POLITEKNIK MELAKA

IMPROVED CURB DESIGN
(ICD)

FATIN UMAIRAH BINTI ZAINI

(11DKA23F1008)

CIVIL ENGINEERING DEPARTMENT

SESI I :2025/2026

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This report submitted to the Civil Engineering Department in fulfillment of the requirement for a Diploma in Civil Engineering

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DECLARATION OF ORIGINALITY AND OWNERSHIP

IMPROVED CURB DESIGN (ICD)

1. I, **ALI BIN ABU** [redacted] is a final year student of **Diploma in Civil Engineering, Politeknik Melaka** which is located at **No.2, Jalan PPM 10, Plaza Pandan Malim,75250 Melaka**.(Hereinafter referred to as 'the Polytechnic')

2. I acknowledge that 'The Project above' and the intellectual property therein is the result of our original /creations without taking or impersonating any intellectual property from the other parties.

3. I agree to release the 'Project' intellectual property to 'The Polytechnics' to meet the requirements for awarding the **Diploma Kejuruteraan Awam** to me.

Made and in truth that is recognized by;

FATIN UMAIRAH BINTI ZAINI
(No. Kad Pengenalan: [redacted]

……..……..
(FATIN UMAIRAH BINTI ZAINI)

In front of me,
TS. ABD GHANI BIN RASHED@MOHAMED [redacted]
As a project supervisor, on the date:

…….. …

TS. ABD GHANI BIN RASHED@MOHAMED

ACKNOWLEDGEMENT

I have taken efforts in this project called Improved Curb Design (ICD) throughout the year. I want to continue by thanking my supervisor, the supporter of my project, Sir Ts. Thank you for your incredible guidance, your sharp and constructive feedback, and for the constant encouragement you gave me throughout this entire process. Your insights and expertise were not just helpful they truly pointed this project in the right direction, and I learned so much from your mentorship.

I am also incredibly thankful for the wider community at the Civil Engineering Department, Polytechnic Malacca. The faculty and staff here provided not only the resources I needed but also an academic environment that challenged and supported me.

To my friends and colleagues, thank you for being in the trenches with me. The late-night discussions, brainstorming sessions, and simple words of support made this journey so much more manageable and even enjoyable.

Finally, to my family, I could not have finished this without you. Thank you for putting up with me, for cheering me on, and for your unconditional support through every late night and stressful deadline. Your belief in me has been an anchor through my entire time at university. I couldn't have done it without you. Thank you for your endless patience, your unwavering support, and for believing in me through every high and low of my academic journey. This accomplishment is as much yours as it is mine.

ABSTRACT

This project was conducted to improve the existing road curb system by introducing the Interlocking Curb (ICD), which offers enhanced durability and faster installation. The main problems identified were low curb strength, lengthy installation time, and poor resistance to external loads and impacts. To address these issues, prototype development and laboratory tests were carried out, including concrete density and compression tests on the 7th, 14th, and 28th days. Results showed that concrete density was more stable and compressive strength increased from 5.8 MPa on the 7th day to 11.6 MPa on the 14th day, reaching the highest value on the 28th day, indicating suitability for ICD. Based on feedback from JKR, this design was confirmed to meet practical requirements and has the potential to enhance durability while speeding up installation compared to conventional curbs. In conclusion, ICD provides a better solution in terms of strength and installation efficiency, with future recommendations including real-life testing and design improvements to accommodate higher traffic loads.

ABSTRAK

Projek ini dijalankan untuk memperbaiki sistem tepi jalan sedia ada dengan memperkenalkan reka bentuk Interlocking Curb (ICD) yang lebih tahan lama dan cekap dari segi pemasangan. Masalah utama yang dikenalpasti ialah kekuatan tepi jalan yang rendah, pemasangan yang mengambil masa lama, serta kelemahan pada daya tahan terhadap beban dan impak luaran. Untuk mengatasi masalah ini, kaedah prototaip dan ujian makmal telah dijalankan termasuk ujian ketumpatan konkrit dan ujian mampatan pada hari ke-7, ke-14, dan ke-28. Dapatan menunjukkan bahawa ketumpatan konkrit lebih stabil dan nilai mampatan meningkat dari 5.8 MPa pada hari ke-7 kepada 11.6 MPa pada hari ke-14, manakala pada hari ke-28 nilai tertinggi dicapai, menandakan kekuatan yang sesuai untuk ICD. Berdasarkan maklum balas JKR, reka bentuk ini telah disahkan memenuhi keperluan praktikal dan berpotensi meningkatkan ketahanan serta mempercepat proses pemasangan berbanding tepi jalan konvensional. Kesimpulannya, ICD mampu menawarkan penyelesaian yang lebih baik dalam aspek kekuatan dan efisiensi pemasangan, manakala cadangan untuk kajian masa hadapan termasuk pengujian dalam keadaan sebenar dan penambahbaikan reka bentuk untuk menampung beban trafik lebih tinggi.

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LIST OF SYMBOLS

Symbol

A	$Cross - Sectional\ Area\ of\ Specimen$
◦	Degree
fc’	Compression Strength
kN	Kilonewton
m	Meter
MPa	Megapascal
N	Newton
%	Percentage
P	Maximum Load
±	Plus Minus
s	Second

LIST OF ABBREVIATIONS

ASTM	American Society for Testing and Materials
ATJ	Arahan Teknik Jalan
AutoCAD	Automatic Computer-Aided Design
CTM	Compression Testing Machine
DMF	Dual-Mass Flywheel
EN	European Standard
FEA	Finite Element Analysis
HSIP	Highway Safety Improvement Program
MS	Malaysian Standard
NDBA	New Dynamic Barrier for Highways
JKR	Jabatan Kerja Raya
JKR	Public Works Department
R&D	Research and Development Project

CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

Roads were one of the important elements in human daily life. One of the main road furniture was the curb, which functioned as a separator between the vehicle path and the outer part of the road such as the shoulder, road divider, and pedestrian walkway. In addition, it also helped drain rainwater into the drainage path and made it easier for drivers to recognize the road boundary.

