident rates will be assessed and contrasted with the original three-intersection system. Based on the findings, suggestions for advancements or additional advancements can be made. The project will also investigate how the upgraded system can be scaled to accommodate future growth and shifting traffic patterns.(Novianka P et al., 2020)

The final year project presents an exciting opportunity to enhance traffic control and increase road safety by changing the three-junction traffic light system to a four-junction system. This project seeks to contribute to the creation of a more effective and intelligent traffic control system through the analysis of existing systems, the design and implementation of infrastructure upgrades, the optimisation of control mechanisms, the consideration of security measures, and the evaluation of system performance. The outcomes of this project could benefit both drivers and pedestrians in urban settings by being applied in real-world scenarios.

# CHAPTER 3

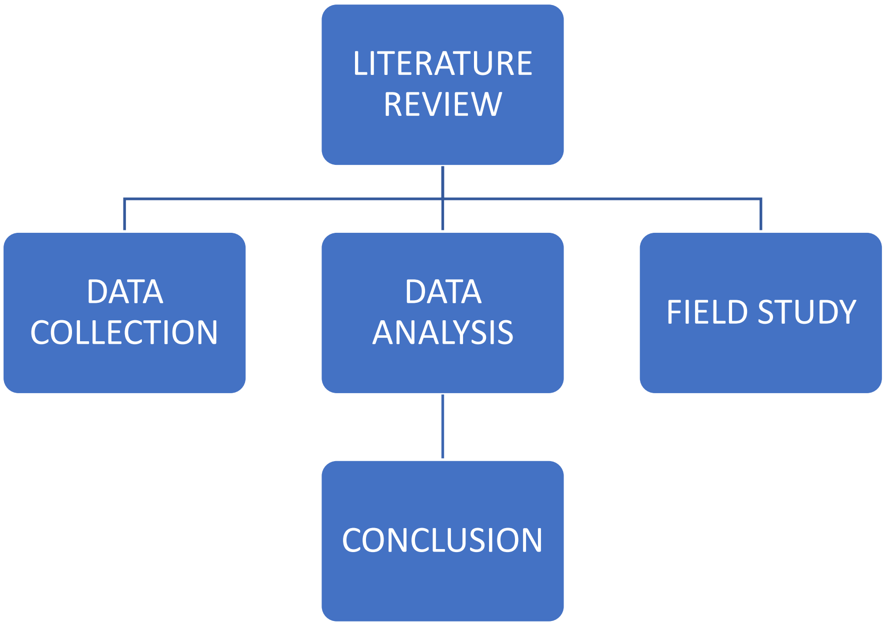
# METHODOLOGY

## 3.1 INTRODUCTION

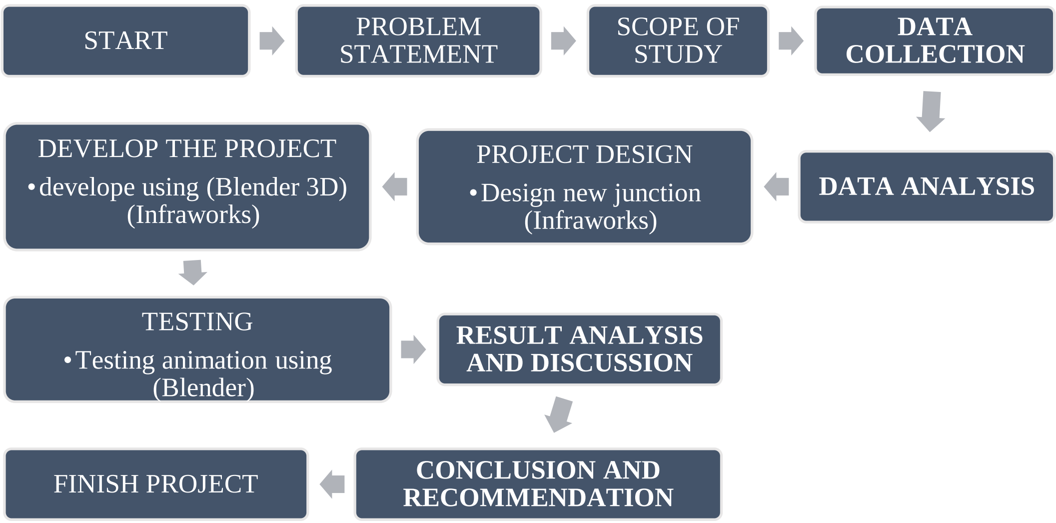
To make a clearer view of proposal it is essential to provide a simple and clear picture of our project describing, explaining, and predicting phenomena called methodology. This chapter will cover a details explanation of the methodology that is being used to make this project complete and work well. Many methodologies or finding from this field are generated in journals for others to take advantage of and improve as upcoming studies. Typically, it encompasses concepts such as paradigms, theoretical models, animation, phases and quantitative or qualitative techniques. In implementing the project, the process of carrying out the project is particularly important to get the outcome of what had been planned from the beginning. In this chapter explain a bit about the summary execution of work done to produce our product to achieve the objective and get quality results.

