

# SUSTAINABLE MOBILITY THROUGH POLLUTION-AWARE MODELS AND POLICIES: A SYSTEMIC REVIEW

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**Abstract:** Sustainable mobility is a challenge with pollution playing a major role. Alternative Transport is important because it enables sustainable mobility. Intelligent transportation systems(ITS), battery assisted electric vehicles, carpooling, regulations and policies towards moderation of vehicle usage and reduction in pollution, carbon emission are in vogue and much literature is centered around them. This paper presents a review of 30 articles surrounding ITS, sustainable transportation models for transportation management and policies.

*IndexTerms* - Sustainable mobility, Intelligent Transportation System, electric vehicles, carpooling.

## I. INTRODUCTION

Transportation enables movement. from one location to another. You can travel by air, rail, road, water and other modes. Considering suppressed demand of transportation disadvantage helps in assessment of suppressed demand in traffic [1]. In particular, whilst increasing car ownership and use has obviously delivered significant benefits to individuals, at the societal level it has also led to an array of economic, social and environmental impacts which require the attention of policy makers. In this regard, it should be noted that rural areas face a number of distinct challenges, investigating individual level factors influence on demand responsive transport system(DRT) will help in recommendation for DRT systems [2]. Traditional models of individual and household travel and activity behavior are estimated using travel diary datasets that ask a small subset of the population of interest to record over a period of one or two days which activities were conducted where, when, for how long, with whom and using what mode of travel. Inference of travel demand estimation with GPS data and error reduction using monte corlo- random utility maximization(RUM) methods for comparison of models of travel demand analysis [3].

Transport sector Investments have a long term life span and high costs. Cost-benefit analysis concept is preferentially used worldwide. Constrained travel demand model and rule of of half proof is provided resulting in economic formulation [4]. The vehicle emission dispersion is a major environmental problem. Dynamic modeling and use in designing pollution-aware traffic controllers can be the solution. The model has to be as accurate as possible, yet numerically simple enough to be used for control design purposes, the model designed to control and regulate traffic pollutants [5]. Rural and urban areas in developing and developed countries face a host of barriers to creating a sustainable mobility form. These barriers may be physical, such as inadequate public transport and infrastructure or low population densities, which are entrenching car dependency, as well as behavioral, for instance the social status associated with car ownership [6] [7]. Physical, soft and knowledge policies are considered for sustainable road transport [6]. The authors reviewed travel behavior studies based on trajectory databases [7].

The first and one of the most important steps in the process of traffic volume prediction is to estimate the number of trips generated in each traffic zone. Two widely-spread methods that are used for prediction are "multiple linear regression" and "cross classification" techniques, an alternative fuzzy based model is proposed [8]. The problem of interest is the following: subject to a given budget, determine which links from a network need improvement (capacity increase) and decide how much budget should be allocated to the links so as to maximize the improvements in both efficiency (total system travel time) and robustness (to be defined) of the network [9].

**RELATED WORK**

Maria et al. [10] offered a systematic approach to assess the interaction of policies for energy in transport with sustainability principles expressed with the Millennium Goals, and reaffirmed in Rio+20 and other major assessment studies such as the Global Energy Assessment. Decision-makers could find practical value in the knowledge it offers to understand interactions and the possibility of multiple vistas: e.g., it could help highlight areas of concern and areas of opportunity or help understand critical links within a contextualized set of policies. That approach had also limits. It was a resource intensive exercise that requires extensive documentation and up-to-date contextual knowledge, capabilities to gather facts and to explain the observed interactions. The approach can be potentially susceptible to misuse biasing results to favor a particular decision.

Sebastian et al. [11] proposed a theoretical grounding of soft transport policy measures that aim at promoting voluntary reduction of car use. A general conceptual framework was first presented to clarify how hard and soft transport policy measures impact on car-use reduction. Two different behavioral theories that had been used to account for car use and car-use reduction are then integrated in a self-regulation theory that identifies four stages of the process of voluntarily changing car use: setting a car-use reduction goal, forming a plan for achieving the goal, initiating and executing the plan, and evaluating the outcome of the plan execution. A number of techniques were described that facilitate the different stages of the process of voluntary car-use reduction and which was used in personalized travel planning programs.

Margareta et al. [12] presented a paper to chart soft policy programs of the type personalized travel planning that had been implemented in Sweden. Long distances, a sparse population providing poor support for public transport, a cold climate, and a high incidence of cars, simultaneous to the industry investing in doubling public transport's market share, all make it important to attempt to answer the question of whether or not soft policy programs implemented in Sweden are as cost-effective in reducing car use as in the other countries where that had been implemented. The next two sections deal, in outline, with the implementation and the demonstrated effects of personalized travel planning programs in other countries. With that as a backdrop, an overview of Swedish programs was then presented. As these are of poor quality in international comparison, the paper was concluded by discussing what can be done to improve them.

Yang Yue et al. [21] Self-containment of employment and jobs-housing balance have been used to examine commuting patterns from different perspectives. Appropriate jobs-housing ratio may achieve high self-containment. However, self-containment may be affected by other factors. In this study, the spatial variation of self-containment of employment and jobs-housing balance is examined with job types, location, and housing prices using the cellphone data in Shenzhen, China.

