

ACKNOWLEDGEMENTS

First and prime most, I thank God for his help in my life. And I would like to express my deepest gratitude to my advisors, Ing. Oluma Gudina, Ing. Yebas Mamuye and Markos Tsegaye (PHd candidate) for their guidance, support and supervision throughout this research work.

I would like also to thank my family and for their constant support and encouragement throughout the my MEng. Study.

Last but not least, I would like to express my sincere thanks to my families (My wife Meron Jemal, My daughter Juliana, My son Natan and my mother and father and all my beloved family) for their great encouragement, support and love.

ABSTRACT

This independent project addresses the most important element of operational performance of roundabout traffic intersections in Jimma: capacity analysis. The relation between a roundabout performance measure and capacity is often expressed in terms of degree of saturation (Demand volume – Capacity ratio).

The capacity analysis is done based on empirical gap – acceptance method that is adopted using manually. The necessary geometric data for the analysis (average entry width, circulatory road width, number of entry and circulatory lanes, and island diameter), traffic movement data with vehicle characteristics and pedestrians volume were collected from Meneharia roundabouts. This roundabout represent different sizes of inscribed circle diameters of roundabouts, which are directly related to their approach leg numbers four legs.

The capacity analysis result indicated that out of Meneharia roundabout have greater than 0.66 degree of saturation. This 0.66 value is recommended by analysis procedure of some model countries such as Australia, Germany, United Kingdom and U.S.A. Whose roundabouts are designed to operate at no more than 85 percents of their estimated capacity.

Approach entry capacity has been analyzed for all Meneharia roundabouts at their legs and with curve – fitting techniques. Effective capacity verses geometric parameters relationship have been developed in order to find out the causes of their over Saturation (v/c ratio greater than 0.85) And the result indicates; number of entry lanes, number of circulatory lanes, high traffic flow and pedestrian volumes are the major causes of their over saturation.

Furthermore, The chart is developed using the parameters number of entry lanes, number of circulatory lanes and opposing circulatory flows, which can assist in designing of roundabouts and forecasting their capacity.

TABLE OF CONTENTS

1. Introduction	1
1.1 Definition of the Problem	1
1.2 Objectives	2
1.3 Organization of the Thesis	2
2. Literature Review	3
2.1 Basic Concepts of Roundabouts and Definitions	3
2.1.1 Major Geometric Features of Modern Roundabout.....	5
2.1.2 Some Description on Basic Elements of Roundabouts.....	7
2.2.3 Methods of Roundabout Capacity Evaluation	8
2.2.1 Empirical Method	9
2.2.1.1 The UK Capacity Formula	9
2.2.1.2 The Germany's Capacity Formula.....	13
2.2.2 Analytical Method	15
2.2.2.1 Tanner's Basic Capacity Equation	17
2.2.2.2 aaSIDRA Gap-Acceptance Method	18
2.2.2.3 Akcelik Base Capacity Equation	22
2.3 Summary	28
3. Data Collection	29
3.1 Study Sites	29
3.2 Geometric Data	33
3.3 Traffic Data	36
4. Analysis and Discussions	35
4.1 General	35
4.2 Analysis and Result	36
4.3 Condition of Roundabouts	43
5. Conclusion and Recommendation	44
5.1 Conclusions	44
5.2 Recommendation	45

6. References	46
7. APPENDIX	
7.1 Appendix A.....	47
7.2 Appendix B.....	52
7.3 Appendix C.....	69

LIST OF TABLES

Table 2-1 Formulas for Calculating Roundabouts Capacity (Brilon1990).....14

Table 2-2 Parameters for Linear Regression (Brilon 1997).....15

Table 2-3 Passenger Car Equivalent Adopted from the U.S DOT’S Roundabout
Guide(2000).....23

Table 3-1 Summarized Vehicles and Pedestrians Volume at Intersections at Peak hour (60 min or 1
hour).....33

Table 3-2 Summarized Entry Traffic Flow on Roundabout Approach legs.....35

Table 4-1 Summarized Capacity Analysis Result on the Intersections.....37

Table 4-2 Summarized Capacity Analysis Result on the Approaches Legs.....40

LIST OF FIGURES

Figure 2-1	Major Geometric Features of Modern Roundabout.....	7
Figure 2-2	Analytical verses Empirical Methods.....	9
Figure 2-3	UK - 6 Geometric Parameters used capacity analysis.....	10
Figure 2-4	Germany's Geometric Parameters.....	13
Figure 2-5	Parameters for Exponential Analysis (Bvilon 1990).....	14
Figure 2-6	Circulating Volumes at Entry.....	25
Figure 3-1	Maximum Peak Hour Vehicles Volume Distribution at Intersections	31
Figure 4-1	Entry Flow verses Degree of Saturation for the Intersections.....	38
Figure 4-4	Opposing Circulatory Flows verses Capacity at Legs.....	41
Figure 4-5	Circulatory Flows verses Capacity at Legs.....	42