Space, time, economics and asphalt

An investigation of induced traffic growth caused by urban motorway expansion and the implications it has for the sustainability of cities

Doctor of Philosophy in
Sustainable Futures

By Michelle E Zeibots
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Statement of original authorship

I certify that the work in this thesis has not previously been submitted for a degree, nor has it been submitted as part of the requirements for a degree, except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of candidate:

Michelle Elaine Zeibots

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1964 – 2007

who loved cities, the people who live in them and fought hard to

improve the transport systems that support them

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Abbreviations and units

AADT	Annual Average Daily Traffic
AAPG	American Association of Petroleum Geologists
ABS	Australian Bureau of Statistics
ADT	Average Daily Traffic
AGO	Australian Greenhouse Office
AP	Accounting Period
ASPO	Association for the Study of Peak Oil
ARIMA	Auto-Regressive Integrated Moving Average
ARR	Amsterdam Ring Road
BRL	Bankstown Rail Line
BRF	British Roads Federation
CART	Citizens Against Route Twenty
CBA	Cost–Benefit Analysis
CBD	Central Business District
CO_2	Carbon Dioxide
DOTARS	Department of Transport and Regional Services
EPR	Energy Profit Ratio
EU	European Union
Gb	Giga barrels

GDP	Gross Domestic Product
GHE	Gore Hill Expressway
GLC	Greater London Council
GLDP	Greater London Development Plan
GRI	Global Reporting Initiative
GRP	Gross Regional Product
GST	General Systems Theory
GWH	Great Western Highway
HBR	Homes Before Roads
HMSO	Her Majesty's Stationery Office
IBRD	International Bank for Reconstruction and Development
ICLEI	International Council on Local Government Initiatives
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IRL	Illawarra Rail Line
ISF	Institute for Sustainable Futures (University of Technology, Sydney)
ISTP	Institute for Sustainability and Technology Policy (Murdoch University)
LATA	London Amenity and Transport Association
LMAG	London Motorway Action Group
MIIM	Macquarie Infrastructure Investment Management

MP	Member of Parliament
NGO	Non-government Organisation
NRMA	National Roads and Motorists Association
NS	Natural Step
NPV	Net Present Value
OD	Origin and Destination
PTRC	Planning Transport, Research and Computation
RRL	Richmond Rail Line
RTA	Roads & Traffic Authority of New South Wales
RWRR	Rochester Way Relief Road
SACTRA	Standing Advisory Committee on Trunk Route Assessment
SARS	Severe Acute Respiratory Syndrome
SDP	State Domestic Product
SEAC	State of the Environment Advisory Council
SHLM	State Highway Lane Miles
SHB	Sydney Harbour Bridge
SHT	Sydney Harbour Tunnel
SMH	*Sydney Morning Herald*
SSD	Sydney Statistical Division
SSM	Soft Systems Methodology

STPP	Surface Transportation Policy Project
TBL	Triple Bottom Line
TDC	Transport Data Centre
TPDC	Transport and Population Data Centre
UITP	International Association (Union) of Public Transport Providers
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
US	United States (of America)
USGS	United States Geographical Survey
VKT	Vehicle Kilometres Travelled
WCED	World Commission on Environment and Development
WSRL	Western Sydney Rail Line

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Abstract

This thesis investigates the implications that urban motorway development has for the sustainability of cities. It does this by focusing on the sudden increase in road traffic that follows after the opening of additional motorway capacity, known as induced traffic growth, and asking whether induced traffic growth affects the ability of an urban system to sustain its essential economic functions. The investigation also addresses how urban systems impact on the biosphere.

Induced traffic growth, and the urban motorway development responsible for it, are often cited as a threat to sustainability because they are seen to increase fuel consumption and air pollution without necessarily improving accessibility within a city. Opponents to urban motorway construction claim that it merely represents a reshuffling of system elements, such that the spatial relationships between transport and land-use are changed, but the amount of time spent travelling, and the number of economic exchanges made by people, remain much the same. Motorway development advocates refute these claims, arguing that motorway construction reduces travel times, cuts emissions and fuel consumption and increases economic activity, thereby enhancing sustainability.

While it should be possible to resolve these issues through a program of empirical analysis, the phenomenon remains contested, raising questions about why and how its contested status affects transport decision-making and transport science. These questions are answered in this thesis by first investigating the social and political context in which debate over induced traffic growth has taken place. To do this, Soft Systems Methodology is used to investigate the way in which conflicts over urban motorway development have been resolved in London, Sydney and Zürich. The comparative analysis highlights differences between the rules of the political decision-making systems in each of the cities, and how these distribute power to different groups within society. While the history of conflicts is similar in each of the cities, more power is given to special interest groups from industry in London and Sydney. By contrast, the system in Zürich gives more power to resident populations through its system of

direct democracy. Consequently, urban motorway development, the induced traffic growth it gives rise to and the impacts they have on city operations are acted upon in Zürich to the extent that transport policy has focused more on the development of comprehensive public transport systems. This leads to the conclusion that the contested status of induced traffic growth is more a product of the socio-economic goals of particular interest groups within society than it is of shortcomings in the empirical record or essentially unresolved theoretical issues.

With the political context as background, the thesis then reviews the empirical analyses and theoretical explanations for the phenomenon. First, a review of past empirical analyses is undertaken to identify the grounds that have been cited to refute the induced traffic growth hypothesis. Two key areas are identified. The first involves difficulties with distinguishing the sources of induced traffic growth from traffic reassignment. The second concerns the absence of traffic data for routes that are potential alternatives to a new motorway from which traffic reassignment may have taken place. A case study of the M4 Motorway in Sydney is presented with data for all arterial through-routes that cross relevant screenlines, thereby overcoming several of the shortcomings identified in the review. This case study adds to the general literature of case studies that corroborate the induced traffic growth hypothesis, but provides the first substantial documented case for an Australian city.

A review of the theoretical explanations for the phenomenon finds that while both microeconomic evaluation and standard modelling procedures provide accounts for the phenomenon that meet institutional expectations of technical veracity, neither constitutes a substantial description of the causal mechanism for the phenomenon, leaving unanswered questions about some findings in the empirical record. This conclusion prompts the development of a systems-based explanation for induced traffic growth that defines it as a form of multiple system feedback processes controlled by a travel budget time constant. By accounting for the phenomenon and its effects in this way, an explanation is provided for changes to travel behaviour and patterns of land-use development that reveals how urban motorway development affects urban systems in an holistic way.

The final section of the thesis combines the insights gained by examination of the politics of the transport decision-making system with empirical analyses and theoretical explanations for induced traffic growth, to produce a general systems view of cities and their place within the earth's biosphere. This treatment considers the problems of oil depletion and global climate change, and the effects that urban motorway development has on the ability of urban systems to adapt to changes in the system environment brought about by these problems. The thesis concludes that urban motorway development and the processes that it triggers, which are embodied in the phenomenon of induced traffic growth, can undermine a city's comparative ability to sustain the accessibility needs of its residents.