There are many approaches to be taken to achieve the objectives of this study. The methodology that has been used is categorized into a few stages:

i. Literature Review
ii. Data collection
iii. Design and Development




## 3.2 FLOWCHART



## 3.3 LITERATURE REVIEW

The literature review for the research on upgrading a three-junction traffic light to a four-junction traffic light in PUO encompasses a comprehensive analysis of existing research on traffic jam data in Malaysia. The focus is on identifying the causes, factors, types of vehicles involved, and the timing of traffic jams. The research also aims to explore potential solutions to address the identified problems.

## 3.4 DATA COLLECTION

The data collection for this research is about the apparatus that we use to collect the data, to analyse the data and what the formula that we can apply at this project. The first one is to obtain traffic congestion statistics from Jabatan Kerja Raya (JKR). Then, it also includes the Traffic Studies in this research which consists of the Traffic Volume Study and Peak Hour.

### 3.4.1 The Operation of the Traffic Light

Operation of the traffic lights on Jalan Raja Musa Mahadi and Jalan Taman Cempaka should be installed at four traffic light junctions. Expanding the operation of traffic lights from a three-junction to a four-junction system involves a strategic adaptation of signal sequences to accommodate the additional intersection. In the transition, traffic light controllers must be reconfigured to introduce a new signal phase for the fourth junction while maintaining synchronization with the existing phases. This adjustment ensures that each direction, including the new intersection point, receives a fair allocation of green time based on traffic demand.

Factors such as pedestrian crossings, left-turn movements, and potential conflicts at the fourth junction are carefully integrated into the signal cycle, emphasizing the importance of optimized control strategies to facilitate safe and orderly movement of both vehicular and pedestrian traffic across the expanded four-junction traffic light network.

There are various forms of traffic flow that are used at intersections. In this project all modes (normal mode, emergency mode and night mode) use the same traffic pattern i.e. only one way of traffic is allowed through the intersection at a time.

### 3.4.2 Traffic Studies

Two types of studies were conducted in this research to determine the condition of traffic lights in the study area. Facilities and landmarks in the area have not changed since 2012 so the current data is assumed to simulate traffic conditions in the past. The traffic study conducted is described in the following sub-topics.

i. Peak Hour Volume

The peak hour volume on Jalan Raja Musa Mahadi is the focus of the traffic study in the area. During peak hours, especially during the morning and evening hours, this area may experience a significant increase in traffic volume. This research process includes periodic data collection to measure the number of vehicles passing through Jalan Raja Musa Mahadi at these critical times. Detailed analysis of traffic movement patterns, peak volume determination, and congestion assessment help identify factors that affect traffic flow at that time. The results of this study provide valuable information for the development of effective traffic management strategies, including the adjustment of traffic signal timings, infrastructure improvements, and the implementation of measures to overcome traffic congestion during peak hours on Jalan Raja Musa Mahadi.

