

Table of Contents

Acknowledgement	ix
Summary	xiii
Contents	xvii
List of Figures.....	xxiii
List of Tables	xxvii
List of Abbreviations and Terms.....	xxix
1 Introduction	1
1.1 Research background.....	1
1.1.1 Potential impacts of on-road vehicle emissions on climate change	1
1.1.2 On-road vehicle emission-reduction strategies at the global and national levels	2
1.2 Research problem: The case of the emerging Megacity of Hyderabad.....	8
1.3 Research gap: Limitations of current practices in the road traffic pollution-abatement process in Hyderabad	9
1.4 Research scope and objectives.....	11
1.5 Research design: Concept, theory and method.....	13
1.5.1 Combined concept for Comprehensive Integrated Framework.....	15
1.5.2 Theoretical foundation.....	17
1.5.3 Method	18
1.6 Dissertation structure	18
2 The Comprehensive Integrated Framework: A novel approach for assessing social transactions in vehicle emission and analysing commuter interdependence in traffic congestion	21
2.1 Introduction.....	21
2.2 Need for Comprehensive Integrated Framework	22
2.2.1 On-road traffic pollution assessment.....	22

2.2.2 On-road traffic pollution abatement	26
2.2.2.1 Technical measures.....	26
2.2.2.2 Non-technical measures.....	28
2.3 Institution of Sustainability and Institutional Analysis and Development- Transaction, institutions and interdependences	31
2.3.1 State of art.....	31
2.3.2 Social transactions mediated by technical system.....	33
2.3.3 Transport institutions	34
2.3.4 Commuter interdependencies	35
2.3.5 Combined concepts of Institution of Sustainability and Institutional Analysis and Development frameworks	36
2.4 Conclusion	43
3 Vehicle emission analysis: Determining the key factors influencing vehicle	45
3.1 Introduction.....	45
3.2 Impacts of existing traffic strategies in Hyderabad	45
3.3 Vehicle emission model – An overview.....	47
3.3.1 Federal Test Procedure	48
3.3.1.1 International Vehicle Emissions.....	48
3.3.1.2 Mobile Emission Model	49
3.3.1.3 Motor Vehicle Emission Simulator	49
3.3.2 New European Driving Cycle.....	49
3.3.2.1 Computer Program to calculate Emissions from Road Traffic	50
3.3.2.2 Handbook Emission Factors for Road Transport	50
3.3.3 Indian Driving Cycle	50
3.4 Vehicle emission estimation by using the International Vehicle Emission model.....	51
3.4.1 General theory behind the vehicle emissions calculation	52
3.4.2 Representative stretch characteristics in Hyderabad	52
3.4.3 Data collection	54
3.4.4 Method.....	55
3.4.4.1 Vehicle Kilometre Travelled	56

3.4.4.2 Start pattern estimation	56
3.4.4.3 Driving pattern estimation	57
3.4.4.4 Vehicle technology distribution.....	57
3.5 Analysis.....	57
3.6 Results.....	64
3.7 Discussion	68
4 Background analysis: A micro-macro study of traffic congestion and relevant scenario analysis of potential traffic measures in Hyderabad	71
4.1 Introduction.....	71
4.2 Factors triggering traffic congestion.....	73
4.2.1 Macroscopic factors.....	75
4.2.1.1 Physical factors.....	75
4.2.1.2 Institutional factors	77
4.2.1.3 Behavioural factors.....	78
4.2.2 Microscopic factors	79
4.3 Congestion abatement measures.....	81
4.3.1 Traffic calming measure	82
4.3.1.1 Application	82
4.3.1.2 Pros and cons	83
4.3.2 Carpooling	83
4.3.2.1 Application	83
4.3.2.2 Pros and cons	84
4.3.3 Congestion pricing.....	85
4.3.3.1 Application	86
4.3.3.2 Pros and cons	87
4.3.4 Staggering working hours or flex-time (F-T) work hours.....	87
4.3.4.1 Application	87
4.3.4.2 Pros and cons	88
4.3.5 Lane differentiation	88
4.3.5.1 Application	89
4.3.5.2 Pros and cons	89

4.4 Hypothetical case: Scenario analysis of potential congestion abatement measures in Hyderabad	90
4.4.1 Scenario 1: Can we calm the traffic in Hyderabad?.....	90
4.4.2 Scenario 2: Carpooling in Hyderabad?.....	91
4.4.3 Scenario 3: Pay or stay	91
4.4.4 Scenario 4: Introduction of Flex-time concept in Hyderabad	91
4.4.5 Scenario 5: Lane differentiation instead of lane splitting.....	92
4.5 Conclusions.....	93
5 Urban traffic through the lens of behavioural game theory: A theoretical analysis of commuter travel mode choice for the development of novel experimental model.....	95
5.1 Introduction.....	95
5.2 Collaboration and coordination problems in mode choice.....	97
5.2.1 Model design.....	101
5.3 Discussion	105
5.4 Conclusion	107
6 Experimental analysis of commuter mode choice: Exploring the effect of traffic demand measures using framed field experiment in Hyderabad, India.....	109
6.1 Introduction.....	109
6.2 Hyderabad's transport crisis and the role of demand-side policy measures.....	110
6.3 The experiment	112
6.3.1 Behavioural game theory in transportation research.....	114
6.3.2 Experimental design and hypotheses.....	117
6.3.3 Sampling and practical conduct of the experiment	120
6.4 Experiment results	123
6.4.1 Analysing treatment effects	123
6.4.2 Analysing the socio-economic determinants of mode choice	126
6.5 Discussion	131
6.6 Conclusion	133

7 Questionnaire Analysis: Understanding commuter acceptability of traffic measures	135
7.1 Introduction.....	135
7.2 Theoretical analysis of commuter behaviour and attitudes	135
7.3 Psychological relevance of commuter acceptance	138
7.4 Commuter acceptance model.....	139
7.4.1 Individual aims and claims	139
7.4.2 Problem perception.....	140
7.4.3 Information about alternative options.....	142
7.4.4 Perceived effectiveness.....	142
7.5 Sample characteristics.....	143
7.5.1 Individual details of the participants	144
7.5.2 Household details of the participants.....	147
7.6 Hypotheses.....	148
7.7 Survey results.....	149
7.7.1 Assessing the potential causes of congestion	149
7.7.2 User rating of the existing public bus service in Hyderabad.....	154
7.7.3 Suitability of traffic measures in Hyderabad.....	159
7.8 Discussion	164
7.9 Conclusion	165
8 Conclusions and research outlook: Revisiting the road traffic pollution-abatement process.....	167
8.1 Summary of the research study and its key findings.....	167
8.2 Theoretical implications concerning commuter behaviour in urban traffic.....	170
8.2.1 Triple convergence	170
8.2.2 Collaboration and asymmetric coordination problems.....	170
8.2.3 Attitude theories.....	172
8.3 Policy implications concerning emission-reduction strategies.....	173
8.3.1 Road supply management.....	173
8.3.2 Travel demand management.....	174
8.4 Revisiting the road traffic pollution-abatement process	175

8.5 Contributions, limitations and further study.....	177
References	179
Annexures	203
A Additional background on calculation of payoffs	204
B Experimental protocols and instructions	207
B.1 General introduction	207
B.2 Instructions exercise 1	208
B.3 Instructions exercise 2	209
B.4 Instructions exercise 2	210
B.5 Instructions exercise 3	211
C Payoff tables by exercises.....	212
D Questionnaire	216
E Additional graphs.....	223
F Additional statistical analysis.....	230