Marianne Hatzopoulou et al. [23] Mitigating the substantial undesirable impact of transportation systems on the environment is paramount. Thus, predicting Greenhouse Gas (GHG) emissions is one of the profound topics, especially with the emergence of intelligent transportation systems (ITS). We developed a deep learning framework to predict link-level GHG emission rate (ER) (in CO<sub>2</sub>eq gram/second) based on the most representative predictors, such as speed, density, and GHG ER of previous time steps. In particular, various specifications of the long short-term memory (LSTM) networks with explanatory variables were examined, and were compared with clustering and the autoregressive integrated moving average (ARIMA) model with explanatory variables. The downtown Toronto road network was used as the study area, and highly detailed data were synthesized using a calibrated traffic microsimulation and MOVES. It was found that LSTM specification with speed, density, GHG ER, and in-links speed from three previous minutes performed the best while adopting two hidden layers, and when the hyper-parameters were systematically tuned. Adopting a 30-second updating interval slightly improved the correlation between true (simulated) and predicted GHG ERs (from predictive models), but contributed negatively to the prediction accuracy as reflected in the increased root mean square error (RMSE) value. Efficiently predicting GHG emissions at a higher frequency with lower data requirements will pave the way for various applications, e.g. anticipatory eco-routing in large-scale road networks to alleviate the adverse impact on global warming.

Sesham Anand et al. [28] Socio-economic status of the traveler are considered for trip planning. Model of trip-planning using socio-economic constraints is presented. The real-time travel information of trips is gathered.

Sesham Anand et al. [29] The proposed model maintained a substantial trade-off between multiple performance metrics, though the trip mean model performed statistically.

Sesham Anand et al. [30] Intelligent transportation systems (ITSs) for trip planning are discussed. Clustering and evolutionary computational algorithms are discussed in this review with a motive to design a trip planning model.

The remaining articles algorithm/model and purpose are listed out in table I

## CONCLUSION AND FUTURE WORK

This paper is motivated by the importance of determining how many traffic road-based surveillance units (RBSU) should be deployed and where to be deployed along a given route to obtain travel time estimations with least errors. The ad-hoc approach to this problem has been the equidistant segment configuration (e.g. every quarter -mile, half-mile or one-mile intervals). RBSU deployment problem: Given a route with known traffic characteristics find the optimal number and location of roadway segments for RBSU deployment that will minimize the estimation error of a selected travel time function. This paper presents a review of 30 articles surrounding ITS, sustainable transportation models for transportation management and policies.

Table –I Role Of Algorithm/ Model And Purpose

	Algorithm/Model	Purpose
Håkansson <i>et al.</i> [13]	Map matching algorithms	GPS-based data are becoming a cornerstone for real-time transportation application
Milos Balać <i>et al.</i> [14]	Lammer's adaptive traffic signal control	The imputation of road flow capacities and estimating the impacts of congestion and crossroads on travel time will be presented and investigated.
Chao Wang <i>et al.</i> [15]	Spatial Analysis	Impact of public transport usage on cancer coverage. A balanced transport and public health policy is required to achieve the best health outcome
S. Chiou <i>et al.</i> [16]	Generic optimization problems	A greater gain of achieving road network robustness whilst incurring less sub-optimality loss against uncertain demand as compared to other alternatives
G. Karoń <i>et al.</i> [17]	V-model of systems engineering have been presented as structure of ITS project.	evaluation of ITS project with use of transport model.
P. He <i>et al.</i> [18]	A novel framework is proposed to separately predict the riding and waiting time of a given journey	investigate the problem of travel-time prediction for bus journeys that takes into account a passenger's riding time on multiple bus trips, and also his/her waiting time at transfer points (interchange stations or bus stops).
GABORIEAU <i>et al.</i> [19]	Procedures to implement mandatory validation for increased commercial speed and total dwell time	Procedures to implement mandatory validation for increased commercial speed and total dwell time
Georgina Santos <i>et al.</i> [20]	compare current road fuel taxes and corrective taxes, estimated on the basis of negative externalities from road transport	Fuel efficiency increases as a response to higher fuel taxes.
Rassafi <i>et al.</i> [22]	Double-frontier cross-efficiency method for road safety	Measure the RSP of 31 iranian provinces by proposing and implementing a novel integrated CEM
D. Chen <i>et al.</i> [24]	Optimized Traffic flow prediction algorithm of radial basis function neural network based on an improved artificial bee colony (ABC) algorithm in the big data environment	Measured traffic flow improvement
Sonja Hausteine <i>et al.</i> [25]	Compare battery electric vehicle and conventional vehicle usage using online surveys	CV user and BEV users are distinct target groups that differ in demographics, mobility patterns and attitudes on BEV
Yang Yue <i>et al.</i> [26]	POI-based mixed use and neighbourhood vibrancy	Influence of density on neighbourhood vibrancy
P. Typaldos <i>et al.</i> [27]	Feasible direction algorithm	Minimization of fuel consumption of a vehicle, by optimizing its kinematic trajectories

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