

**ESTABLISHMENT OF PASSENGER CAR UNIT (PCU)
VALUES FOR URBAN INTERSECTIONS USING
DRONES**

Pramodh Chathuranga Muramudali Senanayake

(189278 D)

Degree of Master of Engineering

Department of Civil Engineering

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Dissertation submitted in partial fulfillment of the requirements for the degree
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DECLARATION OF THE CANDIDATE AND THE SUPERVISOR

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Abstract

The Passenger Car Unit (PCU) serves the purpose of transforming diverse traffic conditions into a consistent traffic flow rate during the planning of roads and intersections. The influence stemming from a mixed traffic environment, particularly prevalent in developing nations, distinguishes it from parameters utilized in analogous countries. Furthermore, the specificity of each country is heightened by considerations such as vehicle operating characteristics, road-related parameters, and environmental conditions. Given that the Passenger Car Unit (PCU) factors presently employed in Sri Lanka have surpassed two decades and thus may be deemed outdated, there is a compelling need for a comprehensive revision to formulate a contemporary set of PCU factors reflective of the current context. In general, the pragmatic challenges entailed in data collection and the intricate nature of methodologies have impeded the timely execution of such revisions, particularly within the context of developing countries. Nevertheless, recent studies have been conducted to discern suitable Passenger Car Unit (PCU) factors for both four-lanes and two-lanes in Sri Lanka; however, comparable investigations for intersections remain absent.

The utilization of drones for traffic engineering purposes is increasingly prevalent, and it has demonstrated efficacy in overcoming various challenges encountered in the field. Notably, the adoption of drones has addressed longstanding impediments, including cost considerations associated with data collection through multi-video cameras and human observers, along with the provision of requisite facilities. Moreover, the application of drones has significantly mitigated practical difficulties inherent in the data collection and processing phases of traffic engineering activities. The precision of video footage is notably enhanced when captured from a stable bird's eye view perspective. Consequently, unmanned aerial vehicles, commonly known as drones, have proven to be efficacious in diverse applications within the domain of traffic engineering. The primary aim of this research is to formulate a methodology for the derivation of Passenger Car Unit (PCU) factors through the analysis of drone-captured videos.

Within the scope of this investigation, the area occupancy of distinct vehicle categories under diverse traffic compositions is juxtaposed against conditions characterized by exclusively passenger cars, all operating at equivalent stream speeds. Recognizing the capability of video-based traffic data to furnish precise insights into vehicle dynamics and associated characteristics, the study employed drone-captured videos to meticulously gather traffic data at a designated intersection. Addressing challenges associated with drones, including limitations such as brief flight durations, susceptibility to adverse weather conditions, and potential wireless connectivity issues, this study employed the Basic Headway Method. The objective was to formulate a comprehensive framework for calculating Passenger Car Unit (PCU) factors. The developed method was subsequently applied to derive PCU factors for a total of ten distinct vehicle categories.

The scope of this study is confined to the establishment of Passenger Car Unit (PCU) factors exclusively for intersections, with a specific focus on informing traffic signal design. Nevertheless, given the demonstrated precision of the proposed methodology and its associated practical advantages, characterized by cost-effectiveness and simplified data collection procedures, there exists a considerable prospect for extending this method to ascertain PCU factors for various other road segments, including arterials, highways, and freeways, in future applications.

Keywords: *PCU, intersection, drone, signal design*

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LIST OF ABBRIVIATIONS

Abbreviation	Description
TRB	Transportation Research Board
PCU	Passenger Car Unit
HCM	Highway Capacity Manual
PCE	Passenger Car Equivalent
PC	Passenger Car
PCS	Passenger Car-Small
VN	Van
MC	Motor Cycle
TW	Three Wheeler
MB	Medium Bus
LB	Large Bus
SCV	Small Commercial Vehicles
MCV	Medium Commercial Vehicles
LCV	Large Commercial Vehicles
TO	Through Only
RO	Right Turn Only