However, most of the common curbs used at that time were easily damaged when impacted by vehicles, especially due to collisions. This damage not only caused high repair costs but also endangered road users, for example when curb fragments broke off and entered the path of other vehicles.

Therefore, this project introduced the Improved Curb Design (ICD) that used the Interlocking Curb system. The interlocking connection concept in this design helped to increase the strength of the curb to be more impact resistant and reduced the risk of breakage. In addition, this curb was supplemented with 12 mm reinforced steel to increase durability. With a stronger design, it helped reduce accidents caused by damaged roadblocks, especially in curved areas or pedestrian walkways.

In addition to being stronger, the Interlocking Curb design was also easier to install than regular curbs. The puzzle joints allowed for faster and neater installation, saving time and manpower. The project also received support from the Public Works Department (JKR) as an innovative improvement to the fragile embankment. Through this improvement, it was hoped that the new design would last longer and reduce the need for periodic maintenance.

1.2 BACKGROUND RESEARCH

In road construction, curbs were one of the important elements to ensure safety and smooth traffic. They were not only dividers between the road and the shoulder, but also helped rainwater flow into the drainage system. In addition, curbs served as a reference for drivers so that they could recognize the road boundary more clearly, especially when driving on bends or junctions.

However, most curbs used at that time had weaknesses in terms of durability. When hit hard, they easily broke and caused debris to scatter on the road. This problem not only made the road look unkempt, but also endangered road users. Therefore, there had to be a more durable solution so that maintenance costs could be reduced.

This project introduced the Interlocking Curb, which used a puzzle system design to make the curb stronger and less prone to damage. In addition, a 10 mm reinforcement steel was added to provide greater strength, especially when impacted by vehicles. With this design, installation was faster and easier, making it a better choice than regular curbs.

This study was conducted to determine to what extent the Improved Curb Design (ICD) could increase curb durability and reduce repair costs in the long term. This project also received support from the Public Works Department (JKR) as an innovation that helped solve the problem of easily damaged curbs.

1.3 PROBLEM STATEMENT

In road construction, curbs were one of the important elements for road safety and management. However, the curb designs that were used still had weaknesses that affected the durability and effectiveness of installation.

One of the main problems was that existing curbs were less resistant to vehicle impacts. When a collision occurred, the curbs easily cracked or broke, causing maintenance costs to increase and endangering road users. In addition, the curb installation process took a long time because conventional installation methods required a lot of labor and high precision. This not only delayed a project but also increased operating costs.

Due to this problem, there was still no truly effective solution to improve the durability and efficiency of curb installation. Therefore, this study was conducted to propose a curb design that was stronger and easier to install. With this innovation, it was hoped that it could reduce maintenance costs and speed up the installation process without affecting the quality and safety of the road.

1.4 RESEARCH OBJECTIVES

1. To design an Improved Curb Design (ICD) product with enhanced structural performance and interlocking features.
2. To study the effectiveness of the ICD product in reducing installation time compared to conventional curb systems.

1.5 SCOPE OF RESEARCH

1. Material Selection

The Improved Curb Design (ICD) used the materials like cement, sand and chipping stone with the standard grade 20, the ratio mixture was 1:2:4 same as the conventional curb. Those materials needed to be as JKR standard so that the cost of the materials doesn't exceed too much comparing conventional curb. Besides that, the addition of chipping stone and Y-12mm steel starter bars for ICD. Those addition materials in the curb made the structure of the curb to be stronger and less maintenance needed for it.

2. Location

The study was conducted in Melaka, specifically at Plaza Malim. The selected location was near our study area and had received approval from the Jabatan Kerja Raya Melaka (JKR).

3. Targeted User

The project was developed for JKR and infrastructure developers, such as contractors, in the Melaka area.

4. Timeline

The project was conducted within one year, covering research, design development, material selection, testing, analysis, and results. The study was completed within the duration of the Final Year Project in accordance with academic deadlines.

5. Installation Time Evaluation using Stopwatch Test

The stopwatch test was conducted to measure the installation time for both the conventional curb and the Improved Curb Design (ICD). The recorded data was used to evaluate which design is faster and more efficient during the installation process.

6. Comparison between Conventional Curb and Improved Curb Design (ICD)

Stopwatch Test Comparison, the installation time and efficiency of both the conventional curb and the Improved Curb Design (ICD) were compared. The analysis of the recorded data was carried out to determine which design demonstrates better overall performance during installation.

1.6 PROJECT SIGNIFICANCE

1. Assisted in the development of stronger and more durable curb designs.
2. Increased road durability and reduced maintenance costs.
3. Simplified the installation process and offered more efficient solutions in the construction industry.
4. Provided useful references for students who wanted to understand innovations in road infrastructure.
5. Helped students identify the real challenges in the construction industry.
6. Contributed to the development of knowledge in the field of civil engineering.

1.7 CHAPTER SUMMARY

This chapter explained why this study was important in improving curb design to be stronger and more durable. With the Improved Curb Design (ICD), the problem of curbs that broke easily and high maintenance costs could be reduced. This study was also useful for students, researchers, and the industry in understanding how to improve the quality of road infrastructure.

In addition, this study could serve as a reference for students who wanted to conduct research related to civil engineering, especially in terms of durability and efficiency of road design. It also showed how innovations in construction could help solve real problems on site.

Overall, this study not only added knowledge to academia but also benefited the construction industry. The next chapter discussed more about the literature review related to this project.