ii. Traffic Volume

The traffic volume study on Jalan Raja Musa Mahadi presents a comprehensive analysis of the pattern and intensity of vehicle movement in the area. By using automatic traffic count methods, manual observation, and video surveillance, this study aims to collect complete data on the number of vehicles passing through the road at various times and traffic conditions. This analysis will also focus on factors that may impact traffic volume, including causes of congestion, pedestrian movement, and vehicle speed patterns. The results of this study are expected to provide in-depth insight to assist in the planning and efficient management of traffic on Jalan Raja Musa Mahadi, ensuring the safety and efficiency of movement in the area.

## 3.5 DESIGN AND DEVELOPMENT

Data collection for this research is about the equipment we use to collect data, analyse the data, and what methods we can use in this project. The first is to get statistics for traffic congestion from the public works department or more easily for users who use the road. Later, it also included a traffic study in this research that consisted of peak hours.

Diagram 3.1 New junction design

## 3.6 LOCATION

The chosen location is in the Gate C area of Ungku Omar Polytechnic, Jalan Raja Musa Mahadi, Ipoh. The purpose of this project is to reduce the rate of congestion that occurs at the main gate of the polytechnic as well as at gate B at the intersection during peak hours. In addition to that, this project can also prevent any accidents from happening. The chance of an accident is very slim.

Diagram 3.2 Top view for junction

Diagram 3.3 View from Taman Cempaka Road

Diagram 3.4 View from Polytechnic to Town

## 3.7 TRAFFIC TIMING

### 3.7.1 Objective

The objective of signal timing is to alternately assign the right of way to various traffic movements (phases) in such a manner as to minimize average delay to any single group of vehicles or pedestrians and to reduce the probability of accident producing conflicts.

### 3.7.2 Formula

Saturation flow, S is the capacity of a traffic-signal controlled intersection is limited by the capacities of the individual approaches to the intersection. This capacity of an approach is measured independently of traffic and other controlling factors and it expressed as the saturation flow. Saturation flow is defined as the maximum flow, expressed as equivalent passenger cars that can cross the stop line of the approach where there is a continuous green signal indication and a continuous queue of vehicles on the approach.

STEP 1

Determine the Saturation Flow, S

A. No on- street parking

1. Effective approach width, w > 5.5m
2. W < 5.5m, refer to table 3.3

| W(m) | 3.0 | 3.25 | 3.5 | 3.75 | 4.0 | 4.25 | 4.5 | 4.75 | 5.0 | 5.25 |
|---|---|---|---|---|---|---|---|---|---|---|
| S(pcu/hr) | 1845 | 1860 | 1885 | 1915 | 1965 | 2075 | 2210 | 2375 | 2560 | 1760 |

B. On street parking. W is reduced by LW where

$LW = 1.7 – 0.9 (Z - 7.6 / k)$

Where Z = clear distance of the nearest parked car from

the stop line

K = green time in second

## STEP 2

Determine of Y value

$y = q / s$

where:

y = ratio of flow to saturation flow

q = actual flow on a traffic signal approach in pcu/hr

s = saturation flow for the approach in pcu/hr

The ‘Y’ value for a phase is the highest y value from the approaches within that phase

## STEP 3

Determine the total lost time per cycle, L

Total lost time per cycle, L is given by,

$L = \sum (I – a ) + \sum l$

Where,

I = Intergreen time between phases = R = a : R = all red interval

a = amber time (assumed 3 second)

l = drivers reaction time at the beginning of the green per phane

(in practice, it set at 2 seconds but 0-7 seconds can also be used )

