

## TABLE OF CONTENTS

<b>DUAL DEGREE PROGRAM STATEMENT</b>	ii
<b>RECOMMENDATION FORM</b>	iii
<b>QUALIFICATION FORM</b>	iv
<b>LETTER OF APPROVAL</b>	v
<b>DECLARATION</b>	vi
<b>ABSTRACT</b>	vii
<b>ACKNOWLEDGEMENTS</b>	viii
<b>TABLE OF CONTENTS</b>	ix
<b>LIST OF FIGURES</b>	xi
<b>LIST OF TABLES</b>	xii
<b>LIST OF APPENDIX</b>	xiv
<b>LIST OF NOTATIONS</b>	xv
<b>CHAPTER I INTRODUCTION</b>	1
1.1 Background	1
1.2 Research Problem	4
1.3 Objectives of the Research	4
1.4 Research Limitations	4
<b>CHAPTER II LITERATURE REVIEW</b>	5
2.1 Pollution Routing Problem (PRP)	5
<b>CHAPTER III THEORETICAL BACKGROUND</b>	9
3.1 Pollution Routing Problem	9
3.2 Fuel Consumption and CO <sub>2</sub> Emissions	10
3.3 Fuel Consumption and Speed	11

<b>CHAPTER IV RESEARCH METHOD</b>	13
4.1 Research Tools	13
4.2 Mathematical Model	13
4.3 Research Method	16
<b>CHAPTER V RESULTS AND DISCUSSION</b>	18
5.1 Parameters Used	18
5.2 Simulation Results	20
5.2.1 Result from Instance UK10_01	20
5.2.2 Result from Instance UK10_02	22
5.2.3 Result from Instance UK10_03	23
5.2.4 Result from Instance UK10_04	24
5.2.5 Result from Instance UK10_05	25
5.2.6 Result from Instance UK10_06	26
5.2.7 Result from Instance UK10_07	27
5.2.8 Result from Instance UK10_08	28
5.2.9 Result from Instance UK10_09	29
5.2.10 Result from Instance UK10_10	30
5.2.11 Pollution cost and computation time	31
5.3 Comparison between Solutions from this Study to Previous Research	31
<b>CHAPTER VI CONCLUSION AND RECOMMENDATION</b>	33
6.1 Conclusion	33
6.2 Recommendations	33
<b>REFERENCES</b>	34
<b>APPENDIX</b>	36