STEP 4

Determine of optimum cycle time, $C_o$

$C_o$ is the average delay for the intersection, but this delay is not increased if the cycle time varies within the range of 0.75 to 1, 50 of the calculated $C_o$ in seconds

$$C_o = 1.5L + 5 / 1 – Y$$

STEP 5

Determine of signal setting

$$g_n = Y_n / Y (C_o – L)$$

Where,

$g_n$ = effective green time of the nth signal phase

$Y_n$ = calculated Y – value of the value of the same signal phase

The actual green time, G = g + l + R

Controller setting time, K = G – a – R

= g + l – a

## 3.8 SUMMARY

The proposed upgrade of the traffic lights from a three-junction to a four-junction system at Jalan Raja Musa Mahadi and Polytechnic Ungku Omar represents a strategic initiative to enhance traffic management and safety in the respective areas. This transition involves a meticulous analysis of traffic patterns, signal timings, and the integration of a new junction. The comprehensive study considers factors such as existing traffic volumes and peak hours. By adapting the traffic light infrastructure, optimizing signal timings, and incorporating intelligent traffic management technologies, the upgrade aims to streamline vehicular and pedestrian flow. Furthermore, collaboration with local authorities, community engagement, and adherence to safety standards are integral components of the proposed upgrade. This transformation anticipates an improved and seamlessly coordinated traffic network, aligning with the evolving needs of these important urban intersections and educational institutions.

# CHAPTER 4

# DATA ANALYSIS

## 4.1 INTRODUCTION

The research area that has been identified is the intersection of Jalan Raja Musa Mahadi with Ungku Omar Polytechnic. It is a major intersection with a two-way street where vehicles move from residential areas to commercial areas in the city center. The traffic flow along this road is extremely high which is caused by numerous factors that affect the increase in traffic flow.

Here are some factors that may affect traffic flow in this area:

- The presence of Ungku Omar Polytechnic: The presence of the polytechnic as a higher education institution adjacent to this intersection may be one of the main factors that increase the flow of traffic. This is because students, staff, and visitors to the polytechnic will use this road regularly.

- Access to Residential and Commercial Areas: As mentioned, this road connects the residential area with the commercial city center. Therefore, people who live in residential areas and work or shop in the city center will use this road.

- Time Factor: Certain times of the day may see increased traffic flow. For example, the time of departure and return from work, class time at the polytechnic, and the change of tourism season.

- Road Infrastructure Quality: Road quality, number of lanes, and traffic safety at this intersection will affect traffic flow. The preference to use this area as an alternative route to work in Ampang or Medan Gopeng may also be influenced by this factor.

Raja Musa Mahadi Jalan Intersection is a parallel intersection with traffic control with traffic lights which is the main route connecting the road to housing estates and places of higher education for students. The intersection of Jalan Raja Musa Mahadi is the focus because it is the route to Ungku Omar Polytechnic. This road is also used as a route to work in Ampang and used to go to Medan Gopeng.

## 4.2 PROCEDURES DATA COLLECTION

Taking traffic flow data is a major step in traffic analysis. There are several procedures we can do to collect traffic flow data:

1. Choose a Data Collection Method: We need to choose an appropriate method to collect traffic flow data. The choice of method will depend on budget, data requirements and available resources. We use CCTV footage to collect data. Our CCTV is made like a traffic camera to facilitate data collection.

2. Select Location: Identify the location that we are the subject of traffic flow data collection at Gate C. The location that we chose is a strategic location to collect data because it can see all three roads that we use.

3. Perform Equipment Installation: We put CCTV on the limiter/wall to record the traffic lights of three intersections. Make sure the equipment is installed securely and according to the guidelines provided by the manufacturer.

   A 360° Wi-Fi Cloud Camera, often referred to as a CCTV (Closed-Circuit Television) camera, is a type of surveillance camera that is designed to provide a comprehensive view of its surroundings. Here are some general features and information you might find in such cameras:

   - 360-Degree Coverage: As the name suggests, these cameras offer a complete 360- degree view of the area they are installed in. This is achieved through a fisheye lens or multiple lenses that cover all directions.
   - Wi-Fi Connectivity: The camera is equipped with Wi-Fi capability, allowing it to connect to your home or office network wirelessly.

This enables remote access to the camera feed through a smartphone, tablet, or computer.

- Cloud Storage: The term "Cloud Camera" indicates that the camera can store video footage in the cloud. This is useful for remote viewing and playback, as the recorded data is stored off-site. Some cameras offer free cloud storage for a limited period, while others may require a subscription.
- Motion Detection: Many 360° Wi-Fi Cloud Cameras come with motion detection technology. When the camera detects motion in its field of view, it can send notifications to the owner's device or trigger recording.
- Night Vision: To maintain surveillance capabilities in low-light or dark conditions, these cameras often feature infrared (IR) LEDs or other night vision technologies.
- Two-Way Audio: Some cameras allow two-way communication, enabling users to listen and speak through the camera. This can be useful for remote monitoring and communication.
- Mobile App Support: Manufacturers typically provide a mobile app that allows users to access the camera feed, control camera settings, and receive alerts on them smartphones or tablets.
- Local Storage Options: In addition to cloud storage, some cameras also support local storage through SD cards or other removable storage options.
- Resolution: The camera's resolution determines the clarity of the images and videos it captures. Higher resolutions provide more detailed footage.
- Pan and Tilt: While a 360° camera covers a wide area, some models also support pan- and-tilt functionality, allowing users to remotely adjust the camera's orientation.
- Compatibility: Ensure that the camera is compatible with the operating systems and devices you intend to use, such as iOS, Android, or specific web browsers.

4. Data Record: At a predetermined time, record traffic flow data according to the chosen method. The data captured may include the number of vehicles, vehicle speed, vehicle type and the time the traffic lights change.

5. Data Analysis: Once we have collected the data, the next step is to analyse it. This may involve processing raw data, such as cleaning data, calculating basic statistics, and creating graphical visualizations.

## 4.3 DATA ANALYSIS TRAFFIC VOLUME

Traffic volume studies are conducted to obtain accurate information about the number and characteristics of vehicle movement in a place. In this study, we have divided traffic movement into six, namely movement from Taman Cempaka to Town (1), movement from Town to Taman Cempaka (2), movement from Taman Cempaka to Ampang (3), movement from Polytechnic to Taman Cempaka (4), movement from Town to Polytechnic (5), movement from Polytechnic to Town (6).

4.3.1. **Taman Cempaka to Town (1).** From the traffic volume study that has been carried out, it has been found that the peak time for this movement is recorded to occur on Monday, which is from 7.00 am to 8.00 am.

4.3.2. **Town to Taman Cempaka (2).** From the traffic volume study that has been done, it has been found that the peak time for movement from this direction is recorded on Mondays from 7.30 am to 8.30 am.

4.3.3. **Taman Cempaka to Polytechnic (3).** From the traffic volume study that has been done, it was found that the peak time for this movement was recorded on Mondays between 7.00 am and 8.00 am.

4.3.4. **Polytechnic to Taman Cempaka (4).** From the traffic volume study that has been done, it was found that the peak time for this movement was recorded on Mondays between 7.00 am and 8.00 am.

4.3.5. **Town to Polytechnic (5).** From the traffic volume study that has been done, it was found that the peak time for this movement was recorded on Mondays between 7.00 am and 8.00 am.

4.3.6. **Polytechnic to Pekan (6).** From the traffic volume study that has been done, it was found that the peak time for this movement was recorded on Mondays between 7.00 am and 8.00 am.

4.3.7. Calculations In Design. From the analysis that has been carried out, it was found that the three roads have different peak times. Therefore, a peak time is required for design purposes. The number of vehicles at that time for all directions is as in the table.

| Direction | **Taman Cempaka to Town (1)** | **Town to Taman Cempaka (2)** | **Taman Cempaka to Polytechnic (3)** | **Polytechnic to Taman Cempaka (4)** | **Town to Polytechnic (5)** | **Polytechnic to Pekan (6)** |
|---|---|---|---|---|---|---|
| Flow (ukp/j) | Car: 298 | Car: 111 | Car: 171 | Car: 132 | Car: 264 | Car: 360 |
| | Motor: 225 | Motor: 109 | Motor: 197 | Motor: 79 | Motor: 121 | Motor: 104 |
| | Vans: 5 | Vans: 0 | Vans: 6 | Vans: 3 | Vans: 2 | Vans: 2 |
| | M. lorries: 4 | M. lorries: 2 | M. lorries: 3 | M. lorries: 5 | M. lorries: 0 | M. lorries: 5 |
| | H. lorries: 0 | H. lorries: 0 | H. lorries: 1 | H. lorries: 2 | H. lorries: 2 | H. lorries: 1 |
| | Busses: 0 | Busses: 0 | Busses: 2 | Busses: 0 | Busses: 1 | Busses: 2 |
| Saturated flow (ukp/j) | | | | | | |

## 4.4 CALCULATION OF DATA

i. morning

Solution:

Table 4.4.1

| Route | Taman Cempaka to town (1) | Town to Taman Cempaka (2) | Taman Cempaka to polytechnic (3) | Polytechnic to Taman Cempaka (4) | Town to polytech nic (5) | Polytechnic to pekan (6) |
|---|---|---|---|---|---|---|
| Flow, q (pcu/h) | 1064 | 444 | 760 | 442 | 780 | 948 |
| Saturation Flow, s (pcu/hr) | 3070 | 3070 | 3070 | 3070 | 3070 | 3070 |
| Y=q/s | 0.34 | 0.14 | 0.24 | 0.14 | 0.25 | 0.30 |
| Y = | 0.24 | | 0.19 | | 0.28 | |

Y= 0.34+0.24

= 0.58 < 0.85

Using L = ((5-3) + (5-3)) + (4+4)

= 12s

Co = 1.5(12) + 5/1-0.58 = 70s < 45...not practical

= 15s < co < 120s

= take 70s as co

Effective green. G

G1 = 0.34/0.58 (70/12) =48s

G2 = 0.11/0.67 (70-12) = 10s

Actual green, G = gn+l-a

G1= 48+4-3 = 49s

G2=10+4-3 = 11s

ii. Afternoon

Solution:

Table 4.4.2

| Route | Taman Cempaka to town (1) | Town to Taman Cempaka (2) | Taman Cempaka to polytechnic (3) | Polytechnic to Taman Cempaka (4) | Town to polytechnic (5) | Polytechnic to pekan (6) |
|---|---|---|---|---|---|---|
| Flow, q (pcu/h) | 532 | 222 | 380 | 221 | 390 | 474 |
| Saturation Flow, s (pcu/hr) | 2902 | 2902 | 2902 | 2902 | 2902 | 2902 |
| Y=q/s | 0.18 | 0.07 | 0.13 | 0.07 | 0.13 | 0.16 |
| Y= | 0.18 | | 0.13 | | 0.16 | |

Y= 0.18+0.16

= 0.34 < 0.85

Using L= ((5-3) + (5-3)) + ((4+4)

= 12s

Co =1.5(12) + 1-0.34 =70s < 45....not practical

= 45s < Co < 120s

= take 70s as Co

Effective green, G

G1 = 0.18/0.34 (45-12) = 13s

G2 = 0.16/ 0.34 (45-12) =19s

Actual green, g = gn+l+a

G1= 12+4-3= 13s

G2= 19+4-3=20

iii. Evening

Solution:

Table 4.4.3

| Route | Taman Cempaka to town (1) | Town to Taman Cempaka (2) | Taman Cempaka to polytech nic (3) | Polytech nic to Taman Cempaka (4) | Town to polytechnic (5) | Polytechnic to pekan (6) |
|---|---|---|---|---|---|---|
| Flow, q (pcu/h) | 387 | 293 | 430 | 368 | 481 | 549 |
| Saturati on Flow, s (pcu/hr) | 1970 | 1970 | 2200 | 2000 | 2200 | 2200 |
| Y=q/s | 0.19 | 0.14 | 0.19 | 0.18 | 0.21 | 0.24 |
| Y= | 0.19 | | 0.19 | | 0.24 | |

Y= 0.19+ 0.24

= 0.43 < 0.85

Using L = ((5-3) + (5-3) + ((4+4)

=12s

Co=1.5(12) +5/1-0.506= 47s< 45... not practical

= 45s< Co< 120s

= take 47s as Co

Effective green, g

G1 =0.19/ 0.24 (47-12) = 14s

G2 = 0.24/ 0.43 (47-12) = 21s

Actual green, g = gn+l+a

G1=14+4-3 =15s

$G2 = 21+4-3 = 22s$

## 4.5 CONCLUSION

As a result of the calculations that have been made to determine the appropriate traffic light system, it was found that the 4-phase traffic light system will be used. This traffic light system is used with a programmed turning system during peak hours and a vehicle detection system during normal hours. The 4-phase system is designed for morning and evening hours which are peak hours. At this time the volume of traffic increased due to PUO students and staff as well as other users moving to their respective destinations. In normal conditions or at night, this warning light has been programmed with the vehicle detection system.

# CHAPTER 5

# DISCUSSION

Based on the conducted research, it was discovered that the quantity of cars using the PUO main gate entry intersection is rising over time. This might occur when PUO employees and students use this intersection as their primary one. Additionally, the public uses Jalan Raja Musa Mahadi as a route for regular tasks like working and dropping off children at school.

The purpose of these traffic signals is to make it easier for people to move, particularly for PUO staff and students to enter and exit the crossroads as well as for members of the public to go through Jalan Raja Musa Mahadi.

Based on the collected data, it is evident that the route is utilized by students, PUO employees, and other users to travel to work and do everyday tasks.

Additionally, there were numerous issues with the traffic light system as it was being sketched. Of these, the original drawing that was sent into the Municipality of Ipoh (MBI) was either rejected or did not comply with Technical Instruction (Road) 13/87 (JKR, 1987). The MBI has suggested adding a lane to the main road, with one lane for entry and one for exit. To widen the highway, 10 meters should be removed from the Ungku Omar Polytechnic area. Our goal emphasizes that just a traffic signal system should be constructed and that the main route should be preserved. This MBI proposal does not meet our goal. The outcome indicates that a municipal road must have an entrance and an exit with a 6-meter radius established at the intersection of Ungku Omar Polytechnic.

The computation resulted in a three-phase traffic light system, with a circular traffic light system being used during the road's morning and evening peak hours. Meanwhile, this route will use traffic lights to detect vehicles at regular hours, including at night.

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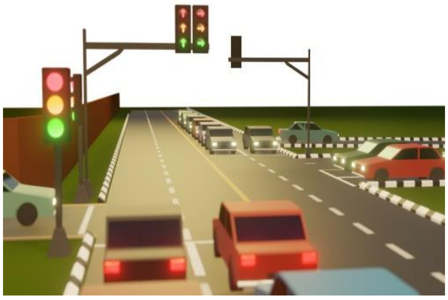
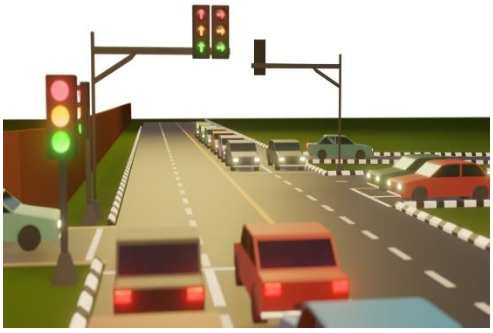
## APPENDIX






Animation
Compositing
Scripting
Global